INFORME

PANEL SOBRE

CULTIVOS ALIMENTICIOS Y NUTRICION HUMANA

GUATEMALA, C. A.

26 al 30 de setiembre de 1966

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INFORME DEL PANEL SOBRE

CULTIVOS ALIMENTICIOS Y NUTRICION HUMANA

Guatemala
26 a 30 de setiembre de 1966

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INSTITUTO INTERAMERICANO DE CIENCIAS AGRICOLAS DE LA OEA

Centro de Enseñanza e Investigación
Turrialba, Costa Rica

Dirección Regional para la Zona Norte
Guatemala, Guatemala

y

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Guatemala, Guatemala

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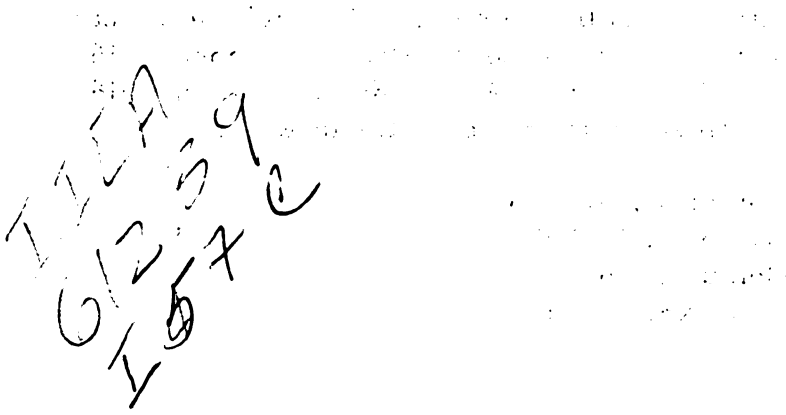

El presente informe se ha preparado con base en los documentos presentados por los expositores. La descripción de las discusiones llevadas a cabo posteriormente a la presentación de cada tema se tomó de cintas magnetofónicas. Algunas pudieron reproducirse fielmente, otras fueron revisadas por los Moderadores de las sesiones y otras por las mismas personas que intervinieron en la discusión de los temas. Reconocemos que algunas exposiciones y opiniones sobre los temas han quedado incompletas, a pesar del gran esfuerzo que se hizo para completarlas.

La preparación de este informe se ha hecho como una contribución del Instituto Interamericano de Ciencias Agrícolas (Dirección Regional para la Zona Norte y Centro de Enseñanza e Investigación de Turrialba), al Panel.

Se debe agregar una nota de duelo por el trágico fallecimiento de la Señorita Frances MacKinnon, del Fondo Especial de las Naciones Unidas, quien tomó parte muy activa en la organización y celebración del Panel y se interesó mucho en la publicación de este informe.

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PROGRAMA

LUNES 26 DE SEPTIEMBRE

9:00 — Sesión Inaugural
Moderador: Dr. E. Echandi

Bienvenida en nombre del IICA
Dr. M. Gutiérrez

Bienvenida en nombre del INCAP
Dr. M. Behar

Presentación de los participantes

10:00 — Receso

10:30 — Las necesidades nutricionales del hombre
Moderador: Dr. M. Behar

Qué nutrimentos o alimentos requiere el hombre?
Dr. W. N. Pearson

Cuáles son los efectos de una nutrición inadecuada?
Dr. M. Behar

12:00 — Receso

13:30 — Fuentes de alimentos
Moderador: Dr. M. Gutiérrez

Cuál es la situación en Centroamérica respecto a cultivos alimenticios, productos alimenticios y forrajes?
Lic. M. Ponce

15:00 — Receso

15:30 — La necesidad de productos alimenticios en la región.
Lic. M. A. Ramírez

17:00 — Discurso
Señor José Figueres

MARTES 27 DE SEPTIEMBRE

8:30 **La situación nutricional del hombre y los animales en América Central**

Moderador: Dr. M. Behar

Revisión de los estudios efectuados en las poblaciones humanas de la región

Dr. A. E. Schaefer

Discusión

Dr. E. Braham
Dr. J. Alvarez

10:00 Receso

10:30 **La producción de proteína animal**

Moderador: Dr. A. E. Dracy

El efecto del medio ambiente y las enfermedades en la producción animal

Dr. W. E. Peterson

Discusión

Ing. A. Aguirre
Ing. H. Fonseca
Ing. R. Jarquín

12:00 Receso

13:30 **Las fuentes de productos alimenticios y la tecnología moderna**

Moderador: Dr. M. Gutiérrez

El mejoramiento del valor nutritivo y el rendimiento de los cultivos alimenticios básicos:

Cereales

Dr. J. H. Lonnquist

Leguminosas

Dr. M. W. Adams

15:00 Receso

15:30 Hortalizas

Dr. E. H. Cásseres

Discusión

Dr. A. Pinchinat
Dr. J. León
Ing. M. Jalil

17:00 La necesidad de efectuar la diversificación de los cultivos alimenticios

Ing. Roberto Egli

MIERCOLES 28 DE SEPTIEMBRE

8:30 Tecnología de los alimentos

Moderador: Dr. R. Bressani

Contribución de la tecnología de los alimentos al mejoramiento de las fuentes de productos alimenticios

Dr. C. O. Chichester

Discusión

Dr. R. Bates
Lic. F. Aguirre
Ing. C. Rolz

Desarrollo de sustitutos de alto contenido proteico

Dr. L. J. Tepley

Discusión

Dr. R. L. Shaw

10:00 Receso

10:30 El planeamiento nacional en relación a las fuentes de productos alimenticios

Moderador: Dr. H. Lombardo

La comercialización y el abastecimiento de alimentos en Latinoamérica

Ing. G. Gerding

Discusión

Lic. M. Ponce
Ing. A. Berríos

12:00 Receso

13:30 Moderador: Dr. E. Echandi

El pescado como fuente de alimento
Dr. L. Vasconcelos

15:00 Receso

15:30 Discusión en grupos

JUEVES 29 DE SEPTIEMBRE

8:30 Discusión en grupos y conclusión de los informes de grupo

Tarde libre

VIERNES 30 DE SEPTIEMBRE

8:30 Sesión plenaria para revisar los informes de los grupos de trabajo
Moderador: Dr. E. Echandi

Grupo I
Dr. C. O. Chichester

Grupo II
Ing. A. Alvarez

Grupo III
Dr. M. Gutiérrez

10:00 Receso

10:30 Sesión de Clausura
Ing. J. A. Torres

CONTENIDO

Página

PRIMER TEMA

LAS NECESIDADES NUTRICIONALES DEL HOMBRE

Moderador: Dr. M. Behar

Dr. Behar: Muy buenos días. Vamos a comenzar la primera sesión de trabajo de este panel. Antes de iniciarla quisiera consultar con las personas asistentes con respecto a un problema de idioma que vamos a afrontar, por lo menos durante el día de hoy, ya que se habían previsto arreglos para traducción simultánea pero desafortunadamente no estuvieron a tiempo. Esperamos que ya para mañana tengamos traducción simultánea. Nos queda entonces el día de hoy. Les pedimos si podríamos usar, como cortesía a distinguidos visitantes que están entre nosotros, el idioma inglés durante la sesión de hoy. En el caso de que la mayoría de las personas asistentes de habla española puedan también entender y manejarse en el idioma inglés.

Esperamos que estén de acuerdo las personas de habla española, ya que queremos una participación activa de todos los participantes. Podrían indicarme si están de acuerdo en que se use el idioma inglés, levantando la mano, las personas de habla española? (todos subieron la mano). Magnífico, muchas gracias.

Before starting the meeting today, I just asked if we could use the English language for the discussion this morning. We were hoping to have simultaneous translation but unfortunately it has not been installed. We hope it will be ready for tomorrow. Forthis morning all the Spanish speaking people have agreed to use the English language. I think it is important and relevant because, as I understand it, we are not here merely for making speeches but for discussing the different subjects touched on by the panel.

The subject for this morning's meeting is "The Nutritional Needs of Man." As I understand, the idea of the panel is to bring together a group of specialists from the different areas of food production, processing, and use, to discuss the problems of nutrition of human beings in this area and to interchange ideas with the "nutritional man."

We thought that it would be convenient before going into the main subject, to review briefly in this morning's meeting, what are the nutritional needs of man and what happens when those nutritional needs are not fully satisfied.

There are two topics to be considered this morning. The first one will be presented by Dr. Pearson. It is on "What are the Nutritional Needs of Man". The second, on the effects of malnutrition, was to be offered by Dr. Ramos Galván from Mexico. In the absence of Dr. Ramos Galvan, who has found it impossible to attend, I will try to speak about the subject which he was to have covered.

Before giving the floor to Dr. Pearson, I would like to emphasize that the introduction by the person in charge should be precisely that--an introduction--and that we expect an absolutely free interchange of ideas and discussion among all participants. I don't want to take up any more of the time, so I would like to request Dr. Pearson to present the introduction to the first topic.

Miss MacKinnon asked me to announce to all of you that you should identify yourselves before speaking, since we want to make a record of the meeting. Please identify yourselves and try not to speak more than one person at a time so that a correct record of this discussion can be made.

QUE NUTRIMENTOS O ALIMENTOS REQUIERE EL HOMBRE?

Dr. W. N. Pearson

In 1894, Dr. W. O. Atwater, one of our nutritional forebearers, wrote "To make the most out of a man, to bring him up to the desirable level of productive capacity, to enable him to live as a man ought to live, he must be well fed". No one would disagree with this statement I am certain and since that time extensive investigations have been carried out in an effort to determine what constitutes being "well fed". The U. S. Government addressed itself formally to this question in 1894, when the Congress of the United States appropriated $10,000 to enable the Secretary of Agriculture to investigate and report on the nutritive value of the various articles and commodities used for food, with special suggestion of full, wholesome, and edible rations less wasteful and more economical than those in common use." I can well imagine the consternation of an investigator of our time who is armed with a grant of $10,000 and is asked to come across with goods such as these.

We have come a long way since 1894, even though we have not yet def ned the completely adequate diet. Lord Boyd Orr has defined health recently as "a state of well being such that no improvement can be effected by a change in diet". We are now in a position to state, within limits, what sort of diet will maintain such a state of health.

Our biggest problem is application of this knowledge to the erradication of the malnutrition. Somehow, I envy the Public Health people who are concerned with the erradication of infectious disease or parasitic disease. For them, the transition from theoretical knowledge to practical measures is frequently simple. They find, for example, a Salk vaccine, or a spray that kills mosquitoes. They set up their program, have it funded, and proceed without having to particularly gain the indulgence of the population within which they will work and without having to alter too many ingrained customs. They spray, they vaccinate - presto the disease disappears or is reduced to a sufferable level. I have over-simplified, of course, but you get the picture. If we could attack malnutrition with spray guns we might not be meeting here today.

I would now like to summarize very briefly those nutrients known to be required by the human, the approximate intakes required per adult per day thought to be compatible with good health and circumstances which are known to alter or perhaps alter these requirements. This brief review, I hope, will form a framework for the discussion to follow.

Before I begin, I should remind you that the recommended intakes that we nutritionists toss about so glibly have two bases. The first is a firm scientific one- the second often contains facets of science and opinion. The interpretation of scientific data, for example, may differ sharply giving rise to this opinion base. This is glaringly evident in two well known recommended dietary allowances for vitamin C. The British recommend a level of vitamin C intake that is half that recommended by the Food and Nutrition Board of the United States. Thus, two sets of authorities having access to the same data have made entirely different interpretations. I shall not go into the reasons for these differences of opinion. I would merely remind you that they do indeed exist.

First, let's briefly consider the caloric need. The need for calories is usually compartmented. The two major compartments are those designed to cover the basal metabolic rate and the caloric demands of work. An additional increment must also be added to cover "maintenance of body temperature, of specific dynamic action of food, growth, etc." but this is usually a small one. The most variable part of the whole caloric need is the work compartment. People who do little physical work require fewer calories. People who do much physical labor need many calories. Thus, the daily caloric need for most adults will fall in the range between 2000 calories and 4000 calories. In the year 1955, the mean number of calories per day available to the U. S. population food balance sheets was 3200 calories. This is considerably in excess of the probable need. In the ICNND nutrition surveys which now number about 30 the available calories usually approximate 2100 to 2200 calories per capita. Usually the figures obtained have not deviated markedly from the values predicted from the FAO food balance tables for these countries. The accuracy of the food production information in many countries is open to some question but, nevertheless, it is safe to conclude that the calories available per capita in many countries including several in Central and South America are fewer than required for optimum health.

The main source of calories in most countries are carbohydrate and fat. Only in a few fortunate countries do proteins contribute an appreciable proportion of the caloric intake. The percentage of calories derived from fat may run as high as 40% in the dairy product countries and as low as 5% in the Orient, with its rice-based diet. We should also remind ourselves that there are no required sugars in the sense that we require certain amino acids in our diets. Neither are there required fats except perhaps for traces of some fatty acids. This means that our carbohydrate and fat needs are for practical purposes, mostly of a quantitative nature. Perhaps when the unsaturated vs. saturated fat controversy is resolved, a more accurate statement will be possible.

In the case of protein we cannot be as casual as we have been in our discussion of carbohydrate and fat. Here we must deal with the building blocks or hydrolytic products of protein - the amino acids. There are eight essential amino acids: methinine, threonine, tryptophan, valine, isoleucine, leucine, lysine, and phenylalanine. The minimum need for protein approximates 0.5 g/kg body weight in the adult, with the recommended intake - usually set around 1 g/kg body weight. Qualitatively, proteins differ tremendously among themselves. Some proteins will never support adequate health no matter what the level of intake. Such a protein is gelatin, which completely lacks certain essential amino acids. Other groups of proteins will support life but do so at a sub-optimum level. Among these may be included the main proteins found in cereal crops - foods designed by nature to serve mainly as caloric sources but which are called upon to furnish the bulk of the dietary protein in many situations. The middle-class of proteins include the legumes-higher protein control of somewhat higher quality than the cereals.

Finally, there are the excellent protein sources that contain the essential amino acids in optimum quantities. These are the proteins from animal sources. Although it is convenient to classify protein sources as I have just done, we should not lose sight of the fact that populations consume mixed diets. In this way the proteins from different sources supplement each other and the biological value of the mixture is usually greater than that of its individual components.

Much ado has been made about amino acid imbalance. Here, disproportionate quantities of some amino acids in the diet in comparison with others has been found to produce a growth depression in experimental animals. Only a few instances of this phenomenon has been recorded in studies with humans and although it is possible that some populations may be affected by amino acid imbalance this is undocumented. Nevertheless we should be aware of this possibility when calculating the potential biological value of mixed diets especially those deriving their protein largely from plant sources.

Now let us turn to minerals. Calcium is a major mineral constituent of the animal body. It makes up about $\frac{1}{2}$ to 2% of the body weight of the adult human. Most of the calcium is present in structural form in the bones and teeth but a small portion contributes to other functions such as blood coagulation, muscular irritability, etc. The appropriate daily intake of calcium required for optimum health has been a matter of much dispute. There are "low calcium people" and there are "high calcium people". The latter believe that a rather high intake of calcium is beneficial while the low calcium people find no good evidence

to support this view. The probable intake of calcium that will maintain a population of adults in good health is probably somewhere between 0.5 and 1 gram per day. The phosphorus requirement is generally considered to relate to the calcium need. It is usually assumed that if the calcium and protein needs of a population are met, the phosphorus requirement will also be met. When calories are obtained largely from cereals, however, the phosphorus may be present largely as phytates which may not be well absorbed.

Iron is a principal component of hemoglobin and myoglobin and of certain ensymes. Some is found in the transfer protein transferrin and some is stored as ferritin and hemosiderin. In the United States there is now a considerable controversy concerning the appropriateness of the currently recommended dietary intakes of iron. The latter now range in the adult from 10 to 15 mg. per day. From such intakes only about 10% is actually absorbed and utilized. Many hematologists in the U. S. are concerned with the rather high prevalence of iron deficiency anemia particularly among women and believe that the recommended intakes should be increased. It is doubtful, however, if levels higher than those now recommended could be obtained from the usual mixtures of naturally occurring foodstuffs. It should be of interest to this group that it is possible that iron is "cleaned out" of diets in technically developed countries. For example, I spent one summer in Egypt setting up a mineral analysis program. During our trial runs we found routinely that local grains and flours (i.e. maize and wheat) were considerably higher in their iron and zinc content than similar products imported from the United States. We ascribed this principally to contamination of the Egyptian grains with dirt. Accordingly, I am not certain that the Food Composition Tables of the U. S. Dept. of Agriculture, dearly beloved by most of us, are very useful when calculating the iron content of diets in countries other than the United States. As a matter of fact, I'm not too certain of their current validity in the U. S. It has been found almost routinely in the ICNND surveys that analysis of daily food composites gave iron figures that were frequently twice as high as those determined by use of the Tables of Food Composition. Whether the additional iron is available is not known - if the contaminants are iron oxides they probably contribute little iron for metabolic purposes.

The magnesium requirement of adult man has been estimated to lie between 200 and 300 mg. per day. These estimates were obtained by the balance technique, however, and are open to question for this reason. Although more and more observations of magnesium deficiency in hospital patients are now appearing in the literature, the frequency of magnesium deficiency or indeed its presence in populations is not known.

Copper and Zinc: copper is undoubtedly an essential nutrient for humans and experimental animals. The adult human contains around 100 mg. of copper and a copper intake of about 2 mg. per day in the adult would appear to be adequate. The role of copper in hemopoiesis in animals is certain but the occurrence of anemias of copper deficiency origin in human populations is not well documented. We should be alert to this possibility.

Iodine forms an integral part of the thyroid hormone and endemic goiter of varying degrees prevails in population groups where the sources of dietary iodine are limited. There have been symposiums almost ad nauseum on the subject of goiter and iodine deficiency and I do not propose to spend any particular time on this element. Suffice it to say that the most convenient way to increase the iodine intake of a population is to iodize or iodate the salt supply. This is a public health measure that is almost akin to the spraying of mosquitos depending upon the circumstances of course, and the reduction of endemic goiter by this means is usually dramatic.

In much the same vein, a certain amount of dietary fluoride is necessary for optimal health in that its presence reduces the susceptibility of teeth to dental caries. Again, the addition of fluoride to public water supplies lacking this element has been demostrated to markedly reduce the incidence of tooth decay in children.

There are certain trace minerals generally considered to be required by the human for which clearly delineated levels of intake have not yet been defined. These include zinc, manganese, molybdenum, cobalt, selenium, and chromium.

An apparent "zinc deficiency" resulting in growth retardation in the Middle East has been reported. Requirements for the other nutrients listed have been clearly established in experimental animals but not yet in the human. At least one of the metals, selenium, is toxic under certain conditions. Grains grown on seleniferous soils may be toxic to animals grazing in such areas. Conversely, selenium deficiency has been seen in sheep grazing on crops raised on soils that are deficient in this element. The role of selenium in human nutrition is unknown but children with kwashirkor have been demostrated to have reduced selenium stores.

The final nutrients I shall review are the vitamins. These include the fat soluble vitamins such as vitamins A, D, E, and K, and the water soluble vitamins such as thiamine, riboflavin, niacin, pantothenic acid, folic acid, pyridoxine, vitamin B_{12}, and biotin. There is no need to discuss these in detail but a few high points deserve mention.

Thiamine intakes not compatible with good health are prevalent in the rice eating countries - in the orient, for example. Niacin intakes that are not compatible with good health are found in populations consuming 80% of their calories in the form of maize. Vitamin A insufficiency is apparently wide-spread in many areas of the world and especially in young children who mostly because of ignorance do get adequate sources of carotene. Only countries eating large quantities of dairy products consume the amounts of riboflavin recommended by the U. S. Food and Nutrition Board. It is probable that much lower levels of consumption are adequate. Ascorbic acid deficiency or scurby occurs most frequently in those countries having great technologies where cow's milk has replaced breast milk as the main source of food for the infant. In the United States scurvy occurs (in very low incidence, I hasten to add) in the very young and the very old. The reason revolves around a lack of education rather than a lack of the appropriate protective foods.

One final point about the vitamins and minerals. If you can manipulate a national dietary to optimum calorie and protein intakes - the vitamin and mineral needs will, under most circumstances, also be met.

I have summarized rather hastily what is known about nutrient requirements. I have referred mostly to the adult and I know that this group is concerned in a large part with the very young person. Without going into detail suffice it to say that virtually all nutrient requirements are increased in the young child per kilogram of body weight. The recommended protein intake per kg. body weight, for the infant is, for example, two or three times that of the adult, the vitamin and mineral requirements are also somewhat increased. Also other physiological stresses such as primary enhance nutrient needs.

Recommended dietary allowances of one sort or another are often used as yardsticks for use in dietary surveys. This is generally useful and at times necessary but it should be pointed out that an adequate interpretation of dietary data must consider the limitations inherent in particular yardsticks being used. Deviations from the recommended allowances of the order of 10 to 20% are probably not going to have significant effects on nutritional status. Also, most recommended allowances are commonly set up for use with diets as consumed by the individual and are not appropriately applied at the level of diets as purchased for use in homes or institutions. They are even less applicable when applied to data collected at a national level which pertains to food available for consumption. Before food is actually consumed losses inevitably occur due to spoilage, transport, storage, waste, diversion to the feeding of domestic animals, etc. The magnitude of the losses is a bit uncertain but some sort of adjustments must be made. In many cases adjustments can be determined only by direct observations under the conditions of actual food distribution.

After the survey data are in, and the areas of dietary inadequacy have been identified, the next logical step is to adjust the food supply in order to erradicate these deficiencies. This is easier said than done for here we leave science as such and enter a jungle of food prejudices, habits, and economic factors. Food has cultural and social significance and the ingrained food consumption habits of a population are very difficult to alter.

There are several approaches to the problems encountered when one attempts to improve nutritional status of people without changing, essentially, the dietary habits.

The production and nutrient content of plant products can be improved considerably by plant breeding and fertilization. The nutrient content of animal products can be developed in the desired direction by breeding and feeding.

In the food industry, products can be enriched with important nutrients and some components can be removed. The ingredients of industrial food products can be selected to give the resulting products the desired nutritional properties.

I am certain we should hear more about this things during the next few days.

Thank you.

DISCUSION

Dr. Schaeffer: The basic problem in many of the developing countries is the large percentage of calories obtained from cereal. Adult man can adequately obtain his protein requirements from such cereals as rice, wheat and corn. Cereals, however, do not furnish sufficient protein for the child age 1 to 10, with the crucial need during the period of one year to five years of age. High cereal diets present a number of problems. Rice, wheat and corn (white) do not supply Vitamin A and Vitamin C. Also, depending upon the degree of refinement of the cereals (polished rice, white flour), they become poor sources of the B complex vitamins and minerals. As civilization or as the food industry advances, there has been an inherent custom to overmill and over-refine. These problems can be overcome by cereal fortification or enrichment with the essential nutrients.

This, then, demands that we know the nutrient composition of foods as they are presented to the consumer and requieres especial emphasis to ensure that all the essential nutrients in the correct amounts and balance are consumed. The primary source of Vitamin A and Vitamin C in high cereal consuming populations are fruits and vegetables.

Today one hears many suggestions that the world's malnutrition problem can be corrected by merely adding the amino acid lysine or by the introduction of the new high lysine corn. The malnutrition problems are not restricted to one single amino acid, thus, in planning a food and nutrition program, one must consider all the nutrients mentioned by Dr. Pearson. Applied nutrition is a public health program and must consider the nutritional needs of man in his environment. For example, when populations have a high infestation of parasites such as hookworm, there is a greater demand for iron. Whereas the average daily requirement for man may be 10 milligrams, infestation with hookworm may increase the requirement by 100% to 500%.

It is important that in considering food, we must consider all the nutrients supplied by the total diet. Merely assuming that if one gets adequate calories and proteins, he is in good shape, is indeed a false interpretation. Nutrition is really a bridge between agriculture and health and it only functions at the time the food is consumed by the human.

Dr. Behar: I would like to emphasize a little further the first comment of Dr. Schaeffer. He has presented very well the nutritional needs of human beings in terms of nutrients. We should not forget that nutrients are present to us in the form of foods so we must consider the proper balance of all the nutrients in a given food or in a given diet. Here is one of the big problems because the primary or the more pressing needs of man are calories and populations tend to satisfy their caloric needs first. If the food with which they are satisfying their caloric needs does not provide adequate amounts of all the nutrients because of their concentration or their quality, the problem begins.

We have been trying to see how the available foods in this area can be utilized particularly to satisfy the protein needs of human beings. We know that the diet in Guatemala for the majority of the population is based on beans and corn. The combination of beans and corn makes a food which is not to bad both in the amount and in the quality of the proteins. If an adult man eats enough corn and beans in the proper

combination to satisfy his caloric needs, he will have enough proteins to satisfy the minimum demand. Unfortunatelly this is not the case with the small child who needs much more of these nutrients in terms of body weight. Using corn and beans in the best possible combination in which the proteins will complement each other, we tried to use this combination as the basic diet for children during their second and third years of life, i.e. the weaning period. Theoretically, the amount of food that those children should consume to satisfy their protein needs was much larger than the amount required to satisfy their caloric needs. The child would have to have many more calories than he needs in order to get enough proteins. But more than that, the bulk of the diet, because of the low concentration of the proteins, was such that a child 2 or 3 years of age could not eat enough of these two foods to satisfy his protein needs. The problem here is one of concentration or balance of the different nutrients within the food and this is something that should be kept in mind.

Dr. Behar: There is another comment I would like to make at this time, at least to stimulate discussion because I know there are some excellent animal nutritionists here. In comparing the nutritional needs of animals and human beings, I have always been impressed by a basic difference. The animal nutritionists have a very definite and measurable objective when they feed an animal. Either they want to produce maximum growth or they want to produce changes in body composition of the animal: more fat, less fat, whatever will be. On the other hand, Dr. Pearson defined the objectives in human nutritional requirements as "optimum health" and this, I think, is one of our biggest problems in human nutrition, ie. what is optimum health? It is my opinion, as a pediatrician, that we have been too much influenced by the animal nutritionists, particularly in the feeding of children. We have tried to imitate the animal nutritionists in establishing maximum growth as the objective. Is that really optimum health? There are some indications, particularly by the work of Dr. Holt, Professor of Pediatrics at Columbia University, New York, and of other leading pediatricians, which suggest this may not be the case. We don't know if some of the diseases such as diabetes, arteriosclerosis and others are not related to overfeeding at an early age. I would like to get some opinions from Dr. Peterson and from any others who will comment.

Dr. Peterson: I am not scheduled to be on the program yet, but I may just throw in some words on the animal nutrition. I am not sure at all, personally, that maximum growth that we cherish so much in the animal husbandry field, for the young is the best objective. Or

how much does the weight or growth of a calf or a little pig in the first part of its life contribute to its ultimate growth? We know it contributes significantly to the increased nutritional requirements at that time and that it might be more economical.

Dr. Behar: Dr. Peterson said he is not scheduled yet, but everybody is scheduled. We are not expecting for the participants to talk only when they are scheduled. The whole idea here is an absolute free participation of everybody in all the meetings.

Dr. Pearson: I would like to comment on the remarks of Dr. Behar and Dr. Peterson. I was always intrigued by the numerous references ences to the experiments of McCay et al and one day I got out the original papers and read them. As I recall, in most of his experiments, McCay kept his animals on a semi-starvation diet so that they never exceeded 100 grams in weight, even at 6 months or 1 year of age. Then he put them on other diets of varying adequacy and demonstrated that the underfed rats lived longer. On the other hand, one point that is ignored is that 40% of the rats died during the preliminary period of semi-starvation. A high price to pay for longevity! The more recent experiments of McCance and Widdowson seem more applicable. They take two litters of new-born rat puppies; let one mother nurse two of them, and the other the remainder - let us say, twenty-two puppies. The mother with twenty-two puppies can not adequately nourish them all and these puppies grow up as runts. The mother with two puppies feeds them very well and these rats grow rapidly. After a three week period, they take the runts and feed them an adequate diet. Nevertheless, the runts never catch up in growth and end up as a small adult population. As I recall, in these experiments they did not show that the runt animals had increased live-spans. Thus, I am not convinced that underfeeding early in life is certain to be followed by increased longevity although it may conceivably result in an adult population that has not reached its full potential genetic size.

Dr. Bressani: I really do not have many comments to make on what Dr. Pearson said, but I would like to go back to what Dr. Schaeffer indicated concerning cereal grains and vitamin concentration in foods, particularly Vitamin A.

There are only two grains that contain some Vitamin A, and these are corn and some of the sorghum varieties. However, people prefer the white type of cereal grains for consumption. In any case, they should be considered as sources of Vitamin A. I would like to make two

other comments in relation to the availability of some of the nutrients in most foods. Too much attention is given sometimes to values in food composition tables in the sense that a food has so many grams of protein or that it has so many miligrams of vitamins, for example, niacine. Actual biological testing shows that the values tend to be lower, suggesting low availability. A typical example of this is niacin in corn. The amount of niacine in corn is rather high, but very little of it is available to the organism. It is through processing that some of this nacine becomes available to the animal. The second comment concerns another nutrient of interest: calcium. Since Latin American population live very much on foods of plan origin, the amounts of calcium intakes are very small as compared to populations consuming animal products. Since corn is cooked with lime water, the amount of calcium remaining in the final product is very high. This calcium is available and highly utilized by the organism, therefore, one sees very little calcium deficiency in many of these populations. With respect to the objectives of animal and human nutrition, I really don't like to blame the animal nutritionist because the objectives are, of course, to produce more in less time so people have more. With respect to the human population, the objective is to have a longer life, less disease, more health, and capacity to learn.

Dr. Chichester: I agree with Dr. Bressani. If one compares the average age of cattle in the large cattle-producing countries in Latin America: Paraguay, Uruguay, Argentina, etc., you find the average age of slaughter is four or five years. If one makes the calculations on a protein basis, they consume more food than cattle of the same weight slaughtered at a younger age. This is an economic problem, in one case the cattle are entirely range fed, while in the other they are fed supplements. From an economic stand point we can afford to take a less efficient conversion of plant protein to animal protein, because of the ease of production, low cost of land, and acreage available. But one could double the protein availability to the population by merely changing the slaughter age from 4 to 5 years. And, in fact, at the present time I think in the United States it's down to around 18 months. In 18 months one can produce a beef steer with higher weight than you can after a period of 4 and a half to 5 years on grazing on natural pasture, although at the cost of improved pastures, disease control, and supplemental feeding. Whether the 18-month old steer will live to be 5 years old we don't care because we are going to kill him anyway.

Then secondly, I'd like to put in my word for the processing industry. The processing industry produces what the people want, within limits,

since this is the basis on which they sell their products. Now, I think we as people concerned with nutrition, don't see a great deal in the typical soft drinks that are sold all over the world, but obviously the population likes them. This is what they want to eat; if we could produce a nutritional product with the same acceptability we would be a great deal ahead.

If the populations want a white flour, the industry will produce a white flour. You have several solutions; you could probably regulate the industry and say that you cannot produce a white flour, but then you've gone against the likes of the population. Or one could try to change the population' food habits or food desires but this is extremely difficult. The easy course is to enrich, which is not a problem from the standpoint of the processer. From the standpoint of the public no difference will be noted because you, in effect, fool the public. You put in something that's good for them, and they still get what they want.

Now, one other comment on the feeding of children. Where the children are fed prepared food materials, the food industry, again, does not prepare these from the standpoint of the child except for the nutritional aspects. The mother decides what is good for her child with some input from the pediatrician or the nutritionist. In general the choice is made by the mother, either on the basis of her taste or her prejudices or previous education. Therefore, you have the problem of dealing with the mother, not directly with the child.

Dr. Pearson: May I have a comment or two? I'm shocked, Dr. Chichester, to hear that white flour is sold because people like it. The other food technologists that talk to me about this always seem to explain this on the basis of the low fat content and therefore better storage, a greater digestibility and finally, fortification with vitamin and mineral mixtures that are very available. These comparisons are always made with whole wheat flour. And the other thing is that I'm personally not sure who chose those homogenized baby foods. Have you ever tasted homogenized turnips versus homogenized carrots, versus homogenized spinach? If you have, I don't think you could tell one from the other, and I'm surprised that they ever made the market at all if mothers ever tasted them.

Dr. Chichester: I don't agree. Let's take the case of the carrots or spinach purées. While I may not prefer their taste when they are produced, an attempt is made to make them as palatable as possible.

There are differences between the several brands thay may be on the market. They have all been developed and the processing conditions have been selected to make them most pleasing products as possible, while maintaining their nutrition.

I debate, really, whether the white flour quality has anything to do with nutrition. If you look at the sales of bread products, you will find that there is only a very small segment of the population (in the United States) which prefers the whole wheat or the breads which are made from flours which have a low extraction. Until several years ago the very large bakeries did not attempt to market this type of bread. The market had to wait until a small producer could touch the small segment of the population which prefers the denser type of bread or the darker or low extraction bread. Although these are very successful, at least in the United States, they are still specialty breads. The majority of the population prefers the very white, light weight white bread. If they didn't, the population would buy the other, the producers would then produce what the population wanted. The economic basis for the food industry is sell what the public will buy, although in general it would be economic to sell food even if the public desired it.

Lic. Ponce: I would like to make some comments on what Dr. Chichester said about the processed foods. I think that he said that most of these processed foods are prepared on the basis of what people want. But I disagree with him. I think that processed foods are prepared not on what people want but on what industries want people to want. The industries are the ones who tell the people what they want in the first place. In the second place, I just wondered how much important those processed foods are to our countries. These are underdeveloped countries and the level of income of the greater percentage of our people cannot afford processed foods. So how can we pretend to get these people to eat a balanced diet on processed foods? Should we not rather concentrate into how much food can we give to these people in an unprocessed form in order to make it available to them at low prices? There was also mentioned here the production of livestock as a principal source of animal protein. Again, I question whether we should concentrate on livestock production for internal consumption in our countries. Livestock is a high cost food. Perhaps we can get some kind of animal protein to the population that is less costly, because even if we produced large amounts of livestock, I am sure most of the population could not afford to pay for it. There are also other considerations; beef is an important export product for our countries and we should produce

it for exports and substitute its internal consumption with some kind of cheaper animal product so that we can offer to our population, at the least cost, the animal protein they need and at the same time use our beef production to diversify our exports.

Lic. Ramírez: I wanted to comment in the lines of Licenciado Ponce. I want to refer to the different degrees of intensity the industry produces to satisfy the wants of the people. These are wants in terms of money or effective demand and therefore the consumption levels are different from one country to another according to the income levels. We may compare a pound of sugar with two quarts of milk and a dozen eggs, which have about the same amount of calories but different protein contents. People have more access to sugar because it is cheaper than the other products, has more calories and lack of proteins. Proteins are the elements that make the foods more expensive, because they are more expensive to produce. If we inspect the industry in Central America and Panama that is dedicated to the production of foods, we immediately notice that it is the biggest industry. Also, due to its organization as home industry, it occupies a larger share of population than the other industries. We ought to conclude that this industry is not capable of adding nutrients to their production. There are some other considerations related to growth in general. The degree of applied technology is related to the salary levels. As salaries go higher, technology goes higher. The addition of elements is possible to modern technology. I wanted to say that we should take into account the wants for each one of the countries and advise the governments, in the first place, to develop their agricultural and livestock production to reduce the present gap and, in the second place, to raise the income level.

The surveys made have shown that the income levels of the vast majorities of the people are very low because they are in the subsistence level. Nevertheless, there are some industries that have caused some impact on the people, like the canned food industry. Canned foods are consumed now by all peoples. Some people take a can of pineapple juice in preference to the fruits because it is lower in price and also because of prestige. This, technology has been imported from the United States and is necessary to develop some standards so that these industries would carry some nutrients to balance their diet. In my experience working for INCAP I have noticed that in countries characterized by high temperatures, the consumption of canned foods is increasing. Here there is room for action that could be taken by the governments to improve the food intakes of the people.

Dr. Dracy: The biggest problem probably in the whole of nutrition is economic. There's no question now that we are turning our minds to meat. We like to eat meat. However, most people fail to realize that the dairy cow is infinitely more advantageous economically for producing desirable nutrients than any other single means. This should be certainly exploited. And this should be done in a number of ways, the one at the present time is to reduce the cost and you talked about food habits, but I'd like you to show me a kid that doesn't like an ice cream cone in Latin America, but by the time he gets it, there's hardly any ice cream. In other words, the portion is so small and the price is so high that it is not an attractive purchase to the child. The next thing is that in our dairy products, especially, at the present time, the cost of production is too high. If the price were lower more people would eat it and I'm here to say that at the farm level it is highly possible to produce a great deal more dairy products than what we are doing. The only reason is that there is no market. It isn't that it couldn't be available. But it will not be available so long as high consumer prices are present. The one is the high cost to the consumer and the other that in order to bring it to the consumer there are so many attachments to it in the form of producer regulations that many farmers, not that they can't do it, but they aren't willing to do it. In other words, the level of technology to produce legalized milk is above and beyond the technical level of the average producer. But if we just rememeber the one item, Get the product economically to the consumer, a great deal of our nutritional element from the standpoint of animal protein nutrition would be eliminated.

Lic. Aguirre: I suppose we should try to summarize because many interesting comments have been presented here. It seems to me that several ideas have been left floating and from the very suggestive presentation of Dr. Pearson we should try to focus our attention to the main problems that come out as the results of the comments that we have heard. Obviously, when we talk about nutriton, we cannot avoid thinking that this is just one item in the development. I say that, because, when we talk about the developed countries, that have obtained a desireable level of nutrition not on an isolated basis but as the result of the general development of the population. Nutrition has been improved along with shelter, clothing and everything. A desirable level of nutrition usually comes when they are able to have a mixed diet; I doubt very much if in those countries the science of nutrition was so highly developed before they attained a desirable nutritional level as it is the case, for example, in the underdeveloped countries today. In the underdeveloped countries we can talk

about many sophistications in terms of nutrition because we can learn from what has been done elsewhere and what we are doing here. But the important factor in nutrition is what the population eats. Now, when we talk about different possibilities in nutrition of the undernourished population, one gets the sensation that they are going to stay that way. They are not going to stay that way as long as we are able to promote the general development, because the general development will immediately bring them the mixed diet and the varied nutrition. Obviously, it would be foolish for us not to take advantage of the many refinements that have been developed in terms of nutrition, so that within this general development we can introduce them not only to promote access to a mixed diet but to a better one. Therefore, we can reach higher levels in a shorter period of time. But it will come, when we are able to promote that general development. In nutrition we are going to be able to do that, when we produce more. We are not producing enough. I know that economically it may present some problems but we are not going to deal with them here. If we will have to produce more, we will have to process this production. We will have to process the agricultural commodities if we want to distribute them, because, unfortunately the fresh foods can not be kept for a long time. The market area that you can cover with the fresh fruit is not as large as the one you can cover with the processed one. In respect of processed foods, I don't want to try to elaborate further arguments and determine who decides who wants what. The processer or the population? It seems to me that up to the present moment, what we have done has been a simple application of technology that was developed elsewhere, in order to meet the needs for the economic (let's call it economic), development in these areas. Not that the processer does not care what the population wants, because obviously he will always try to meet that demand. The trouble is, that he doesn't have at his disposal the technology to process the local foods to render a product the way the population would like it; he has to rely upon technology that has been developed for different raw materials. I know, of course, that there are some exceptions to this. So, one thing that I think is very important is that we should try to promote the development of food technology applied to our own raw materials to meet at least this two factors that the population demands: low cost (at this stage of development) and a product that the people like to eat. As Dr. Chichester mentioned, one important thing is flavor; let's say in general terms, the organoleptic characteristics of the item, because otherwise the consumer will not eat it. So, it seems to me, that one factor which is extremely important and that we should learn, sooner or later, is how to process our own food products at the cheapest

possible way, but not thinking only in the technology itself but in the "sex appeal" that should have the finished product, for the population which is going to consume it. Our populations have their own cultural patterns, they have their own habits, they are used to have a great variety of flavors in their mouth because the tropical raw foods offer them a tremendous variety. The moment that we start with an industrialized product that is going to standardize its flavor, the consumer will resent it because he is not used to it. We have to be aware of this factor when we develop new products.

Well, I know that I was not very successful in trying to summarize the general ideas, as it was my intention when I started, but at least I had a chance to put my little grain of sand.

Thank you very much.

Dr. Bressani: I wanted to go back to what Lic. Aguirre said: people consume what they want.

I agree with him in the general sense of the word but I also agree with Mr. Ponce that the producer has a tremendous influence. Taking this sentence to mind, I have been thinking that our programs in Latin America have been asked to concentrate in nutrition, in production of vegetable crops, lets say, and things like that, but we have not paid very much attention to animal production and I think that the potentiality of nutritional animal productivity in Latin America is enormous, the problem is that we don't have the knowledge, we don't have the research, and we don't have the people that is needed to increase animal productivity. As far as I am concerned, I think that all people prefer animal products than vegetable products, aside from the fact that we are doing work on the other side, but I think that the development shows that men went hunting because they thought that meat was good and even today animal products are preferred. What I mean is that we really should concentrate much more on animal productivity. For instance, in this thing of dairy production, the potentials are great but we don't know how to go about it and we can not transport knowledge from other countries that have a high level of production. We have to do it ourselves.

In the second place, with respect to profit food, I think that we tend to confuse things a little bit. What we really need in Latin America is not the sophisticated type of processing. This is really good and we must not forget it, but we have to concentrate on how to keep

whatever we produce now. I have examples of cereal grains being sold to the consumer that are highly contaminated with all kinds of fungi, with worms, and we hear very often the tremendous loss of grains we have had because we have not been able to preserve them correctly, and I think that we need at least to do some work along these lines or apply the knowledge that has been accumulated in other countries. I think that this type of processing, the simple kind of processing is something that will not put too much price on the final product and people will be able to pay for it as compared with the other type of product that is sophisticated which is best for exporting purposes and finally, I think that we all agree on what our problems are and what our solutions could be, but what we need here is to be more efficient in productivity, we really lack that and unless we have productivity, we won't be able to develop in many other ways and I am afraid that industrial development means that we must have a balance development, both in agriculture and in industry.

Dr. Chichester: Only one thing. When we discuss processing, I think we should define what we mean by processing. Most of the cereal grains that we eat are processed, they are dry. We never eat the raw grain, so therefore, we have a processing industry that exists in every country. So in my own mind, when I talk about processing, I think of it from the simple one of putting out the corn to dry on the cob to the most sophisticated method we have now which is irradiation. This is the whole gamut.

Dr. Behar: Dr. Pearson, do you want to add anything?

Dr. Pearson: I think I've said enough, Dr. Behar.

CUALES SON LOS EFECTOS DE UNA NUTRICION INADECUADA?

Dr. M. Behar

We move then to the next subject, I am taking the liberty of making some introductory remarks to the subject for its discussion. I'm very glad that Lic. Aguirre has put a question which has been very much discussed and I would probably exaggerate what he said but he said that we should not worry about nutrition, that this problem would be corrected authomatically once the economic of the country develops. Well, I think this is a dangerous hypothesis and one that has been responsible for very low interest in nutrition. I would like to add, who is going to make the development? He said: we must produce more. Who are going to produce? People. How will these malnourished people be able to produce more? And this is the problem that has not been, to my mind, given enough attention. The situation in other areas has been different, we cannot wait a century for development, we must accelerate development and for this acceleration of development we need human beings that are able to do it. I am introducing in this way my subject "What affects does malnutrition produce".

Well, I think that we have been too much medically oriented in analysing the effects of malnutrition and by that I mean that we know and we recognize the accute, severe defficiencies like accute protein calorie malnutrition which shows a dramatic picture that kills a lot of children, or like severe vitamin A defficiency, which produces blindness in small children, or accute beriberi, and scurvy. I am not going to go into details of all those diseases, I just want to say that those diseases should be considered only as indicators of a much bigger and important problem which is not usually recognized or not attributable to malnutrition.

It has been said that what we recognize as nutritional problems is only the visible part of an iceberg. We recognize only what is on the surface. But the larger part is under water and we don't see it. Well, this is a good comparison but still under estimate the real situation, because what is actually happening is much more dramatic than that. A better comparison will be with an enormous underwater mountain of which only a very small peak is visible and those are the acute, severe diseases that we see

in clinics, hospitals, etc. I don't want to concentrate on them. They should be taken care in the hospitals, in the clinics, they are important, they should be cured at the individual level, but we should be more concerned with the very large majority of the population who is suffering of subclinical unrecognized nutritional defficiency; the large underwater part of the mountain.

If we take calorie malnutrition, for instance, there are surveys indicating that no more than 15% of the children of the pre-school age suffer of either marasmos or kwashiorkor, the two forms of severe protein calorie malnutrition, while 80-90% of the children are suffering of subclinical forms of malnutrition not recognized as diseases and which are not considered to be nutritional problems. What are those?

If we look at mortality figures and we analyse the rate of mortality in our countries and try to relate them to the nutritional situation of the population, we find a very striking situation if we compare, for instance, the deaths of children below one year of age, that is what we call in Public Health "Infant Mortality". The figure in the United States is about 20 children for 1000 live births. In most countries in Latin America there are in the ranges of 50 to 100. In other words, there are from $2\frac{1}{2}$ to 5 times greater. But if we take the mortality of children between 1-4 years of age, we find in the United States figures of about 1 per 1000 children of that particular age group while in Latin America we find them to range from 10 to 50. We can see that the ratio is now from 10-50 times greater. Why?

The other factors responsible for diseases and deaths which at this ages are primarily infectious diseases in Latin America, operate with the same intensity at both age groups. Then, why should the children die much more between 1 and 4 than they do before one? We have demonstrated by direct field studies that this difference is caused by malnutrition. Those children don't die of malnutrition, they die of measels, diarrhea, they die of many other common, ordinary diseases, but which are ussually not fatal in well nourished children but are much more fatal in subclinical malnourished children.

Let's take one particular disease, for example: Measles. This is a disease which is practically universal, at least it used to be before the vaccine. The rates of prevalence of the disease are not different in the countries; but the fatality rate, that is the number of deaths of all those children who get measles, is from

200-400 times greater in Latin America than in the Unites States and this is not because it is a different disease, it is not a different virus, it is only the child that is different, and the main difference is in its nutritional status.

Lets consider what happens to those that don't die. We will use the growth as an indicator of health. The children of the rural areas of Guatemala are born with a weight a little below the average of the children in the Unites States or Europe. They catch up during the first one to two months, so by the age of three months there is very little difference between the average United States children and these children. Then, they follow this pattern up until the age of about six months, their growth is from then lower than the standard and by the age of one year they practically stop growing up to the age of three or four years. Then they start to grow again at a normal rate which is parallel to the rate of other children but maturity at puberty occurs at the same chronological age and finally, they are smaller adults. Is this problem genetic as has been said? We don't believe so, because we have data showing that children of many different etnic origin do the same under the same environmental conditions. We take, for instance, the children in Costa Rica, which are almost pure white, well they do exactly as our Mayan indian children if they are under the same environmental conditions. On the other hand, if we take children of our Mayan or mixed population but who are well fed and well take care of, they do follow exactly the pattern of children in other areas. So we believe that among the pattern is the effect of the environmental factors and among them, one of the most important is nutrition.

This is physical growth, but again it can be said: what is the importance of physical growth? is there any advantage in being bigger? Really there is not for most purposes of life. However, we consider that physical growth should only be regarded as an indicator of health and of maturation, including the development of all the important physiological functions, then this becomes extremely important and unfortunately there is data suggesting that what happens in physical growth is happening in development, including mental development. And this of course is important. This is much more important than physical growth. The data is not yet completed, it is not absolutely conclusive, but there are good studies which suggest that there is a good correlation between physical growth and mental development in children. These children of the age of 4 or 5 have usually the body size of a child of 2 or 3. There is about 2 years retardation by the age of 5 in body size. It seems that it is a very similar situation in terms of mental

development and capacity to learn. This is very difficult to measure but those children at the age of 5, or 6 years of age are not yet really at the age mentally that they should be by chronological age. Well, this has tremendous implications and although we don't know if this retardation will be corrected later in life, it affects the children at the age that they go to school and they have to learn, and even if they recover of this retardation in mental development the fact is that at school age they are well below their standard for their age. This has not been taken into consideration in the school systems. The curricula is based on the age of the child, so that a child of 6 or 7 years of age should learn such and such things which have been developed for other types of populations and we have been surprised to see the large number of failures of those children in school. Well, probably the curricula is not adapted to their capacity. The indications of this in terms of the future are obvious.

There are other aspects of development about which I am not going to go into detail, such as resistance to stress, resistance to diseases, and other functions which are important and which also seem to be affected in the same way as physical growth.

Going now to the adult population, which has to live on an insufficient diet, chronically insufficient, not really very dramatically insufficient so that they develop deficiency diseases, they are consider "normal people" living mostly in the rural areas and poor sections of the cities, they are not getting the nutritional recommendations indicated to us by Dr. Pearson this morning; and they have not been for long periods of time. There is no question that there is an adaptation in those individuals. We don't know enough about this adaptive mechanism but they do survive and seem to produce work with less calories that theoretically are needed and with less proteins. Well, what is the price of this adaptations?

We suspect, and we are measuring it now at INCAP, that the adaptation is in terms of a more economical metabolism or a more economical way of life. It has been very much stated in literature that these populations are usually apathetic, they lack wheel and initiative and although they may be physically able in terms of physical work because of training, but mentally and psichologically the situation is different and this may be the price they are paying in adaptation to not satisfying their nutritional needs.

This is why I am very much concerned with the hypothesis of Lic. Aguirre, that we should wait until the country develops and then they will eat well. I think we should't wait, because if we don't take care

of the working population and the potential workers of the future, I don't see how we are going to break that vicious circle of low productivity, low consumption, and malnutrition. So I would like to introduce the subject for discussion, summarizing again that I am not very much concerned about the very sick child that needs hospitalization. They are or should be taken care at the hospitals. I am much more concerned about the child that is living in the rural areas, considered "normal" and for the adult who is also considered "normal" and who is living on a sub-optimal nutritional conditions and affecting the development of the countries.

DISCUSION

Peterson: During the first six months, when there's a catch up are they rather universally breast fed?

Behar: Yes, they are breast fed with no supplementary feeding.

Aguirre: Well, I think I'm entitled to initiate this discussion since my idea has been challenged. First of all, I'm glad because with the discussion it has been easier to bring out some important factors. On the first place, I don't want you to get the impression that I take the pessimistic attitude of let's wait, laissez-faire, laissez-passé. I'm not trying to promote that idea. What I meant was that you cannot deny the fact that there are the following factors: in industry you get higher productivity than in agriculture because obviously you have a machine at your disposal. Therefore, going back to what Dr. Bressani mentioned, we have to increase our level of productivity because our sources of investment are small. Now, if we increase our productivity we are increasing our general wealth, and our general wealth will have to reflect in the level of development of the population. Now, let's think in terms of agriculture. It is not a question of producing ten times as many tons of corn or beans or whatever we are producing, because then we are facing some more problems: distribution, marketing, absortion by the consumer of all that production, but if we agree that we get a high productivity industrially than agriculturally, and for a long time to come we have to admit that the raw materials of our industry will have to come from agriculture because our mineral resources are only initially tapped, it means that the development of the food industry will naturally promote the development of agricultural production, which at this stage we cannot just increase for the sake of increasing.

If you increase the agricultural production, even taking into consideration that the cause of the malnutritional level of your laborers isn't going to be as highly productive as it should be, we are going to face another kind of problems. It is the question that you face every year in a country like Guatemala where the corn is the basic food. Look at the current production and you can see immediately that it follows the price. In a scarcity year the price goes up and then next year everybody is producing more corn and the price goes down. Nobody is interested in producing more because we don't have any system yet that takes up that production and offers it the effect on price for next year.

What I meant in that respect is that since our productivity is going to be higher dollar by dollar invested in industry than in agriculture, when we promote the industrialization of the area which in turn will have to be based on raw materials that will come from agriculture. We are going to accelerate that process mentioned, granted of course, it would be foolish on my part not to realize that we are not going to take advantage of all the knowledge that has been accumulated in terms of nutrition and nutrition development of the population. It is obvious that we have to go to production. There is no way out. It is just not a question that we argue here and we decide so many calories and so many vitamins and so many aminoacids if they are not available at the price that the population can pay it becomes a little idealistic so that is why I just wanted to clarify a little bit and not that you get the impression that I am thinking in terms of laissez-passé.

Behar: Thank you very much.

Dr. Schaefer: I want to clarify that I am not an economist either. The problem that Lic. Aguirre emphasized is one that is dear to my heart; i.e. the welfare of the infant and the pre-school child. Considering the question of subsidies, whether in Central America or in the United States, I recall that governments have subsidised the mining industry, the postal service, transportation, i.e. air and bus lines when they were initiated; they have subsidized education and school feeding which, by the way, was started in Argentina about 100 years ago. But generally very little attention has been paid to the idea that governments need to invest in youth and to subsidize pre-school feeding plans. Every child has an inborn right to grow and develop mentally and physically so that he can make his maximum contribution to production.

I hope this conference will face squarely the one way to break this vicious cycle of malnutrition and low productivity. If it requires subsidy, be it from industry or from government, I hope that you will come up with some concrete suggestions as to how Guatemala or El Salvador or Costa Rica can insure that the pre-school child will have the opportunity to achieve maximum growth and maximum mental development. How much of this subsidy should be borne by government or by industry, I don't know. I think it is a matter that has been ignored largely, perhaps because we did not realize the seriousness of the insult caused by sub-optimal nutrition that Dr. Behar has described. There is an urgent need to break this cycle and we all agree that we should have an adequate supply of food and income sufficient to make it available for private purchase. But I don't think we should wait until the development of industry makes it possible for the majority of working people who are now living in a subsistence agricultural economy to break out of this cycle.

Lic. Ramírez: I just want to say that there are many ways to develop a country and we could be lost in the discussion of what is economic or social growth. It is a well known fact that the income levels in Central America are very low and therefore savings and capital formation are low. Capital from outside do not come even with conditions of monopoly. Because of the low income levels these industries will not develop up to high levels of productivity that would guarantee low cost supply to provide adequate consumption to the people that we are concerned about. As a matter of fact, the new industries have been subsidized by the government by means of tax exemptions, income tax exemption, but the price levels have not diminished due to the tariff protection and monopoly conditions.

When we think in terms of industry there is not only demand for raw materials but also food for urban population. Urban development is facilitated by the foods produced by agriculture. So we have to balance our thoughts with the idea that industry needs a growing agriculture and livestock sector. I rather think that a dynamic agricultural development is a prerequisite for industrial settlement and development.

Dr. Behar: We are going to continue until 12:30 and we'll start this afternoon at two so we still have about 10 minutes.

Ing. Carlos Rolz: I would like to bring to discussion another factor and this is the time factor. By refering to a time factor, I ask, will production keep up with population growth? By this I mean that we have to prepare materials for infants, and not only infants but adults also. Much of our vegetable mixtures come from cereals, and some emphasis has also be given in this discussion to meat production. Nonetheless, I would like to ask whether we can keep up with the production of cereals and with the production of meat so as to raise this rate so high as to be able to feed the population that we will have in 10 or 15 years. An article by Dr. Humphrey of Penn State states that we should look into microbial synthesis as the future raw material for food. I would like to hear some comments on this from the nutrition viewpoint. I would like to know if we can get all the protein, all the caloric intake and all the minerals that Dr. Pearson talked about from microbial synthesis.

Dr. Behar: Lic. Ponce wishes to comment.

Lic. Ponce: I just want to refer to the statement of Mr. Rolz as to whether or not we are going to produce enough to supply our needs in the next 15 years. If we make up our minds in Central America we can produce enough. For example, we are now producing enough corn to supply the amounts necessary for a balanced diet. I am sure we would produce more rice and beans in a very short time so that we could provide the needs of our population. They should stimulate production regulating the market. Livestock will respond to a program of quality and quantity development as it has been shown by Nicaragua and Costa Rica. The land tenure structure is deterring the increase of production and productivity.

Dr. Bressani: I think that the problem with us is that we are always looking for something else rather than concentrating on what we have. Bacterial proteins were mentioned but have we paid really enough attention to what we have? I think we have a lot of work to do to be able to utilize that which we have more efficiently. For example, corn has been mentioned as a crop that one year is very expensive and the next year is very cheap, and we don't know how to control this situation. Why don't we, instead of keeping that corn, invest it in animal production? Certainly swine can be fattened with a lot of corn. Dairy production is based in many places with cereal grains and other types of protein concentrates. I think this is our problem here that we have a lot of something but we don't know how to utilize it because we like the continuity of things, like we might have a lot of production but then we don't know a way of saving this product or

how to distribute it to people and this is what we should do. Going back to bacterial protein, this is a new thing in protein sources and it was about five years ago when the French reported that they could produce these materials very cheaply, much cheaper than the cow, but the technological problems involved are becoming apparent. For one thing they are very difficult to digest, and there are many problems like this. People have reported that they can supplement cereal based diets but this is not really completely true because the processing that has been applied has destroyed the nutritional quality of this thing, and rather than concentrating too much on this things why don't we try to improve the cotton seed that is being manufactured in Central America? Or why don't we find better ways of processing soya beans or introducing soya beans in the area? Why don't we isolate proteins from beans? There are tremendous varieties of beans that are not utilized much but can serve as protein sources for people, rather than trying to develop something like bacterial proteins.

Dr. Wayne Adams: I agree very much with what Dr. Bressani has just said and want to make a comment of a similar nature myself and particularly with respect to the problems that were discussed earlier, that we need technological developments if we are going to use bacterial proteins. Now, he raised another point on which I would like to comment briefly and that is the ebb and flow of production of corn or cereals and the difficulties which production irregularities impose on industry and this really raises the question of how we might store products and keep them over from one year to the other. As an example of what I mean here in terms of nutrition I recently met an agronomist from Brasil, who points out that in Brasil the bean crop comes roughly twice a year and that they have a big production during the first crop and this is not fully utilized by the time the second crop comes along. The people who eat beans don't want to use what is left of the first crop because it has deteriorated in value, it's more difficult to cook, it takes a longer soak period and is less digestible. What we really need in a case like that is some storage research to point the way, but also some storage facility to regulate humidity and temperature, as well as to protect the crop from some of the smaller parasites that get into storage material. Last year I was very favorably impressed by a speech made by Dr. Ted Schultz of the University of Chicago, who many of you may know as an economist who has specialized in underdeveloped regions of the world, and his specialty extends primarily to the area of south east Asia. I would judge without having first hand experience, that some of those problems might not be unrelated to ours. The part that impressed me most was that Schultz, an economist, points out most clearly that what is needed

in such a situation is not a great influx of capital per se but new wealth input.

It was interesting to me as a crops production specialist, to learn that Ted Schultz uses the introduction of hybrid corn in India or into Thailand as a prime example of new input. Hybrid corn does require a little more technology because you have to know how to produce hybrid seed, of course, but basically here is a raw material input, analogous to the opening of a new phosphate mine, that has the potential of revolutionazing food production and it is based on the introduction of an essential raw material that has a very low cost initially.

Dr. Behar: I am afraid we have to close the meeting we shall adjourn to recess. The subject that has been under discussion for the last few minutes is fundamental and is the question "can we produce more food in quantity and in quality to satisfy not only the protein needs of our population but the demands that are going to be presented to us in the very near future as the population increases at the rate that it does?" I think the discussion on this topic has been left unfinished but I am sure it will be discussed in greater detail in the next meeting.

Sesión de la tarde - 26 de septiembre

Dr. Echandi: el Dr. Mario Gutiérrez G. ha salido a encontrar al Señor José Figueres y yo voy a tomar la mesa mientras llega. El primer trabajo de esta tarde es "Cuál es la Situación en Centroamérica en relación a cultivos alimenticios, productos alimenticios y forrajes", que será presentado por el Lic. Mario Ponce.

SEGUNDO TEMA

FUENTES DE ALIMENTOS

Moderador: Dr. M. Gutiérrez

CUAL ES LA SITUACION EN CENTROAMERICA RESPECTO A CULTIVOS ALIMENTICIOS, PRODUCTOS ALIMENTICIOS Y FORRAJES?

Lic. M. Ponce

I have been requested to talk to you about the food crop situation in Central America. This is quite a wide topic and I have preferred to shorten it by refering only to those products that are most important in the diet and livelihood of the Central American people. The study by Lic. Ramirez on the minimum requirements for a balanced and proper diet in Central America and Panama makes reference to sixteen essential components: eggs, milk, meat, vegetables, fruits, bananas, roots and tubers, sugars and fats. I shall concentrate on the three main basic commodities in Central America, corn, rice and beans.

These three products, which we shall call the basic commodities (granos básicos) are the most important ones on two accounts. First, they are the main income source of small farmers in Central America and second, they constitute the main source of food for the population. It is estimated that 45% of the total area is under cultivation (two million hectares are dedicated to these three products). This total area is distributed among 700,000 farms, comprising 85% of the total agricultural units in Central America. Assuming that there is one family per unit, we can conclude that four million people depend on the production of these commodities for their livelihood.

These basic commodities represent 13% of the gross product of the agricultural sector in Central America. On the demand side, as said before, beans, rice and especially corn are of greatest importance in the Central American diet. Corn and sorghum are the most important components of feedstuffs. More recently, corn is becoming a mayor industrial raw material. However, the relative importance of these cereals varies among the Central American countries. For instance, in Guatemala, El Salvador and Honduras, corn and beans are relatively more important, while in Nicaragua and Costa Rica rice consumption takes preeminence.

As I said before, there are 700,000 agricultural units that produce rice, corn and beans. If we take into account that there are about 950,000 agricultural units in Central America and that of these, some 730,000 units are farms which range from less than one hectare to seven hectares, we can conclude that most of the production of these crops comes from very small farms. These small units are the result of deficiencies in the structure of land tenure and are a limiting factor to increased production. One contributing factor to this problem is that in many cases crops are not adapted to ecological characteristics but simply to the availability of land regardless of topography and soil quality. These factors place physical and economic limitations on the farmer's capacity to produce, which, in turn, makes credit inaccessible to the small farmer. In fact, when we look at the statistics on credit granted by financial institutions to agriculture in Central America, we find that only a very small amount of the total credit available is destined for grain production. Lack of knowledge and insufficient repayment capacity tend to make credit less accesible to the small farmer.

There are other limiting factors that apply to the general agricultural situation in Central America and that also have an unfavorable influence on the production of basic commodities. There is not enough agricultural research on a wide basis, and above all, there is a lack of practical application of research findings. Then, there are the poor living conditions of the farmers and their lack of education. There are also institutional difficulties that tend to limit agricultural production in general: lack of coordination among the institutions that are in charge of agricultural development, the unavailability of the results of agricultural research to the small farmer, limited production of varieties of improved seeds that are at the same time inexpensive and accessible to the farmer. The availability of credit makes it impossible to take advantage of the results of research and of technological innovations. As for the marketing aspects of these commodities, there have been studies that show that only about 45% of the corn, 50% of the beans, and 72% of the rice, are channeled through the marketing system. As in the case of production, the marketing structure of basic commodities shows only a rudimentary degree of evolution. The produce is subjected to considerable loss due to deficiencies in storage and conservation. There are also deficiencies in transportation and market information. It has not yet been possible to eliminate the wide price fluctuations throughout the production cycle. That means very low prices during harvest time and high prices in the months of scarcity. There are also cyclical fluctuations over the years.

In times of abundance prices go down. This discourages production which causes prices to go up resulting in a production cycle that is not conducive either to an efficient planning of production nor to an adequate distribution of the available supplies.

There are also external factors that contribute to worsening the grain situation in the region. There is the sharp increase in population. Central America has the highest population growth rates in the world, about 3.5% per year. During the last twelve to fifteen years there has been a great concentration of population in urban centers. This requires a better marketing systems and a greater effort on the part of farmers to increase production to supply the needs of the rural people and of urban families. The present anachronic systems of production and marketing do not satisfactorily cover the needs of the population and the requirements of the developing countries. As a result, lately there has been a scarcity of basic grains, especially rice and beans. This tends to show itself through higher prices, increased imports from third countries and also in a decreased grain availability per capita.

In addition to the above, there are the problems derived from the creation of the Common Market in Central America. The Common Market presents problems for the production and marketing of basic commodities that require a different solution from the traditional one, in which the most important thing was the internal supply of the countries. Countries must know produce for a regional market. Due to the circumstances I have pointed out, the rationalization and increase of basic commodities' production and the improvement of the marketing system have been given increasing attention in the agricultural development plans of the Central American Countries.

Plans to increase production, improved marketing and schemes, for price stabilization, also exist at a regional level.

The current situation for each of the basic crops is as follows:

Corn

It is estimated that in 1965 there was 1½ million hectares under cultivation. The plans for 1969 contemplate the planting of 1.575.000 hectares. That is a 4% increase. The estimated production for 1965 was 1.437,000 tons and, for 1969 it is estimated that production should increase to around 1.900.000 tons. Most of the increase in production is expected to come through increased yields; it is

expected that there should be a yield increase of 26% relative to 1965 figures which show an average yield of 954 Kgs. per hectare. In accordance with the projections this should be brought up to 1,200 Kgs. per hectare by 1969. Higher yields is supposed to come through increased application of technology. It is intended to apply improved technology to 320,000 hectares in 1969. In 1965 there were only about 50,000 hectares cultivated with modern methods of production. The major corn producers are Guatemala and Honduras, followed by El Salvador, Nicaragua and Costa Rica in order of importance. All countries consider in their plans some increases in the area under cultivation, except Nicaragua where an increase in yields is expected to be accompanied by a decrease in the area planted.

I have made a comparison of grain production with balanced diet requirements prepared by Lic. Ramirez from INCAP. There appears to be important results that should be taken into account for corn production plans. In 1965 there was a production of 1.437,000 tons and in accordance with the estimates of Lic. Ramirez, in that year the minimum requirements for a balanced diet called for only 730,000 tons of corn. Supposing that this dietary requirements have been achieved, there would have been in that year an excess production of 717,000 tons of corn. If the projections for 1969 in production and diet requirements were fulfilled, there would be an excess production of more than a 1.000.000 tons of corn. Of course, production figures refer to gross output while purchases figures refer only to human consumption. We must also take into account that this comparison is being made with hypothetical figures based on what should be an adecuate diet for the population. What actually happens in reality is that people are consuming more corn. That is, they are depending more on corn to fulfill their dietary needs.

On the other hand, the production estimates given do not take into account crop losses, which are considerable. But even if crop losses together with the corn that goes into feedstuffs were taken into consideration, there would still be an excess of production over consumption. For instance, in 1962 estimates of crop losses were 83,000 tons and about 38,000 tons were used for animal feeds. So, even if we deduct these 135,000 tons from the 1965 production figures, we would still have over 600,000 tons of corn for which we have to find some use on the assumption that an adecuate balanced diet was consumed. There is the possibility of exports, but corn is a high-cost product in Central America and we could hardly expect to export this product outside of the area under favorable conditions in view of its low price in the world market.

The above considerations give us important indications as to the need to rationalize corn production in order to balance supplies with internal demand for human, animal and industrial consumption.

This year we might have to confront a situation of over-production; a large crop is expected and as a result, prices have decreased and might cause a downward trend in cyclical production. If prices continue to go down farmers will be discouraged and they will abandon corn production the following years and we will have again the production cycle which has already been mentioned.

Beans

With beans the situation is different. Apparently bean production has many problems in Central America and supply has not been able to keep-up with demand. Adecuate measures for disease and pest control which are the main reasons for the decrease in production have not yet been developed. Although there has been an increase in the area cultivated, there has not been a corresponding increase in production. As a result, bean prices have been quite high during the last five years and can be considered out of reach for most consumers. This may be one reason why there is a large consumption of corn as a substitute for beans in the traditional diet in the region. Although production goals have been set up by all the countries in Central America, there are no specific measures as to how to achieve these goals.

The Inter-American Institute of Agricultural Sciences has undertaken an interesting research program with the objective of developing new varieties that are resistant to diseases and that are adaptable to the different regions of the Central American area. The work is being conducted jointly with the Central American Cooperative Program for the Improvement of Food Crops. However, these projects are at an initial stage and findings are not available to countries with plans to increase production on a short term period.

Projections for bean production are as follows: in 1965 there were about 310,000 hectares of land under cultivation and the expected goal is to reach 377,000 hectares by 1969. Emphasis has been placed on greater yields as well. It is hoped that modern technology can be applied to 40% of the area in beans; that would mean around 152,000 hectares in 1969. The average 1965 yield of 518 Kgs. per hectare is expected to be raised to 758 Kgs. in 1969.

When we compare production figures with the estimates for adecuate diet requirements, we find a deficit of 117,000 tons in 1965. If production projections and diet requirements were fulfilled by 1969, the deficit should be reduced to 14,700 tons. The larger production needs are in Guatemala which showeda 66,000 tons deficit in 1965; next it is El Salvador with a deficit of 43,000 tons and Costa Rica with 12,000 tons. Honduras and Nicaragua are self-sufficient. If production goals and minimum diet requirements are fulfilled, bean deficit by 1969 would amount to 15,000 tons. However, I have some doubts as to the possibility of achieving the desired goals; inasmuch as there are no specific projects in operation in any of the countries of Central America.

Rice

Rice is perhaps the basic crop that has made greater use of technological innovations in Central America. In spite of this, we have not yet been able to solve the problem of internal supply in a satisfactorily manner. A study made by FAO shows that rice production increased from 128,000 tons in 1951-1953 to 129,000 tons in 1960-1962. That is only a 1% increased over a ten year period. Over the same period, there has been a 32% increase in population. This gives us an idea of the decrease of rice supplies per capita over the same period.

In 1951-1953 we had a positive balance in our rice exports but from 1960 on there has been a continued deterioration of the internal rice supply causing a reversal of the international trade flow and yearly increases in rice imports of Central America. Nine thousand tons were imported in 1961; 11,000 tons in 1964 and 16,000 tons in 1965. The rice situation for 1965 and projection for 1969 are as follows:

In 1965 there was an estimated 115,200 hectares under cultivation with an estimated production of 112,800 tons of milled rice. Average yields were 1,500 Kg. per hectare of patty rice. Projections for 1969 contemplate the planting of 145,400 hectares and a production of 182,700 tons of milled rice. Yields are to increase to 2,000 Kgs. per hectare. That is a 30% increase over the 1965 average. Comparison of production figures relative to the estimated needs for a balanced diet shows a deficit in 1965 of 92,000 tons. If the production goals and the minimum requirements of a balanced diet were accomplished by 1969, there would still be a deficit of 50,000 tons. As I said before, there are no specific projects in operation which would help to achieve the projected

increases in production. However, all the countries have programs that are contributing to this end, such as the seed projects of the Cooperative Programs for Improvement of Food Crops and the fertilizer programs of the Freedom from Hunger Campaign.

With regards to marketing, there is evidence of wide marketing margins due to imperfections in the system. In some cases farmers receive only 50% of the final consumer price. This percentage may not be too much in those countries where the product is subjected to transformation or to a better presentation to improve its appeal to consumers; but I refer to a situation where the product is retailed in the same form as it comes from the farm. Under these circumstances a 50% marketing margin is high. It is important to mention that all the countries have in operation price stabilization programs for basic grains, they also have storage centers. However, there is still much to be done to improve the efficiency and scope of operations of these programs.

There is a need for additional storage space and greater financial assistance for the operations of such programs. It can be said that at present, corn is the only product for which there is a price stabilization program in all the countries. All countries guarantee a minimum price to the farmer. Three countries guarantee prices to consumers. However, all countries have shown interest in improving the marketing situation and their price stabilization activities for the basic commodities. Studies and projects to enlarge storage facilities and to improve the operations of the price stabilization programs are under way. There is also interest to develop and improve market information reports.

The economic integration movement started in 1950 by the Central American countries has created a possibility to develop regional projects for incrementing production and improving the marketing of agricultural products. This adds a new dimension to the supply and demand of grain since it is no longer possible to think in terms of individual countries but on a region as a whole.

On account of the Common Market some projects of regional scope have been prepared. The Central American Joint Planning Mission has prepared a plan for grain production based on the following objectives: to attain regional self-sufficiency of basic commodities; to improve the diet of the population; to increase the level of income and to achieve production specialization by zones within the region.

The plan aims at increase supplies of basic commodities through greater yields to be achieved by the application of modern technology. The program is aimed at those farmers with sufficient ability and physical resources to adopt technological improvements and increase their productivity over a short time period.

There are also other projects aimed at increasing productivity in the production of basic commodities. An improved seed production program with the following objectives is currently under consideration by the Ministers of Agriculture: Strenghtening of research; organize the production of improved seeds; and to promote and coordinate its distribution.

The distribution of improved seed will be carried out under the supervision of official national institutions as well as authorized private associations. The program will give assistance to the national institutes interested in seed production and will prepare personnel through direct training and scholarships. Arrangements are being made with the Escuela Agricola Panamericana in Honduras to establish a regional germplasm bank.

Another possibility currently being explored is the extension for an additional five year period of the fertilizer program. Such extension may be financed by the United Nations Special Fund and direct contributions by Central American governments. The objective will be to encourage the use of fertilizers on food crops; the utilization of proper formulas and methods of application; and to improve fertilizer distribution through cooperatives and farmers associations.

CENTROAMERICA: Superficie cultivada, área tecnificada y porcentajes de tecnificación programados para los principales productos agropecuarios.

Miles de Hectáreas

	Superficie requerida		Area tecnificada		Area tecnificada / Superficie requerida	
	1965	1969	1965	1969	1965	1969
Maíz	1509.4	1575.0	50.0	320.2	3.3	20.3
Arroz	115.2	145.4	19.2	66.3	16.7	45.5
Frijol	310.8	377.8	-	152.6	-	40.3
Sorgo	269.5	301.9	-	61.2	-	20.5
Pastos	5323.1	5933.5	-	1295.8	-	21.8

FUENTE: Misión Conjunta de Programación para Centroamérica.

CENTROAMERICA: Rendimiento programado de los granos básicos

kg/ha

	Centroamérica		Guatemala		El Salvador		Honduras		Nicaragua		Costa Rica	
	1965	1969	1965	1969	1965	1969	1965	1969	1965	1969	1965	1969
Maíz	954	1207	875	1164	1458	1747	775	918	895	1321	1298	1440
Arroz	1545	2010	1640	3044	1478	1904	1691	1818	1588	2184	1743	1640
Frijol	518	758	454	1018	662	662	436	449	717	1024	543	538

FUENTE: Misión Conjunta de Programación para Centroamérica

PRODUCCION DE ALIMENTOS Y FORRAJES EN CENTROAMERICA

CENTROAMERICA:

1) PRODUCCION DE LOS PRINCIPALES BIENES AGROPECUARIOS, 1965 y 1969

2) PROYECCIONES DE LA DEMANDA MINIMA ADECUADA DE ALIMENTOS BASICOS 1965-1969

Miles de toneladas métricas

	Centroamérica		Guatemala		El Salvador		Honduras		Nicaragua		Costa Rica	
	1965	1969	1965	1969	1965	1969	1965	1969	1965	1969	1965	1969
MAIZ												
Producción[1]	1437.4	1900.9	680.3	767.1	203.0	447.9	356.4	436.6	158.2	174.6	39.5	74.7
Demanda mínima[2]	720.0	815.3	282.1	318.8	182.3	205.2	141.6	161.3	58.9	66.3	55.1	63.7
Diferencia	717.4	1085.6	398.2	448.3	20.7	242.7	214.8	275.3	99.3	108.3	-15.6	11.0
FRIJOL												
Producción[1]	146.3	284.4	26.6	123.3	16.5	20.2	48.6	60.4	36.1	59.4	18.5	21.1
Demanda mínima[2]	264.0	299.1	92.8	104.8	59.9	67.5	46.6	53.0	33.4	37.6	31.3	36.2
Diferencia	-117.7	-14.7	-66.2	18.5	-43.4	-47.3	2.0	7.4	2.7	21.8	-12.8	-15.1
ARROZ (oro)												
Producción[1]	112.8	182.7	10.2	34.6	19.7	26.1	14.2	26.8	26.3	46.0	42.4	49.2
Demanda mínima[2]	205.0	232.9	55.6	62.9	47.9	54.0	37.2	42.4	26.7	30.1	37.6	43.5
Diferencia	-92.2	-50.7	-45.4	-28.3	-28.2	-27.9	-23.0	-15.6	- .4	15.9	4.8	5.7
CARNES[3]												
Producción[1]	123.0	158.4	25.0	30.8	17.2	19.9	18.2	23.6	27.9	42.0	34.7	42.1
Demanda mínima[2]	316.7	358.2	111.3	125.81	71.9	80.0	55.9	63.6	40.1	45.2	37.5	43.6

1) FUENTE: Misión Conjunta de Programación para Centroamérica

2) Demanda mínima adecuada de alimentos básicos para Centroamérica y Panamá. Lic. Marco Antonio Ramírez (INCAP)

3) Datos de producción se refieren a carne de ganado bovino únicamente.

DISCUSION

Ing. Berríos: I would like just to make a few comments on a particular remark made by Licen iado Ponce. It refers to the present year abundance of corn, and he said that maybe that would not justify the formulation of the program. I think that the need of specific projects subsists and is very present particularly to prevent or to check ups and downs of corn production as customarily happens when a favorable year such as the present year gives a good crop and no provisions have been made to foresee measures to face the next year's customary shortage of corn.

Ing. Aguirre: I would like to make a comment concerning the expected overproduction of corn as it is contemplated for the year 1969, supposing that the Central American population will go from their present diet to a more balanced one. It seems to me that there are areas which haven't been developed within the livestock industry because of the lack of sufficient amount of a basic grain like corn. Particularly, swine production in the Central American area has been in a sort of a defficiency state for years and perhaps the number one limitation for the commercial production of swine in Central America still is the unavailability of inexpensive carbohydrate sources.

If as expected the yields of corn within the Central American area were to increase to a sufficient level as to provide an overproduction over and above of human consumption, there is a tremendous potential for the utilization of corn in the development of a sound swine industry that will definitely have a local market. There is a large demand in Central America for swine products and there is also a possibility of these for becoming of export commodities.

Dr. Shaw: Licenciado Ponce, I just want to ask a question: Did I understand that you said that the income from the three crops you mentioned was the majority of the farm income in Central America? (El Lic. Ponce respondió negativamente). Does it exceed the income derived from coffee? sugar? cotton?

Dr. Echandi: I just want to comment about some of the things that Licenciado Ponce said. You indicated that there are no programs in Central America that are supposed to carry on or design to increase bean production. I don't know if I understood you correctly or not. I think that there are quite a few and I think that we feel

very optimistic about some of the ones in progress now. One other thing that Lic. Ponce said, that worries me, is the significance of the free interchange of grains in Central America; we know definitely that countries as Honduras and Nicaragua have ecological areas that are quite suitable to produce beans, and of course this might cause some trouble in increasing production of the other countries. I don't know if some provision has been made in that respect or studies have been directed towards this very important aspect.

Dr. Pinchinat: Seems to me that Licenciado Ponce said that is not an urgent need to increase soil fertility now, but to increase soil availability. Well, that would sound like advocating extensive agriculture instead of intensive agriculture.

Dr. Jalil: I have a question for Licenciado Ponce. If I understood correctly, he said that the 1965 yield of bean was 519 kilogram per hectare and that the projection targets for 1969 envisage a yield of 780 kgs. per hectare. What basis did you use to work out this target if as you said that the region don't have any program in mind for increasing production? I understand, as you mentioned, that there are some projects proposal which are still in preliminary stage. One that you have in mind is the seed production project to be assisted under the UN Special Fund, as well as a large program of fertilizer in the area. Also the germplasm bank of food crops that will be established and that has been properly launched by Dr. M. Gutiérrez will contribute eventually to increase yield of beans. But, my question is: These programs are still on preliminary stage and you cannot probably depend on them to prepare or to reach some targets for increasing bean yield and therefore must be in some way or another, an existing program on which you can base this increasing production. I like to know it.

Dr. Berríos: The program takes into account improvement of yields through improvement of technology. That is to say, the use of better seed, fertilizers, insecticides, and so on, in part of the total acreage that could be managed by the extension services and of credit programs of the national governments, while the rest of the acreage should be managed by the traditional agriculture methods. Therefore, there are targets on the improvement of yield for the part of the acreage that will improve the average yield of the total. As I understand your question was referred to how we expect to raise the yield.

Lic. Ramírez: On the basis of present organization I quite agree with Licenciado Ponce regarding the lack of ability to implement a regional program. It has been emphasized that cycles prevail in the

prices of agricultural products. You might be familiar with what is called the "cobweb theorem" which takes into account the inability of agricultural production to adjust to agricultural demand. One year high prices induce the agriculturist to produce grains. Abundant production push down. The agriculturist then raises pigs to use the excess production of grains. Next year there is abundance of pigs and their prices go down and then it is more economical to sell the corn than feeding it to the pigs. That brings up the prices of grains again and another cycle starts. As long as the governments do not carry out subsidizing programs to guarantee prices for the producers, we will encounter the agricultural cycles and production will vary from year to year. In a market oriented economy production responds to the demands of the market. The governments should provide the infrastructure related to better communications and transportation plus better marketing which include storage and guarantee prices if we want to increase food supply to the level of national needs.

Dr. Shaw: I am very much interested in the distribution of agriculture production between food crops and export crops. As I understood the answer to my last question: 13% of the agriculture production is in food crops. Is that right? Is this then a changing figure over the years, in other words, has this become a larger percentage or has it remained constant or was it a smaller amount? In other words, there has been an increase in the export. Has this been because government have encouraged the export of crops, in your opinion? Has these been more efficient methods in production of export crops than in food production. Is it because in effect, export crops are more profitable?

Dr. Bates: We have mentioned and discussed the problems associated with agriculture production and some of the solutions. One of the problems we have mentioned and I'd be curious to see what you would put forth in solutions refers to the land tenure problem, which of course is world-wide. One has these very small areas, the trend of course is for these areas to get smaller and less efficient. How does one rationalize this type of social structure with what we know and recognize as the trend agriculture should take?

Dr. Ponce: I like to answer all of your questions later.

Dr. Gutiérrez: The major problem is that varieties developed for the temperate zone cannot be used under tropical conditions. The gene has to be transferred to adapted varieties and this takes time

and work. It is not possible to use seed produced in the U. S. A. to raise a crop under the growing conditions that prevail in Central America.

The Rockefeller Foundation, through the Central American Food Crop Improvement Program has been promoting the incorporation of opaque endosperm 2 into some of the locally adapted varieties. This work was started this year.

Dr. Bressani: Of course, what Dr. Gutiérrez said is true but I have received from Colombia a line of corn with the opaque 2 gene that is adapted to Guatemala. This corn is being grown at the INCAP. Some people have been moving along this line faster than others.

Dr. Gutiérrez: I might add one last comment. Opaque endosperm 2 expresses itself very well in flint but visual classification of this gene is more difficult in dent varieties and very difficult, if not impossible, in varieties with floury endosperm.

Dr. Ponce: I'd like to answer your comments and the questions that have been asked. Ingeniero Berríos said that he disagrees with such statement that in view of the abundance of corn this year there should not be prepared programs for further corn production. Actually, I did not say that there should not be prepared corn production programs. I said that the fact that there was going to be an abundance of corn this year might precipitate a production cycle that will have an unfavorable effect on farmers decisions to plant on the following year, so that event though there are programs under consideration, the above circumstances might limit the fulfillment of production goals. I think that we should plan corn production in accordance with human, animal and industrial needs. We should plan our corn storage, so that we can handle situations like we have this year. I agree with him that what is now happening might be considered an abnormal situation in the production of corn. But if we had enough storage space, we could very well guarantee support prices to farmers this year and would have more time to balance supply and demand. At the same time, we should be planning on how to use our excess production of corn. This is basically Ingeniero Aguirre's comments indicating the wide possibility of using corn for other uses other than human consumption. I agree with him but we must also take into consideration that use of corn for livestock and swine production depends on the price relationship of meat and corn. If prices of corn are high like they usually tend to be, we can hardly use it for swine and livestock production. Also in order to make better use of corn for the production of swine and livestock, we must undertake programs to improve breeds and yield of livestock of these animals.

With the stock we have at present we could very well considered our corn waisted. Feeding corn to low quality animals that can transform it into high meat yields is a costly proposition. On the other hand, it is not possible to increase tremendously the animal consumption of corn from one year to the next. In accordance with the figures I have read by 1969 there could be an excess production of over a million tons of corn, if the balanced diet projected by Lic. Ramirez was achieved and if productions figures were also reached. It is estimated that this year animal consumption of corn would be in the order of 58,000 tons, we can see the tremendous effort it would require to divert to animal feeds all the excess production. We must also take into account the possibility of producing cheaper animal feeds; the agronomists here can verify or refute me, but I think that it is cheaper to produce sorghum than corn for animal feeds. So I wonder to what extent is it wise to go on increasing corn production, that is, to what extent could we justify, from an economic point of view, an increase in corn for animal feed? We can divert our efforts to production of other grains for the same purpose at a lower cost and at the lower availability for animal feeds. I say that we must take into consideration these factors in our plans for corn production. I am not proposing that we stop planning for increasing corn production, the point is to prepare those plans in accordance with animals and industrial needs. I feel we should pay more attention to beans and rice, there is a tremendous shortage of both of them. As to Dr. Echandi's remark that there are programs to increase bean production, I meant to say that there are no specific programs for production. You will recall that I did mention that the Training and Research Center in Turrialba, from the Inter-American Institute of Agricultural Sciences, is carrying out a program to produce better varieties of bean seeds that is adaptable to the ecology of Central America. Again, I repeat, there are fertilizer projects, seed production project, but no specific projects for the increase of corn, beans and rice production. On this respect I feel that these should prepared what I call integral projects that should take into consideration research, seed, credits, use of fertilizers, and marketing. In this case if we plan to produce some seed we should also plan for more storage space, credit to the farmers and price guarantee. Otherwise we find ourselves in a situation where we have the seed but the farmers cannot use it because there is no credit available if they produce more as is happening with corn, They find there is not enough storage space and consequently, no price guarantee.

As to the comment that was made of the possibility of selling corn in the world market, prices of corn in the international market are low and it is doubtful whether under these circumstances it would be profitable to foment the production of corn for export.

We just can not compete with the United States, Argentina, or South Africa in the production of corn for the world market. Dr. Pinchinat I do not know whether I quite understood your comment. Increase of production contemplated for 1969 is based more on greater yields than on greater areas of cultivation. I fear that this is a right approach, because we can increase yields just by applying little technological innovations even under the deficient structure of the land tenure in Central America.

I suppose that is the reason why the countries emphasize the obtainance of higher yields through technological innovations rather than through greater areas of cultivation. As to Dr. Pearsons' question about protein content of corn, I can only say that most of the corn that is produced in Central America is white corn. If we are thinking in terms of using the corn for animal feed or oil production, perhaps we should direct our efforts more to yellow corn which I believe has a higher protein vitamin content and is better suited for animal feed. As for human consumption, yellow corn presents processing problems that make people prefer white corn. I think that white corn is a softer grain and that makes it easier for the people to prepare our tortillas. I imagine that is a reason for their preference of this kind of grain, even though from a nutritional point of view yellow is better than white corn.

I agree with Dr. Bressani on the need of more coordination between the different organizations that work with research, production and use of agricultural products. Dr. Shaw made a question regarding the cycle of demand and supply of grains - corn.

Well, I would say that we tend either to stock or planting. For instance, let's say in the case of corn this year. Prices will vary. It seems that if this year the corn price goes down, the farmers simply stop planting corn. On the whole, we cannot expect a response of the market on the total number of farmers because we always have corn production even if the prices come very low. There still will be corn production.

Dr. Bates' problem of land tenure is one of the most tremendous problems in Central American agriculture. We realize that we should do some changes in land tenure. But land tenure is not only an economical problem, it is a political problem and we certainly can not expect overnight changes. Redistribution of land or some kind of structural solution to the land tenure problem is definitely the basis for most of our agricultural problems in Central America.

LA NECESIDAD DE PRODUCTOS ALIMENTICIOS EN LA REGION

Lic. M. A. Ramírez

My talk is called "The need of Food Products in the Region". Our starting point is what Dr. Pearson told us this morning, that is, the elements that the basic diet should provide for the whole population. With the fact in mind that food has to cover three portions, as Dr. Pearson said: calories, proteins and other essential nutrients. INCAP has studied the food habits of the region and has developed a list of products which would gurantee the intake of those basic elements in the required amounts to provide the average caloric intake according to average activities, average temperature and average body weight. Having those things in mind, we proceed to study the composition of the population according to ages and sexes. Taking the adult male as reference, INCAP in cooperation with ICNND, has developed the different requirements for each age of the population. Therefore, we followed the system of ranking the population in order to get some average requirement according to the ages distribution most common in statistical information. You will see that the statistical information for each one of the countries is grouped from 0 to 4 years, 5 to 9 and so on. The range is of five year . So we arranged the requirements in regards to nutritional needs of the population according to the information available.

A balance of elements is required in order to avoid waste and therefore, total absortion. The law of proportions is valid for consumption of proteins since utilization is determined by the least available amount. The need for food is recurrent and proper nutrition should at all times guarantee total absortion of elements, especially when food resources are scarce. Regarding the income structure of the population of Central America, we know that the average family income that would guarantee proper minimum food, dwelling, clothing, and fuel needs should amount to about $2,500 yearly. Earning such income the family would not have anything left for saving.

By inspection of the income structure of the population, we see that between 80% and 90% of the average family income is below that figure. An adequate daily food intake for the average family would require $2 daily or $730 yearly. From 40% to 50% of the family income is below $750 and hence is just enough to guarantee only food consumption. Since food is the basic need, agriculture should first provide food for the population and then produce raw materials for industry. Thus the dilemma is solved by stating that nutrition and nutritional education are the most basic needs and the first to take into consideration in any

development program. We have an interaction between economic and social factors in the food habits of the population. In our paper we have taken the basic list of foods developed by INCAP covering 16 products that would provide a wholesome diet. Every article is related to the rest of them in the sense that each product is complemented by the other products of the list. This is a theoretical standard in order to have a level of requirements in the food demand to compare with food availability or food supply. The method followed to calculate minimum needs is to take each product assigning each group of ages by sex their share of consumption. Thus the demand of the male and female population is established for every item of the list. This is daily demand. Multiplying by 365 we arrive at the requirements for a given year, which in the paper presented corresponds to 1964. We get then the projections of what the populations will need every following year multiplying by the annual growth rate of the corresponding country.

We have to remember that population grows at fast rates in Central America and that such rates are going to be even larger than they are shown in these calculations. Nevertheless, we have applied the present growth rates for each one of the countries in order to get the requirements for each product of the list. This is only the point of reference to establish the availability of foods in regard to minimum adequate demand. That brings us to the relation between population and nutrition. If we examine the growth of agriculture and livestock in relation to the other sectors of gross national production, we notice that the situation has not changed within the last twenty five years. Agriculture and livestock occupy now almost the same relative position of 1950. Industry has not shown any relative increase either.

The food industry is the most important since it occupies more labor and capital than the other industries. This is one of the signs of underdeveloped economies: dedication of most of their resources to the producing of food for the population.

If we compare the supply situation for each one of the countries in Central America, starting with Costa Rica, we find that her production of milk, meat, bananas, corn, rice, and sugar is almost sufficient for minimum national needs. There is a deficiency in the production of eggs, vegetables, fruits, roots and tuberous plants, wheat and edible oils. Vegetable oils are showing recently remarkable increases.

El Salvador shows self sufficiency in the production of milk, corn, and sugar. And deficiency in the production of eggs, meat, beans, vegetables, bananas, fruits, wheat, rice and oils.

Guatemala is self sufficient only in the production of bananas, corn, and sugar, and it is deficient in the production of meat, eggs, milk, beans, vegetables, fruits, roots, wheat, rice, and oils. Nevertheless, Guatemala exports vegetables and fruit to the other countries of Central America, mainly El Salvador and Honduras. Which goes to show that even a food as perishable as vegetables responds to prices. Fruit markets have also developed and fruit is flowing to the urban centers of the common market.

Honduras, like Guatemala, shows self sufficiency only in the production of bananas, corn, and sugar. It is also deficient in all the other products of the list.

Nicaragua enjoys a better position than the last countries and is self sufficient in the production of milk, beans, bananas, corn, rice, sugar, and edible oils. There is deficiency in the production of eggs, meat, vegetables, fruit, roots, and wheat.

Panama has sufficiency in the production of vegetables, fruits, bananas, roots, corn, rice, and sugar. There is defficiency in the production of milk, eggs, meat, beans, vegetables, wheat, and oil.

From this bird's eye view we draw a composite picture of Central America and Panama as a whole, of self sufficiency only in the production of bananas, corn, rice, and sugar. By projecting the present situation into the future we arrive at the dismal conclusion that the gap between demand and supply will be wider rather than shorter. Of course, action might be taken and the governments might tackle the task of providing opportunities for the population thus enabling them to effectively demand the goods necessary for their wellbeing. That will necessitate modifications in the social and economic structure such as agrarian reform and proper utilization of all available lands.

The conditions are now worse than in 1950 because the agricultural and livestock sector have grown at a rate of 2%, whereas population has increased at a rate of 3.1% between the two censuses. The growth of population has brought down the availability of foods. The Malthusian bogey of a worsening condition threaten the population if a deliberate effort is not exerted to follow the example of the more developed nations that have coped with the problem by increasing productivity and subsidizing agricultural programs together with better marketing. The bogey of the population's law shows mainly in the rural areas, where the lack of development of agriculture has not provided opportunities to the able population looking for work. There exists large disparity between rural and urban incomes that calls for government action to

enable the rural worker to participate in the consumption of urban goods. During the last fifteen years, the situation has been rather static.

We see that production has followed definite paths for each one of the products. Milk and beef have grown at very slow rates, increasing at a rather decreasing rate. This is the reason for the national planning boards to design means for a push that would raise supply for the next decade.

Nicaragua in the first place and Costa Rica in the second place have shown that the growth rate of the livestock population can be accelerated. Allow me to refer here to the items pertaining to eggs and poultry. Guatemala have shown dramatic results applying scientific methods to the production of eggs and poultry. At present, it is satisfying the urban needs and exporting surpluses to the other countries of Central America.

Nevertheless the price has been declining due to the increase of supply and a contraction of egg and poultry production appears ominously in the horizon. In order to stimulate maintenance of growing rates it is absolutely indispensable that price is stabilized at levels above the turnover point. Only on this condition the industry will produce enough to satisfy the needs of the urban and rural population. The rural population regard eggs as a cash getting product and sell rather than consume them. Contrary to urban production the growth rate of poultry and eggs in the rural sector is static, around 2% annually. We don't envisage any acceleration unless a purposeful plan is executed to that effect.

In considering the animal foodstuffs we conclude that deficiency will continue by substantial amounts through 1980. The deficits will be in the order of 15% for milk, 53% for eggs, and 50% for meat. In view of this situation it is clear that eggs and poultry would contribute largely to fill the gap due to its cheaper installations and faster cyclical biological growth.

The cereals, roots, vegetables, and fruits, will grow at a constantly progressive rate that would shorten the gap between supply and demand. Sugar and oils will be maintained at the same rate of growth and probably the increase will come from increasing productivity of industry. In general, the supply of basic foods will continue to grow at a steady low rates and consequently present conditions will become worse in view of the fact that population will grow at progressively increasing rates, unless a definite action is taken to increase productivity and modify the social and economic structure by means of agrarian reform, intense

exploitation of available land, providing of the proper infraestructure and also applying price subsidies and better marketing.

If no public or private action is taken, the situation during the past 15 years forecast the future years as a period of increasing famine. One last comment: the idea of relative advantage that has oriented some Central American countries to produce articles such as cotton, coffee, bananas, and cattle for the purpose of gaining foreign currency from exports should now be revised in view of the price trends prevailing in traditional exporting countries. If such trends continue upward gains of foreign currency will be wiped out by food expenditures in foreign countries.

Thank you.

DISCUSION

Gutiérrez: We will have a ten minute discussion of the paper presented by Lic. Ramírez. We will change our program a little. The next speaker won't talk today, but tomorrow morning. And then we'll hear Mr. Figueres. So we are open for discussion.

Dr. Chichester: I wonder if we must take the basic assumption that nothing will change in particular, technology will not change some of these considerations. We discussed the poultry industry in Guatemala, which I had commented on. That the pultry industry is facing the problem of over production because it only supplies the urban areas. How much can technology influence a better distribution of this kind of crop? And I think perhaps, maybe, we are taking a defeatist attitude in assuming that the trends for the last fifteen years will prevail for the next fifteen. I question one other thing: that I wonder whether we should worry in any particular country, about products and I notice here that every country is defficient in wheat production. I wonder if we should really worry about the fact that the countries here are deficient in wheat production. Climatically they are not very well adapted to it. Should we be more selective, or should the groups be more selective in general in what kind of products to be produced? If (and I am only using wheat, I am not quite sure what acreages are available to wheat), but whether or not a study shouldn't be made as to what products the country is best suitable for and the emphasis placed on these products, and so if one has to go into the foreign market to buy the products the population would like, that it cannot produce, I see nothing really wrong with this. I think that in many cases there is an effort to make a particular country or region self-sufficient in all the vital products and this is a basic mistake.

(Change of speaker)

.....to call the attention on the way this basic diet was estimated. We were forced to include some wheat although ideally we would not like to, because we know wheat is not an essential item in a diet. It could be replaced by any other cereal. The fact is that the population is consuming wheat, they like wheat, and we will not prevent them to eat wheat. They have demanded and we have included the minimum amount that could be included, taking into consideration food habits. The same goes through for most of the other items of the list. And you will notice that if you will look on page 12 how this basic list of foods was elaborated for each country, that there are significant variations on the amount of the different items among the countries. You will take milk, for instance, we estimated that some countries need as low as 250 grams per capita per day. That is the case of El Salvador and Guatemala, in contrast to Nicaragua with 400. There are no significant biological differences between the Guatemalans and the Nicaraguans. It is just that the availability is greater in Nicaragua and we can afford a greater consumption in Nicaragua, and a lower consumption, that still will be adequate, the minimum adequate to satisfy a balanced diet. We were down in Belice and we see corn, for instance, we see that we afford a consumption of 228 grams per person per day in El Salvador, Guatemala and Honduras, because they are corn eating populations. They are now eating about 500 grams per person per day and not the 228 that we are recommending and we have put only 50 grams for Panama because they are not a corn eating population. They depend mostly on rice. So the considerations that were made for estimating this basic list were in the first place nutritional, that means to satisfy the adequate diet, but the foods more available, less expensive and that will be accepted by the population. Of course adaptations could be made, and some items that seem to be in excess could replace others that seem to be in deficit, but this would imply changes in food habits, which we know are not easy to accomplish. So this is a theoretical calculation and should only be seen for targets in food availability, meaning by that either for local production or imports. That for food availability, not necessarily for food production. The most economical way has to be studied by persons that are able to do it. And we must also remember that we are dealing here also with a very hipothetical situation in which we are assuming that all the sections of the population are consuming equal amounts of all the foods, which we know is not true. We know that if we take milk, or eggs, for instance, there is a bigger proportion of the population that is consuming much more than the average estimate per person made here, and that means that a large part of the population has no availability to those

particular items. But this is just to show the limitations, and, of course, the usefulness of this type of estimations.

Lic. Ponce: I would like to point out the deficiency that we have in our market in production of some products, to make possible for the population to make use of the availability of these foods in Central America. We have the case of milk, in accordance with my figures, there is enough milk production in Central America to supply the milk for the minimum adequate diet estimated by INCAP. There is enough milk for those in Central America. But the question is, is this milk available to the people? The answer is NO. This milk is not available to the people. First, there is the "stational production" that is, we have large amounts of milk at the beginning of winter, when we say winter we mean the rainy season, this milk cannot be adequately used or preserved, so some of it is wasted and some of it is transformed into cheese and other products, which are not as valuable from the dietetic point of view as it would be if it were consumed as pure milk, Then we have the consumers centers isolated from the production centers, so we cannot bring this milk from the production areas to the consuming areas. We have difficulty in transportation and difficulty in conservation of milk, and then we have high prices for milk, that simply are out of reach of the population, so we have milk, but actually it is a luxury product in Central America, even though we could possibly provide milk at reasonable prices if we correct some of the problems that we are confronting, specially on the market aspect of milk and also on the conservation. Taking each country, we have Costa Rica, about only 30% of the production (Costa Rica on the contrary has better facilities for milk distribution in all Central America), in their country about 30% of the milk is destined to other products rather than to the consumption. While Honduras, which has the worst facilities for distribution, has 77% of the milk production which has to be used for other uses rather than for consumption, simply because we cannot get this milk to the daily consumer.

Dr. Pinchinat: Mr. Ponce mentioned that at least for Costa Rica there is a shortage of beans and corn. On the other hand, Mr. Ramírez pointed out that there is an excess of these two products in Costa Rica. I would like to know whether they are using two different sources of information, and if so which source is closer to reality.

Lic. Ponce: Dr. Pinchinat brought up a point that I did not want to mention, actually. Mr. Ortiz already mentioned that our statistics in Central America are not very reliable, so it is of no use arguing who is right and who is wrong. I will speak for my field, but probably Lic. Ramírez has consulted other sources of information for his

results. It seems to me that if we take into consideration the last imports that have taken place in the last few years, we will see that there is shortage of the former products. Also Mr. Figueres mention that we have years of scarcity and years of plentiness in each country.

DOCUMENTO PRESENTADO POR EL LIC. MARCO A. RAMIREZ **

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DEMANDA MINIMA ADECUADA DE ALIMENTOS BASICOS PARA CENTROAMERICA Y PANAMA

PROYECCIONES PARA 1965-1974*

Guatemala, Centroamérica, julio de 1966

INTRODUCCION

El presente trabajo se llevó a cabo con el propósito de establecer las cantidades mínimas de alimentos básicos de que debe disponerse en el área de Centraamérica y Panamá, para satisfacer las necesidades nutricionales de la población actual y de la que se estima para el lapso de los próximos diez años. En la realización de un trabajo de esta naturaleza, fue necesario, como primera medida, hacer algunas generalizaciones a partir de cifras promedio nacionales, o de la información más completa accesible en cuanto a variables como condiciones de vida, vivienda urbana y rural, hábitos alimentarios, condiciones climáticas y otras que en mayor o menor grado influyen sobre los requerimientos nutricionales o sobre la dieta más conveniente para satisfacer esos requerimientos. Se consideró que la información y experiencia acumuladas por el INCAP y los datos que pudo obtenerse de otras fuentes, eran suficientes para llegar a cifras estimativas que pudiesen ser utilizadas como índices de orientación en el desarrollo de programas encaminados a la satisfacción de esta necesidad de orden primario de las poblaciones del área.

Los datos en cuanto a la población son los notificados en 1964 por cada una de las oficinas de información estadística de los seis países que integran el Istmo Centroamericano. Asimismo, se dio por sentado que el crecimiento demográfico y la composición de esa población por grupos de edades o por sexo, observados durante la década anterior, habrían de permanecer estables en el curso de la siguiente década, no obstante que la tasa de crecimiento tiende a aumentar.

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** Jefe del Servicio de Estudios Económicos, División de Nutrición Aplicada del Instituto de Nutrición de Centroamérica y Panamá. Publicación INCAP E-365

Para cada país se hizo una distribución, por edad y por sexo, de los pobladores, ponderando la demanda alimenticia de cada grupo de acuerdo con la dieta establecida como la mínima adecuada por el Instituto de Nutrición de Centro América y Panamá (INCAP), para cada uno de sus países miembros. Estas dietas mínimas adecuadas son, para cada país (Cuadro No. 1), dietas teóricas o promedios por persona y por día, las cuales han sido calculadas tomando en consideración, en primer lugar, los hábitos alimentarios determinados por las series de encuestas dietéticas realizadas por el INCAP en todos los países del área (1, 2). Se establecieron, de esta manera, mínimos de consumo que satisfacen los requerimientos nutricionales de la población, pero manteniendo siempre los hábitos o pautas de alimentación existentes. En otras palabras, se introdujeron únicamente las modificaciones mínimas necesarias para obtener lo que se considera una dieta colectiva adecuada. En segundo lugar, se tuvo en cuenta el costo y la disponibilidad de los alimentos, a manera de satisfacer los requerimientos nutricionales al precio más bajo posible y en una forma práctica acorde a las posibilidades de aprovisionamiento local de alimentos.

Puesto que esta dieta fue calculada para satisfacer las necesidades del hombre adulto promedio, seguidamente se hicieron los ajustes necesarios para cada uno de los otros grupos de edad que integran la población actual, con distintos requerimientos nutricionales y usando los factores que se indican en el Cuadro No. 2. Ya que cada una de las dietas guarda el debido balance en cuanto a la concentración de todos los nutrientes esenciales, para los cálculos correspondientes únicamente se tomó como base el aporte calórico de las mismas. Partiendo de lo expuesto, se estimó que al satisfacerse con estas dietas las necesidades calóricas de cualquier individuo, sus requerimientos en lo referente a los demás nutrientes esenciales también serían satisfechos. En este sentido y dada la situación prevalente en Centro América y Panamá, se trató, con particular énfasis, de lograr una ingesta de proteínas adecuada, tanto desde el punto de vista cuantitativo como cualitativo.

Seguidamente se tomó cada uno de los alimentos que integran la dieta básica recomendada para cada país y se estableció la demanda global diaria, esto es, el total que se deriva de la suma de las necesidades de los distintos sectores de la población. La demanda diaria de cada alimento contenido en la lista básica se multiplicó por 365 días para determinar la demanda total por año. Esta demanda se calculó a partir de los datos disponibles para 1964 y, de acuerdo con la tasa anual de crecimiento de la población, se proyectó a la década comprendida entre 1965 y 1974.

Con base en los datos que figuran en el Cuadro No. 2 se efectuó la distribución de frecuencias por edades en la forma en que se resumen en la parte inferior del Cuadro No. 3, para indicar el nivel de demanda, en términos de porcentajes de las necesidades totales, aceptando como 100% los requerimientos diarios del adulto promedio.

En el caso de Panamá, se adoptaron las cifras proyectadas por la Dirección de Estadística y Censo de ese país, al lo. de junio de 1963. Las proyecciones al 30 de junio de 1964 se efectuaron de acuerdo con la tasa de crecimiento a fin de que éstas coincidieran con el origen de las series estimadas para los otros países del área centroamericana. El Cuadro No. 4 revela la población total correspondiente a cada uno de los países, en las fechas citadas, y en el Cuadro No. 5 se identifica la población global, por grupos de edad, al 30 de junio de 1964. En los Cuadros Nos. 6 a 11 se da a conocer la población de cada uno de los países del área a la misma fecha (30 de junio de 1964), distribuida por grupos de edad y por sexo.

Las Series Estadísticas Históricas Seleccionadas de la Misión Conjunta de Programación para Centro América (3), sirvieron como punto de partida para la elaboración de los Cuadros Nos. 4 y 5 y de la Gráfica 1 que, como puede apreciarse, constituye una pirámide perfecta y de base muy amplia. Una inspección a simple vista revela que la mayor parte de la población está comprendida dentro de los grupos correspondientes a las edades inferiores a los 19 años, característica que plantea un desafío a los gobiernos y a las instituciones especializadas con respecto a la conservación de los recursos humanos y su desarrollo. Puede también apreciarse cómo las altas tasas de mortalidad, en edades tempranas de la niñez, se reflejan por una rápida disminución en la amplitud de los escalones a medida que los grupos ascienden en edad, hecho que a su vez no es sino la repercusión de las condiciones de vida desfavorables que existen en la actualidad.

Proyecciones de la demanda de alimentos y método de cálculo

Con base en los datos expuestos, se procedió a estimar la demanda de productos alimenticios para cada país y para cada grupo de edad (Cuadros Nos. 12, 14, 16, 18, 20 y 22), como sigue:

La primera columna corresponde a los rangos de cinco años de las edades de población, partiendo de cero hasta diecinueve años, y el resto a los de veinte años y más. El propósito de esta distribución, por rangos de edad, es el de establecer el consumo normal del adulto masculino promedio, y las diferencias con los otros grupos de consumidores.

En la segunda columna se identifican las cifras de población (en miles de habitantes), para cada grupo de edad.

La tercera columna es el porcentaje del número de habitantes, para cada grupo de edad, con respecto al total de la población.

Las cifras de población masculina comprendida dentro de cada grupo de edad, están representadas en la cuarta columna. Este porcentaje, cabe señalar, se determinó de acuerdo con las tendencias que el crecimiento de la población, por sexos, acusó en cada uno de los países de Centro América y en Panamá, durante el período de 1950 a 1964.

La demanda para cada individuo del sexo masculino, en cada grupo de edad, estimada de acuerdo con los otros requerimientos en cuanto a calorías y en base a los factores que se indican en el Cuadro No. 2 figuran en la quinta columna.

La sexta columna constituye el resultado de multiplicar cada una de las cantidades de la columna 5 por los gramos de demanda de cada uno de los alimentos básicos. El producto es la cantidad mínima en términos de gramos que cada individuo en cada grupo de edad necesita consumir diariamente del producto básico.

La séptima columna es el producto de la multiplicación de los gramos de demanda individual de cada alimento (columna 6), por la población masculina identificada en la columna 4. Representa, por lo tanto, el total de miles de gramos de demanda diaria de cada alimento para cada grupo de edad de la población total del sexo masculino.

Los datos en la octava columna corresponden a la distribución de la población del sexo femenino, expresada también por grupos de edad.

La novena columna concierne a la demanda femenina, por cada grupo de edad.

De nuevo, como en el caso de la columna 6, la décima columna es el resultado de multiplicar la cantidad mínima básica de demanda de cada alimento por los datos de la columna anterior, en este caso la 9.

La undécima columna constituye, asimismo, el resultado de la multiplicación de los datos que se dan a conocer en la columna precedente por la población femenina calculada en la octava columna. El total en la decimosegunda columna resulta de la suma de los valores de la columna 7 con los de la undécima.

Los datos de la decimotercera columna se obtienen multiplicando los de la columna 12, esto es, el total de la demanda diaria, por grupos de edad y por sexo, por los 365 días del año. El producto resultante (columna 14) es la demanda anual para cada uno de los alimentos que constan en el Cuadro No. 1

Las proyecciones de la demanda mínima adecuada de cada uno de esos alimentos, calculadas en la forma expuesta, se obtienen de la ecuación de la línea recta:

$Y_n = a_{n-1} + a_{n-1}b$
a = cantidad base
b = tasa de crecimiento de la población
n = año a que corresponden los datos

Esas proyecciones, correspondientes al período 1964-1974, se presentan para cada país en los Cuadros Nos. 15, 17, 19, 21 y 23, respectivamente. Estas también pueden obtenerse aplicando la fórmula de la población, procedimiento que es más simple y seguro. En este caso la ecuación es:

$P_{n+1} = P_n (1+r)$
P = cantidad necesaria
n = año a que corresponden los datos
r = tasa de crecimiento de la población

Aún cuando, como ya se señaló, el mismo cálculo ha sido hecho para cada producto y para cada país, es conveniente destacar que únicamente se presenta el detalle completo para el primero de los productos enumerados en el Cuadro No. 1 (leche), ya que el fin que con ello se persigue es, en síntesis, ilustrar la técnica a que se ciñó el cálculo correspondiente.

Algunas de las comparaciones hechas entre los datos que consignan los informes de producción para 1964, y los diversos productos contenidos en la dieta básica, han revelado gran disparidad entre la producción real y la cantidad requerida. Esta diferencia constituye la deficiencia absoluta de la producción de alimentos con respecto a la demanda básica teórica de los mismos. Dada la importancia de estos hallazgos, posteriormente se hará una investigación sistemática encaminada a determinar la magnitud cuantitativa y cualitativa de esos déficits y, en base a los resultados, se establecerán pautas para el esfuerzo que cada país habrá de realizar para producir, en cantidades suficientes, los alimentos básicos que requiere la población. El estudio en cuestión abarcará también los niveles de ingreso de los pobladores y su influencia en la demanda efectiva, así como los posibles cambios que, al elevarse el ingreso porrazón de los programas de desarrollo económico que se adelantan en cada uno de los países del área, se originen de la demanda de alimentos en relación con los otros gastos de consumo.

Conclusión Global

El examen de los cuadros que ilustran la distribución de la población

por grupos de edad, y la cantidad que corresponde a cada uno de esos grupos, con respecto a la población total, revela -como puede apreciarse en la Gráfica 1- que las mayores concentraciones se encuentran en la base de la pirámide, la cual se asienta en una cifra que fluctúa entre el 17 y el 20% para cada uno de los países (Cuadros Nos. 6-11), y disminuye rápidamente a medida que aumenta la edad cronológica de los grupos de edad siguientes. Las cantidades acumuladas para los primeros cuatro grupos revelan que los niños y los jóvenes menores de 19 años predominan con porcentajes que oscilan entre el 53 y el 58% de la población total. El resto, que fluctúa entre 42 y 47%, corresponde a la población de 20 y más años para cada uno de los países.

La elaboración de una gráfica con la distribución por edades para cada una de las poblaciones de Centro América y Panamá, tendría características similares a las correspondientes a la Gráfica 1. Como ya se indicó, esta representación piramidal tiene como origen el hecho fundamental de la gran proporción de mortalidad existente en el área en edades tempranas de la vida, y el grado de disminución de cada escalón corresponde al vacío que dejan los decesos ocurridos entre la población. La cúspide guarda relación con la base de esa pirámide, ya que es también una consecuencia de la situación que prevalece en los primeros grupos de edad. La desnutrición, según se ha demostrado, constituye uno de los factores contribuyentes de importancia en la corta expectativa de vida que, por lo tanto, no permite acumulación en el apice de la pirámide.

Esta característica demuestra así la necesidad que hay de dedicar grandes esfuerzos al mejoramiento de las condiciones económicas de la colectividad. Esta política debe, por supuesto, acompañarse de programas de educación nutricional, y de la ejecución de planes de producción de los alimentos necesarios para constituir una dieta que disminuya los efectos nocivos de la desnutrición sobre la población infantil y que, a la vez, aumenten la expectativa de vida de la población centroamericana.

Las posibiliaades efectivas para la solución de este grave problema serían, en primer lugar, la aplicación de un amplio programa de divulgación que propicie el mejor aprovechamiento de las subsistencias alimenticias disponibles, a fin de mejorar el índice de ingestión alimenticia de la población. Juntamente con esta campaña debería propiciarse el establecimiento de industrias que produzcan abundantemente y a precios razonables, los alimentos básicos que ha menester la población. Este programa, naturalmente, habría de basarse en un mejor aprovechamiento de las tierras y en una reorientación de la producción agrícola, aplicando una política de desarrollo agropecuario que asegure una mayor producción de alimentos y materias primas, así como el aumento de la productividad en el campo. Este programa de desarrollo

no sólo debería transferir recursos hacia sus aplicaciones más productivas, sino efectuar también reformas económicas y sociales que garanticen suficiente poder adquisitivo para la población, a efecto de que ésta pueda incrementar el consumo de los alimentos necesarios para su integridad física y mental.

Paralelo a un alto porcentaje de mortalidad se observa una alta tasa de natalidad en los países del área centroamericana, la que fluctúa entre un 3% para El Salvador, Nicaragua y Panamá y un 3. 7% para Costa Rica* Antes de que estas cifras de crecimiento anual se estabilicen, tenderán a aumentar a medida que mejore la situación de los recursos humanos, en virtud de los progresos en cuanto a condiciones sanitarias y del mayor acceso a la oferta de alimentos. Este fenómeno se traduciría, indudablemente, en una ampliación hacia arriba -de la base de la pirámide- como respuesta lógica al mejoramiento de las condiciones sociales y económicas. Dicho en otras palabras, lo anterior significa que la población activa de los países de esta región soporta en la actualidad una carga económicamente improductiva, constituida por los niños y los jóvenes.

Este hecho contrasta con el crecimiento no sostenido del producto nacional bruto y con el déficit o falta de accesibilidad a los bienes y servicios producidos. Es, pues, necesario desarrollar el producto nacional bruto, no sólo para garantizar la provisión de bienes que necesita la población sino para proporcionar ocupación que otorgue poder adquisitivo a la población creciente.

Un examen de las tendencias de la distribución de la población entre el sector rural y urbano revela que el traslado de población rural al medio urbano durante los últimos 15 años, es apenas de un poco más del 6%, aún si, como lo ilustra el Cuadro No. 24, hay una acumulación de la población centroamericana en el sector rural que constituye más del 65% de la población total. Este porcentaje de habitantes vive a niveles inferiores de subsistencia por razón de que el ingreso derivado de la agricultura, ocupación a que este sector se dedica preferentemente, es demasiado bajo.

Debido a la baja productividad de la agricultura y actividades extractivas relacionadas, así como al hecho de que la mayor parte de la población se encuentra fincada en el campo, la población activa ni siquiera puede atender adecuadamente la nutrición de sus dependientes, y menos aún, la satisfacción de las otras necesidades.

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* Esta tasa de crecimiento es la que en términos generales corresponde a la última década, y es más acelerada que la que se observó durante el período que medió entre los censos llevados a cabo antes de 1950 y este último. Sin embargo, cabe advertir que al descender la tasa de mortalidad sin que se altere la tasa de natalidad, el ritmo de crecimiento de la población será más acelerado.

Júzguese la importancia de los esfuerzos que los países del Istmo Centroamericano han de efectuar si desean dar impulso a sus recursos agropecuarios y programas de infraestructura tales como vivienda, educación, salud e higiene, dentro de sus planes globales de desarrollo socioeconómico.

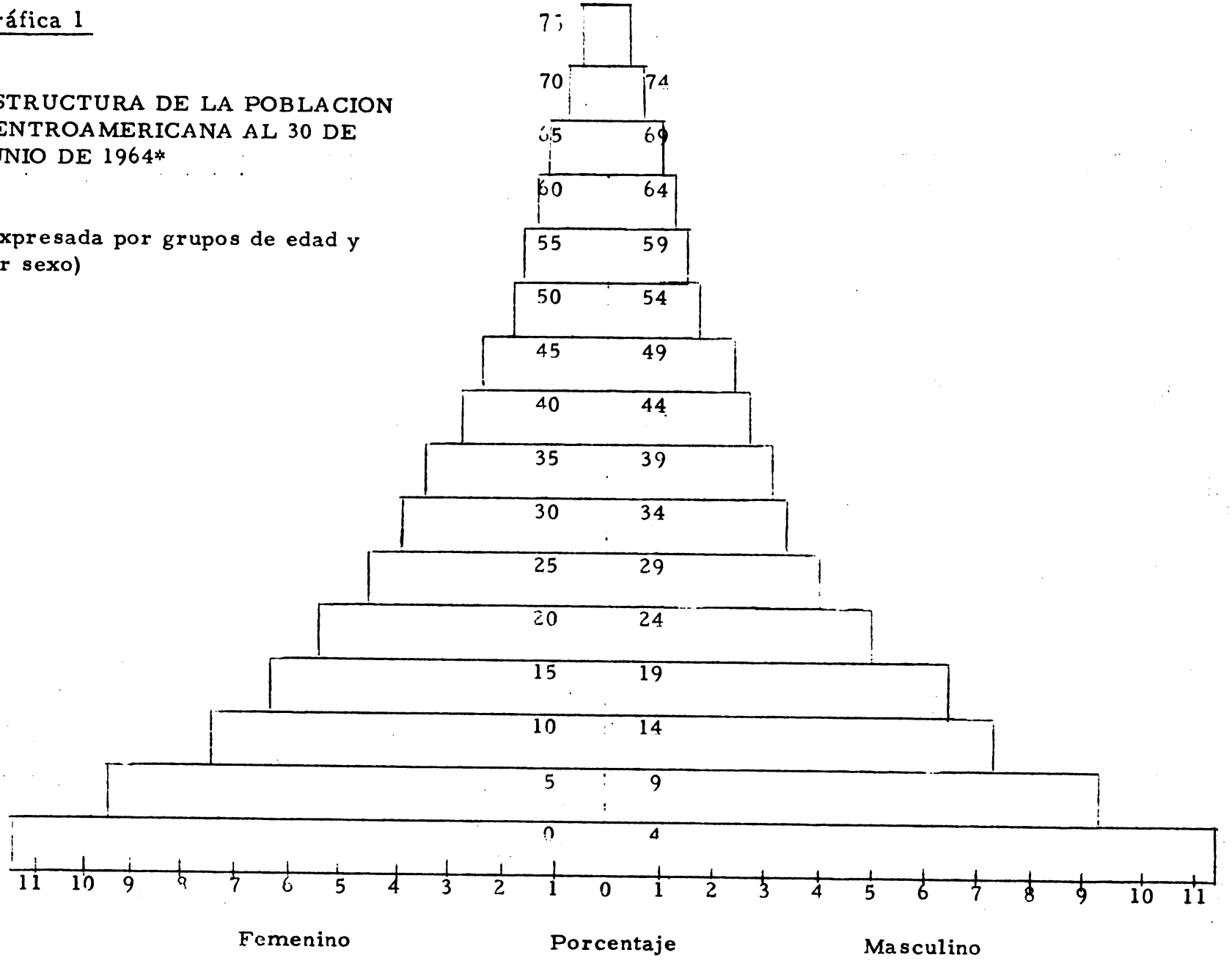
Estas consideraciones inducen a recordar los siguientes pensamientos de Ragnar Nurkse que, expresados sucinta y concretamente confirman de pleno la magnitud y realidad del problema: 2... Un hombre pobre puede no tener suficiente para comer; al estar desnutrido, su salud puede ser débil; al ser físicamente débil, su capacidad de trabajo es baja, lo que significa que es pobre, lo que a su vez significa que no tendrá suficiente para comer, y así sucesivamente" (6)

Esta situación es, en síntesis, lo que se conoce como causación acumulativa, ya que todas las causas del proceso se entrelazan en forma circular. El "círculo vicioso de la pobreza" solamente puede romperse atacando el problema en un enfoque global, es decir, teniendo en cuenta la situación actual en todos sus aspectos, a fin de introducir modificaciones que hagan posible una utilización más adecuada de los recursos existentes, e impulsando el alza del nivel de vida de los pobladores, con lo cual se propiciaría su mejoramiento social.

Gráfica 1

ESTRUCTURA DE LA POBLACION CENTROAMERICANA AL 30 DE JUNIO DE 1964*

(Expresada por grupos de edad y por sexo)



*Esta gráfica no incluye la República de Panamá. Sin embargo, este país tiene una figura similar.

Cuadro No. 1

DIETA MINIMA ADECUADA PARA CENTRO AMERICA
(Expresada en g. de peso neto/persona/día)

	Costa Rica*	El Salvador*	Guatemala*	Honduras*	Nicaragua*	Panamá**
Leche	300	250	250	300	400	300
Huevos	48	48	24	24	24	25
Carnes	90	90	90	90	90	90
Frijol	75	75	75	75	75	30
Vegetales amarillos	15	30	45	15	15	30
Vegetales verdes	15	30	45	15	15	15
Otros vegetales	100	150	150	100	150	60
Frutas	120	100	120	120	100	120
Musáceas	150	150	100	150	150	150
Raíces y tubérculos	75	60	45	60	60	120
Maíz	132	228	228	228	132	50
Trigo	105	114	114	97	114	60
Arroz	90	60	45	60	60	180
Azúcar	40	35	45	30	45	40
Panela	60	15	45	30	15	10
Grasas	20	15	15	20	15	30

* Datos inéditos proporcionados por la Srta. Marina Flores, Jefe del Servicio de Investigaciones Dietéticas, División de Nutrición Aplicada del INCAP. Estos fueron elaborados teniendo en consideración los resultados de los diversos estudios de consumo alimentario realizados en cada país por la Srta. Flores (1) y el costo y disponibilidad de alimentos.

** La distribución de las cantidades correspondientes a la República de Panamá fue elaborada por el autor.

Cuadro No. 2

FACTORES UTILIZADOS PARA ESTIMAR LA DEMANDA DE CONSUMO EN BASE DE CALORIAS*

Hombre adulto	1.00
Mujer adulta	0.74
Niños, ambos sexos:	
7-9 meses	0.36
10-2 meses	0.40
1-3 años	0.41
4-6 años	0.56
7-9 años	0.70
Varones 10-12 años	0.89
Niñas 10-12 años	0.81
Varones 13-15 años	1.11
Niñas 13-15 años	0.93
Varones 16-19 años	1.19
Niñas 16-19 años	0.78
Embarazo	0.81
Lactancia	1.04

* Las unidades de demanda fueron calculadas por la Srta. Marina Flores a partir de los requerimientos calóricos adoptados por el INCAP

Cuadro No. 3

UNIDADES DE DEMANDA CALCULADAS EN BASE DE CALORIAS*

Edades (años)	Masculino	Femenino
0- 1.0	0.38	0.38
1.1- 2.0	0.39	0.39
2.1- 3.0	0.41	0.41
3.1- 4.0	0.46	0.46
4.1- 5.0	0.51	0.51
5.1- 6.0	0.56	0.56
6.1- 7.0	0.61	0.61
7.1- 8.0	0.66	0.66
8.1- 9.0	0.70	0.70
9.1-10.0	0.76	0.73
10.1-11.0	0.82	0.77
11.1-12.0	0.89	0.81
12.1-13.0	0.96	0.85
13.1-14.0	1.03	0.89
14.1-15.0	1.11	0.93
15.1-16.0	1.13	0.89
16.1-17.0	1.15	0.85
17.1-18.0	1.17	0.81
18.1-19.0	1.19	0.78
19.1-20 y más	1.00	0.74

* Este cuadro fue elaborado con base en el Cuadro No. 2, en el supuesto de que las cantidades son equidistantes de los límites que para cada rango se establecen en dicho cuadro y a fin de obtener una cantidad promedio que corresponda a cada sexo y a cada grupo de edades

UNIDADES DE DEMANDA POR EDAD Y SEXO DE LOS GRUPOS DE POBLACION

(Valores promedio)

Edades (años)	Masculino %	Femenino %
0-4	0.40	0.40
5-9	0.60	0.60
10-14	0.90	0.80
15-19	1.15	0.85
20 y más	1.00	0.74

Cuadro No. 4

POBLACION TOTAL DEL ISTMO CENTROAMERICANO - 1964
(Expresada en miles de habitantes y por países)

Costa Rica	1 445.7*
El Salvador	2 828.4*
Guatemala	4 304.1*
Honduras	2 192.9*
Nicaragua	1 582.0*
Panamá	1 129.0**

* Las cantidades correspondientes a cada uno de los cinco países de Centro América fueron calculadas con base en las Series Estadísticas Históricas Seleccionadas de la Misión Conjunta de Programación para Centroamérica (3)

** Las cifras para la República de Panamá se obtuvieron de la Dirección de Estadística y Censo de ese país (4)

Cuadro No. 5

POBLACION TOTAL DEL ISTMO CENTROAMERICANO*
(Expresada en miles de habitantes, y por grupos de edad, al 30 de junio de 1964)

Grupos de edad (años)	Habitantes
0-4	2 438.3
5-9	2 020.8
10-14	1 695.4
15-19	1 384.4
20-24	1 145.9
25-29	956.5
30-34	803.5
35-39	683.7
40-44	572.9
45-49	479.9
50-54	386.6
55-59	301.5
60-64	223.3
65-74	264.8
75 y más años	124.6
TOTAL	13 482.1

* Además de las fuentes consultadas en la elaboración del Cuadro No. 4, el autor utilizó para los cálculos correspondientes a la República de Panamá, el Compendio General de Población publicado por la Dirección de Estadística y Censo de ese país en 1965 (5).

Cuadro No. 6

POBLACION, POR GRUPOS DE EDAD Y POR SEXO, AL 30 DE JUNIO DE 1964

COSTA RICA*

Grupos de edad (años)	Población (en miles de habitantes	%	Masculino (50%)	Femenino (50%)
0- 4	289.3	20.0	144.65	144.65
5- 9	232.8	16.1	116.4	116.4
10-14	182.0	12.6	91.0	91.0
15-19	139.5	9.6	69.75	69.75
Subtotal	843.6	58.3	421.8	421.8
20 y más	602.1	41.7	301.05	301.05
TOTAL	1445.7	100.0	722.85	722.85

* Las cantidades correspondientes a cada uno de los cinco países de Centro América fueron calculadas con base en las Series Estadísticas Históricas Seleccionadas de la Misión Conjunta de Programación para Centro América (3).

Cuadro No. 7

POBLACION, POR GRUPOS DE EDAD Y POR SEXO, AL 30 DE JUNIO DE 1964.

EL SALVADOR*

Grupos de edad (años)	Población (en miles de habitantes)	%	Masculino (49%)	Femenino (51%)
0- 4	521.7	18.4	255.6	266.1
5- 9	419.8	14.8	205.7	214.1
10-14	352.3	12.5	172.6	179.7
15-19	282.7	10.0	138.5	144.2
Subtotal	1576.5	55.7	772.5	804.0
20 y más	1251.9	44.3	613.4	638.5
TOTAL	2828.4	100.0	1385.9	1442.5

* Véase nota al pie del Cuadro No. 6.

Cuadro No. 8

POBLACION, POR GRUPOS DE EDAD Y POR SEXO, AL 30 DE JUNIO DE 1964

GUATEMALA*

Grupos de edad (años)	Población (en miles de habitantes)	%	Masculino (51%)	Femenino (49%)
0-4	752.8	17.5	383.9	368.9
5-9	587.9	13.7	299.8	288.1
10-14	512.6	11.9	261.4	251.2
15-19	458.8	10.7	234.0	224.8
Subtotal	2312.1	53.8	1179.2	1132.9
20 y más	1992.0	46.2	1015.9	976.1
TOTAL	4304.1	100.0	2195.1	2109.0

* Véase nota al pie del Cuadro No. 6

Cuadro No. 9

POBLACION, POR GRUPOS DE EDAD Y POR SEXO, AL 30 DE JUNIO DE 1964

HONDURAS*

Grupos de edad (años)	Población (en miles de habitantes)	%	Masculino (50%)	Femenino (50%)
0-4	403.0	18.4	201.5	201.5
5-9	348.6	15.9	174.3	174.3
10-14	295.0	13.4	147.5	147.5
15-19	226.5	10.3	113.25	113.25
Subtotal	1273.1	58.0	636.55	636.55
20 y más	919.8	42.0	459.9	459.9
TOTAL	2192.9	100.0	1096.45	1096.45

* Véase nota al pie del Cuadro No. 6

Cuadro No. 10

POBLACION, POR GRUPOS DE EDAD Y POR SEXO, AL 30 DE JUNIO DE 1964

NICARAGUA*

Grupos de edad (años)	Población (en miles de habitantes)	%	Masculino (50%)	Femenino (50%)
0-4	282.5	17.9	141.25	141.25
5-9	268.7	17.0	134.35	134.35
10-14	212.5	13.4	106.25	106.25
15-19	156.9	9.9	78.45	78.45
Subtotal	920.6	58.2	460.3	460.3
20 y más	661.4	41.8	330.7	330.7
TOTAL	1582.0	100.0	791.0	791.0

* Véase nota al pie del Cuadro No. 6.

Cuadro No. 11

POBLACION, POR GRUPOS DE EDAD Y POR SEXO, AL 30 DE JUNIO DE 1964

PANAMA*

Grupos de edad (años)	Población (en miles de habitantes)	%	Masculino (51%)	Femenino (49%)
0-4	189.0	18	96.4	92.6
5-9	163.0	14	83.1	79.9
10-14	141.0	12	71.9	69.1
15-19	120.0	11	61.2	58.8
Subtotal	613.0	55	312.6	300.4
20 y más	516.0	45	263.2	252.8
TOTAL	1129.0	100	575.8	553.2

* En la elaboración de este Cuadro se utilizaron como fuente de referencia para los cálculos correspondientes, datos publicados por la Dirección de Estadística y Censo de la República de Panamá (4, 5)

Cuadro

DETERMINACION DE LOS REQUERIMIENTOS DIARIOS

COSTA

COLU

1 Rango de edades (años)	2 Población (miles)	3 %	4 Masculino 50% (miles)	5 Unidad de demanda	6 (5)x300 Demanda/persona (g)	7 (4)x(6) Demanda/ grupo etario (miles g)
0-4	289.3	20.0	144.65	.40	120.0	17358.0
5-9	232.8	16.1	116.4	.60	180.0	20952.0
10-14	182.0	12.6	91.0	.90	270.0	24570.0
15-19	139.5	9.6	69.75	1.15	345.0	24063.75
Subtotal	843.6	58.3	421.8			86943.75
20 y más	602.1	41.7	301.05	1.00	300.0	90315.0
TOTAL	1445.7	100.0	722.85			177258.75

Cuadro

PROYECCION DE LA DEMANDA MINIMA ADECUADA

(Expresada en función de una tasa de

COSTA

Año	Leche (miles lts.)	Huevos (miles doc.)	Carnes (miles kg.)	Frijol (miles kg.)	Vegetales amarillos (miles kg.)	Vegetales verdes (miles kg.)	Otros vegetales (miles kg.)	Frutas (miles kg.)
1964	120828.0	33563.4	36278.4	30207.0	6041.4	6041.4	6041.4	48331.2
1965	125298.6	34805.2	37589.6	31324.7	6264.9	6264.9	6264.9	50119.5
1966	129934.7	36092.9	38980.4	32483.7	6496.7	6496.7	6496.7	51973.9
1967	134742.3	37428.5	40422.7	33685.6	6737.1	6737.1	6737.1	53896.9
1968	139727.7	38813.2	41918.3	34931.9	6986.4	6986.4	6986.4	55891.1
1969	144897.7	40249.3	43469.3	36224.4	7244.9	7244.9	7244.9	57959.1
1970	150258.9	41738.5	45077.6	37564.7	7512.9	7512.9	7512.9	60103.5
1971	155818.4	43283.0	46745.5	38954.6	7790.9	7790.9	7790.9	62327.4
1972	161583.7	44884.4	48475.1	40395.9	8079.2	8079.2	8079.2	64633.5
1973	167562.3	46545.1	50268.7	41890.6	8378.1	8378.1	8378.1	67024.9
1974	173762.1	48267.2	52128.6	43440.5	8688.1	8688.1	8688.1	69504.8

No. 12

ANUALES DE LECHE DE LA POBLACION - 1964

RICA

MNAS

8 Femenino (miles) 50%	9 Unidad de demenda	10 (9) x 300 Demanda persona (g)	11 (8) x (10) Demanda grupo et. (miles g)	12 (7)+(11) Demanda diaria/ grupo et. (miles g)	13 365x(12) Demanda anual grupo et. (miles g)	14 Demanda anual en litros (1000g=1 lt)
144.65	.40	120.0	17358.0			
116.4	.60	180.0	20952.0			
91.0	.80	240.0	24570.0			
69.75	.85	255.0	24063.75			
421.80			86943.75			
301.05	.74	222.0	66833.1			
722.85			153776.85	331035.6	120827.994	120.828.0

No. 13

DE ALIMENTOS BASICOS PARA EL PERIODO 1964-1974

aumento de la población de 3.7% anual)

RICA

Musáceas (bananos, etc.) (miles kg.)	Raíces y tubérculos (miles kg.)	Maíz (miles kg.)	Trigo (miles kg.)	Arroz (miles kg.)	Azúcar (miles kg.)	Panela (miles kg.)	Grasas (miles kg.)
60414.0	30207.0	53164.3	42289.8	36248.4	16106.4	24165.6	8059.2
62649.3	31324.7	55131.4	43854.5	37589.6	16702.3	25059.7	8357.4
64967.3	32483.7	57171.3	45477.1	38980.4	17320.3	25986.9	8666.4
67371.1	33685.6	59286.6	47160.0	40422.7	17961.1	26948.4	8987.3
69863.9	34931.9	61480.2	48904.7	41918.3	18625.7	27945.5	9319.8
72448.8	36224.4	63755.0	50714.2	43469.3	19314.9	28979.5	9664.7
75129.4	37564.7	66113.9	52590.6	45077.6	20029.5	30051.8	10022.3
77909.2	38954.6	68560.1	54536.4	46745.5	20770.6	31163.7	10393.1
80791.9	40395.9	71096.8	56554.3	48475.1	21539.1	32316.7	10777.6
83781.2	41890.6	73727.4	58646.8	50268.7	22336.1	33512.5	11176.4
86881.1	43440.5	76455.3	60816.7	52128.6	23162.5	34752.4	15889.9

Cuadro

DETERMINACION DE LOS REQUERIMIENTOS DIARIOS

EL SAL

COLUM

1 Rango de edades (años)	2 Población (miles)	3 %	4 Masculino 49% (miles)	5 Unidad de demanda	6 (5)x250 demanda persona (g)	7 (4)x(6) demanda grupo etario (miles g)
0-4	521.7	18.4	255.6	.40	100.0	25560.0
5-9	419.8	14.8	205.7	.60	150.0	30855.0
10-14	352.3	12.5	172.6	.90	225.0	38835.0
15-19	282.7	10.0	138.5	1.15	287.5	39819.0
Subtotal	1576.5	55.7	772.5			135069.0
20 y mas	1251.9	44.3	613.4	1.00	250.0	153350.0
TOTAL	2828.4	100.0	1385.9			288419.0

Cuadro

PROYECCION DE LA DEMANDA MINIMA ADECUADA

(Expresada en función de una tasa de

EL SAL

Año	Leche (miles lt)	Huevos (miles doc)	Carnes (miles kg)	Frijol (miles kg)	Vegetales amarillos (miles kg)	Vegetales verdes (miles kg)	Otros vegetales (miles kg)	Frutas (miles kg)
1964	194124.9	64708.3	69885.0	58237.5	23295.0	23295.0	116475.0	77650.0
1965	199948.6	66649.5	71981.5	59984.6	23993.8	23993.8	119969.2	79979.5
1966	205947.1	68648.9	74141.0	61784.1	24713.6	24713.6	123568.2	82378.8
1967	212125.5	70708.5	76365.2	63637.6	25455.1	25455.1	127275.3	84850.2
1968	218489.3	72829.9	78656.1	65546.8	26218.7	26218.7	131093.6	87395.7
1969	225043.9	75014.6	81015.8	67513.2	27005.3	27005.3	135026.4	90017.6
1970	231795.3	77265.1	83446.3	69538.6	27815.4	27815.4	139077.2	92718.1
1971	238749.1	79588.2	85949.7	71624.7	28649.9	28649.9	143249.5	95499.6
1972	245911.6	81970.5	88528.2	73773.5	29509.4	29509.4	147547.0	98364.6
1973	253288.9	84429.7	91184.0	75986.7	30394.7	30394.7	151973.4	101315.6
1974	260887.6	86962.5	93919.5	78266.3	31306.5	31306.5	156532.6	104355.0

No. 14

ANUALES DE LECHE DE LA POBLACION - 1964

VADOR

MNAS

8 Femenino (miles) 51%	9 Unidad de demanda	10 (9)x250 Demanda persona (g)	11 (8)x(10) Demanda grupo etario (miles g)	12 (7)+(11) Demanda diaria grupo et. (miles g)	13 365x(12) Demanda anual grupo et. (miles g)	14 Demanda anual en litros (1000g=1 lt)
266.1	.40	100.0	26610.0			
214.1	.60	150.0	32115.0			
179.7	.80	200.0	35940.0			
144.2	.85	212.5	30642.5			
804.0			125307.5			
638.5	.74	185.0	118122.5			
1442.5			243430.0	531849.0	194124885	194124.9

No. 15

DE ALIMENTOS BASICOS PARA EL PERIODO 1964-1974

aumento de la población de 3% anual)

VADOR

Musáceas (bananos etc.) (miles kg)	Raíces y tubérculos (miles kg)	Maíz (miles kg.)	Trigo (miles kg.)	Arroz (miles kg.)	Azúcar (miles kg.)	Panela (miles kg.)	Grasas (miles kg.)
116475.0	46590.0	177041.9	88521.0	46590.0	27177.5	11647.5	11647.5
119969.2	47987.7	182353.1	91176.6	47987.7	27992.8	11997.0	11997.0
123568.2	49427.3	187823.7	93911.9	49427.3	28832.6	12356.8	12356.8
127456.1	50910.1	193458.4	96729.2	50910.1	29697.6	12727.5	12727.5
131093.6	52437.4	199262.2	99631.1	52437.4	30588.5	13109.4	13109.4
135026.4	54010.5	205240.1	102620.0	54010.5	31506.1	13502.6	13502.6
139077.2	55630.9	211397.3	105698.6	55630.9	32451.3	13907.7	13907.7
143249.5	57299.8	217739.2	108869.6	57299.8	33424.9	14324.9	14324.9
147547.0	59018.8	224271.4	112135.7	59018.8	34427.7	14754.7	14754.7
151973.4	60789.3	230999.5	115499.8	60789.4	35460.5	15197.3	15197.3
156532.6	62613.0	237929.5	118964.6	62613.0	36524.3	15653.3	15653.3

Cuadro

DETERMINACION DE LOS REQUERIMIENTOS DIARIOS

GUATE

COLU

1 Rango de edades (años)	2 Población (miles)	3 %	4 Masculino 51% (miles)	5 Unidad de demanda	6 (5)x250 demanda persona (g)	7 (4)x(6) demanda grupo etario (miles g)
0-4	752.8	17.5	383.9	.40	100.0	38390.0
5-9	587.9	13.7	299.8	.60	150.0	44970.0
10-14	512.6	11.9	261.4	.90	225.0	58815.0
15-19	458.8	10.7	234.0	1.15	287.5	67275.0
Subtotal	2312.1	53.7	1179.2			209450.0
20 y mas	1992.0	46.3	1015.9	1.00	250.0	253975.0
TOTAL	4304.1	100.0	2195.1			463425.0

Cuadro

PROYECCION DE LA DEMANDA MINIMA ADECUADA

(Expresada en función de una tasa de

GUATE

Año	Leche (miles lt)	Huevos (miles doc)	Carnes (miles kg)	Frijol (miles kg)	Vegetales amarillos (miles kg)	Vegetales verdes (miles kg)	Otros vegetales (miles kg)	Frutas (miles kg)
1964	300073.1	50012.2	108026.3	90021.9	54013.2	54013.2	180043.8	144035.1
1965	309375.3	51562.6	111375.1	92812.6	55687.6	55687.6	185625.2	148500.1
1966	318965.9	53161.0	114827.7	95690.0	57413.8	57413.8	191380.0	153103.6
1967	328853.9	54809.0	118387.4	98656.2	59193.7	59193.7	197300.0	157849.9
1968	339048.3	56508.1	122057.4	101714.5	61028.7	61028.7	203429.0	162743.2
1969	349558.8	58259.8	125841.2	104867.6	62920.6	62920.6	209735.2	167788.2
1970	360395.2	60065.8	129742.3	108118.6	64871.2	64871.2	216237.2	172989.7
1971	371567.4	61927.9	133764.3	111470.2	66882.2	66882.2	222940.0	178352.4
1972	383086.0	63847.7	137911.0	114925.8	68955.5	68955.5	229851.6	183881.3
1973	394961.7	65826.9	142186.2	118488.5	71093.1	71093.1	236977.0	189581.6
1974	407205.5	67867.6	146594.0	122161.6	73297.0	73929.7	244323.2	195458.6

No. 16

ANUALES DE LECHE DE LA POBLACION -1964

MALA

MNAS

8 Femenino 49% (miles)	9 Unidad de demanda	10 (9)x250 demanda/persona (g)	11 (8)x(10) demanda/grupo etario (miles g)	12 (7)+(11) demanda/diaria grupo et (miles g)	13 365x(12) demanda/anual grupo et. (miles g)	14 Demanda anual en litros (1,000g=1 lt.)
368.9	.40	100.0	36890.0	75280.0		
288.1	.60	150.0	43215.0	88185.0		
251.2	.80	200.0	50240.0	109055.0		
224.8	.85	212.5	47770.0	115045.0		
1132.9			178115.0			
976.1	.74	185.0	180578.0	434553.0		
2109.0			358693.0	822118.0	300073070	300073.1

No. 17

DE ALIMENTOS BASICOS PARA EL PERIODO DE 1964-1974

aumento de la población de 3.1% anual)

MALA

Musáceas (bananos etc.) (miles kg)	Raíces y tubérculos (miles kg)	Maíz (miles kg.)	Trigo (miles kg.)	Arroz (miles kg.)	Azúcar (miles kg.)	Panela (miles kg.)	Grasas (miles kg.)
120029.2	54013.2	273666.4	136833.2	54013.2	54013.2	54013.2	18004.4
123750.1	55687.6	282150.3	141075.1	55687.6	55687.6	55687.6	18562.5
127586.4	57413.8	290895.9	145448.4	57413.8	57413.8	57413.8	19137.9
131541.6	59193.7	299147.3	149573.6	59193.7	59193.7	59193.7	19731.2
135619.3	61028.7	309212.1	154606.0	61028.7	61028.7	61028.7	20342.9
139823.5	62920.6	318797.7	159398.8	62920.6	62920.6	62920.6	20973.5
144158.1	64871.2	328680.4	164340.2	64871.2	64871.2	64871.2	21623.7
148627.0	66882.2	338869.5	169434.7	66882.2	66882.2	66882.2	22294.1
153234.4	68955.5	349374.4	174687.2	68955.5	68955.5	68955.5	29985.2
157984.7	71093.1	360205.0	180102.5	71093.1	71093.1	71093.1	23697.7
162882.2	73929.7	371371.4	185685.7	73929.7	73929.7	73929.7	24643.2

Cuadro

DETERMINACION DE LOS REQUERIMIENTOS DIARIOS

HON

COLU

1 Rango de edades (años)	2 Población (miles)	3 %	4 Masculino 50% (miles)	5 Unidad de demanda	6 (5)x300 demanda persona (g)	7 (4)x(6) demanda grupo etario (miles g)
0-4	403.0	18.4	201.5	.40	120.0	24180.0
5-9	348.6	15.9	174.3	.60	180.0	31374.0
10-14	295.0	13.4	147.5	.90	270.0	39825.0
15-19	226.5	10.3	113.25	1.15	345.0	39071.2
Subtotal	1273.1	58.0	636.55			134450.2
20 y más	919.8	42.0	459.9	1.00	300.0	137970.0
TOTAL	2192.9	100.0	1096.45			272420.2

Cuadro

PROYECCION DE LA DEMANDA MINIMA ADECUADA

(Expresada en función de una tasa de

HON

Año	Leche (miles lt)	Huevos (miles doc)	Carnes (miles kg)	Frijol (miles kg)	Vegetales amarillos (miles kg)	Vegetales verdes (miles kg)	Otros vegetales (miles kg)	Frutas (miles kg)
1964	180438.0	25060.8	54131.4	45109.5	9021.9	9021.9	60140.0	72175.2
1965	186392.5	25887.8	55917.7	46598.1	9319.6	9319.6	62124.6	74557.0
1966	192543.4	26742.2	57763.0	48135.9	9627.2	9627.2	64174.7	77017.4
1967	198897.4	27624.6	59669.2	49724.3	9944.9	9944.9	66292.5	79558.9
1968	205461.0	28536.3	61638.3	51365.2	10273.0	10273.0	68480.1	82184.4
1969	212241.2	29477.9	63672.4	53060.3	10612.0	10612.0	70740.0	84896.5
1970	219245.2	20450.7	65773.5	54811.3	10962.2	10962.2	73074.4	87698.1
1971	226480.2	31455.5	67944.1	56620.0	11324.0	11324.0	75485.9	90592.1
1972	233954.1	32493.6	70186.2	58488.5	11697.7	11697.7	77976.9	93581.6
1973	241674.6	33566.0	72502.4	60418.6	12083.7	12083.7	80550.1	96669.8
1974	249649.8	34673.6	74894.9	62412.4	12482.5	12482.5	83208.2	99860.0

No. 18

ANUALES DE LECHE DE LA POBLACION - 1964

DURAS

MNAS

8 Femenino 50% (miles)	9 Unidad de demanda	10 (9)x300 demanda persona (g)	11 (8)x(10) demanda grupo etario (miles g)	12 (7)+(11) demanda diaria g. et. (miles g)	13 365x(12) demanda anual g. et. (miles g)	14 Demanda anual en litros (1000 g= 1 lt.)
201.5	.40	120.0	24180.0			
174.3	.60	180.0	31374.0			
147.5	.80	240.0	35400.0			
113.25	.85	255.0	28878.75			
636.55			119832.75			
459.9	.74	222.0	102097.80			
1096.45			221930.55	494350.75	180438024	180438.0

No. 19

DE ALIMENTOS BASICOS PARA EL PERIODO 1964-1974

aumento de la poblacion de 3.3% anual)

DURAS

Musáceas (bananos etc.) (miles kg)	Ráíces y tubercu-los (miles kg)	Maíz (miles kg)	Trigo (miles kg)	Arroz (miles kg)	Azúcar (miles kg)	Panela (miles kg)	Grasas (miles kg)
90219.0	36087.6	137132.9	58335.6	36087.6	18043.8	18043.8	12035.2
93196.2	37278.5	141668.3	60260.7	37278.5	18639.2	18639.2	12432.4
96271.7	38508.7	146333.0	62249.3	38508.7	19254.3	19254.3	12842.6
99448.7	39779.5	151162.0	64303.5	39779.5	19889.7	19889.7	13266.4
102730.5	41092.2	156150.3	66425.5	41092.2	20546.1	20546.1	13704.2
106120.6	42448.2	161303.3	68617.6	42448.2	21224.1	21224.1	14156.5
109622.6	43849.0	166626.3	70882.0	43849.0	21924.5	21924.5	14623.6
113240.1	45296.0	172125.0	73221.1	45296.0	22648.0	22648.0	15106.2
116977.0	46790.8	177805.1	75637.4	46790.8	23395.4	23395.4	15604.7
120837.3	48334.9	183672.7	78133.4	48334.9	24167.4	24167.4	16119.7
124824.9	49930.0	189733.9	80711.8	49930.0	24964.9	24964.9	16651.6

Cuadro

DETERMINACION DE LOS REQUERIMIENTOS DIARIOS

NICA

COLU

1 Rango de edades (años)	2 Población (miles)	3 %	4 Masculino 50% (miles)	5 Unidad de demanda	6 (5)x400 demanda persona (g)	7 (4)x(6) demanda grupo etario (miles g)
0-4	282.5	17.9	141.25	.40	160.0	22600.0
5-9	268.7	17.0	134.35	.60	240.0	32244.0
10-14	212.5	13.4	106.25	.90	360.0	38250.0
15-19	156.9	9.9	78.45	1.15	460.0	36087.0
Subtotal	920.6	58.2	460.3			129181.0
20 y más	661.4	41.8	330.7	1.00	400.0	132280.0
TOTAL	1582.0	100.0	791.0			261461.0

Cuadro

PROYECCION DE LA DEMANDA MINIMA ADECUADA

(Expresada en función de una tasa de

NICA

Año	Leche (miles lt)	Huevos (miles doc)	Carnes (miles kg)	Frijol (miles kg)	Vegetales amarillos (miles kg)	Vegetales verdes (miles kg)	Otros vegetales (miles kg)	Frutas (miles kg)
1964	173309.4	18052.9	38994.6	32495.5	6499.1	6499.1	64991.0	43327.3
1965	178508.7	18594.6	40164.4	33470.4	6694.1	6694.1	66940.7	44627.2
1966	183864.0	19152.4	41369.4	34474.5	6894.9	6894.9	68949.0	45966.0
1967	189379.9	19727.1	42610.5	35508.7	7101.7	7101.7	71017.4	47345.0
1968	195061.3	20318.9	43888.8	36574.0	7314.8	7314.8	73147.9	48765.3
1969	200913.1	20928.5	45205.4	37671.2	7534.2	7534.2	75342.4	50228.3
1970	206940.5	21556.2	46561.6	38801.3	7760.3	7760.3	77602.7	51735.1
1971	213148.7	22203.0	47958.5	39965.4	7993.1	7993.1	79930.8	53287.2
1972	219543.2	22869.1	49397.2	41164.3	8232.9	8232.9	82328.7	54885.8
1973	226129.5	23555.2	50879.1	42399.3	8479.8	8479.8	84798.5	56532.4
1974	232913.4	24261.8	52405.5	43671.2	8734.2	8734.2	87342.5	58228.3

ANUALES DE LECHE DE LA POBLACION - 1964

RAGUA

MNAS

8 Femenino 50% (miles)	9 Unidad de demanda	10 (9)x400 demanda persona (g)	11 (8)x(10) demanda grupo etario (miles g)	12 (7)+(11) demanda diaria grupo et. (miles g)	13 365x(12) demanda anual grupo et. (miles g)	14 Demanda anual en litros (1000 g=1 lt)
141.25	.40	160.0	22600.0			
134.35	.60	240.0	32244.0			
106.25	.80	320.0	34000.0			
78.45	.85	340.0	26673.0			
460.3			115517.0			
330.7	.74	296.0	97887.2			
791.0			213404.2	474820.3	173309.409	173309.4

No. 21

DE ALIMENTOS BASICOS PARA EL PERIODO 1964-1974

aumento de la población de 3% anual)

RAGUA

Musáceas (bananos etc.) (miles kg)	Raíces y tubérculos (miles kg.)	Maíz (miles kg.)	Trigo (miles kg.)	Arroz (miles kg.)	Azúcar (miles kg.)	Panela (miles kg.)	Grasas (miles kg.)
64991.0	25996.4	57192.1	49393.2	25996.4	19427.3	6499.1	6499.1
66940.7	26776.3	58907.9	50875.0	26776.3	20082.2	6694.1	6694.1
68949.0	27579.6	60675.1	52401.2	27579.6	20684.7	6894.9	6894.9
71017.4	28407.0	62495.4	53973.3	28407.0	21305.2	7101.7	7101.7
73147.9	29259.2	64370.2	55592.5	29259.2	21944.4	7314.8	7314.8
75342.4	30137.0	66301.3	57260.2	30137.0	22602.7	7534.2	7534.2
77602.7	31041.0	68290.4	58978.0	31041.0	23280.8	7760.2	7760.2
79930.8	31972.3	70339.1	60747.4	31972.3	23979.2	7993.1	7993.1
82328.7	32931.5	72449.2	62569.8	32931.5	24698.6	8232.9	8232.9
84798.5	33919.4	74622.7	64446.9	33919.4	25439.6	8479.8	8479.8
87342.5	34937.0	76861.4	66380.3	34937.0	26202.7	8734.2	8734.2

Cuadro

DETERMINACION DE LOS REQUERIMIENTOS DIARIOS

PANA

COLU

1 Rango de edades (años)	2 Población (miles)	3 %	4 Masculino 51% (miles)	5 Unidad de demanda	6 (5)x300 demanda persona (g)	7 (4)x(6) demanda grupo etario (miles g)
0-4	196.5	16.7	100.2	.40	120.0	12025.2
5-9	168.6	14.3	86.0	.60	180.0	15480.1
10-14	142.9	12.2	72.9	.90	270.0	19681.0
15-19	117.6	10.0	60.0	1.15	345.0	20687.7
Subtotal	625.6	53.2	319.1			67874.0
20 y más	550.1	46.8	280.5	1.00	300.0	84172.5
TOTAL	1175.7*	100.0	599.6			152046.5

*Esta cifra incluye la población indígena

Cuadro

PROYECCION DE LA DEMANDA MINIMA ADECUADA

(Expresada en función de una tasa de

PANA

Año	Leche (miles lt)	Huevos (miles doc.)	Carnes (miles kg.)	Frijol (miles kg.)	Vegetales amarillos (miles kg)	Vegetales verdes (miles kg)	Otros vegetales (miles kg)	Frutas (miles kg.)
1964	98483.4	14242.5	29545.5	9848.3	9848.3	4924.2	19696.7	6568.8
1965	101437.9	14697.9	30431.4	10143.8	10143.8	5071.9	20287.6	6765.9
1966	104481.0	15109.9	31344.3	10448.1	10448.1	5224.0	20896.2	6968.9
1967	107615.4	15563.2	32284.6	10761.5	10761.5	5380.8	21523.1	7177.9
1968	110843.9	16030.0	33253.2	11084.4	11084.4	5542.2	22168.8	7393.3
1969	114169.2	16510.9	34250.8	11416.9	11416.9	5708.5	22833.8	7615.1
1970	117594.3	17006.2	35278.3	11759.4	11759.4	5879.7	23518.9	7843.5
1971	121122.1	17516.5	36336.6	12112.2	12112.2	6056.1	24224.4	8078.8
1972	124755.8	18042.0	37426.7	12475.6	12475.6	6237.8	24951.2	8321.2
1973	128498.5	18583.2	38549.5	12849.8	12849.8	6424.9	25699.7	8570.8
1974	132348.5	19139.9	39704.6	13234.8	13234.8	6617.4	26469.7	8827.6

No. 22

ANUALES DE LECHE DE LA POBLACION - 1964

MA

MNAS

8 Femenino 49% (miles)	9 Unidad de demanda	10 (9)x300 demanda persona (g)	11 (8)x(10) demanda grupo etario (miles g)	12 (7)+(11) demanda diaria grupo et (miles g)	13 365x(12) demanda anual grupo et. (miles g)	14 Demanda anual en litros (1000 g=1 lt)
96.3	.40	120.0	11553.6			
82.6	.60	180.0	14873.0			
70.0	.80	240.0	16808.2			
57.6	.85	255.0	14691.2			
306.5			57926.0			
269.6	.74	222.0	59845.0			
576.1			117771.0	269817.5	98483405.75	98483.4

No. 23

DE ALIMENTOS BASICOS PARA EL PERIODO 1964-1974

aumento de la población de 3% anual)

MA

Musáceas (bananos etc.) (miles kg)	Raíces y tubérculos (miles kg)	Maíz (miles kg)	Trigo (miles kg)	Arroz (miles kg)	Azúcar (miles kg)	Panela (miles kg)	Grasas (miles kg)
49241.7	39393.4	16417.2	19696.7	59090.0	13127.8	3279.5	9848.3
50718.9	40575.2	16909.7	20287.6	60862.7	13521.7	3377.9	10143.8
52240.5	41792.4	17417.0	20896.2	62688.6	13927.3	3482.4	10448.1
53807.7	43046.2	17939.5	21523.1	64569.2	14345.1	3586.8	10761.5
55421.9	44337.6	18477.7	22168.8	66506.3	14775.5	3694.4	11084.4
57084.6	45667.7	19032.0	22833.8	68501.5	15218.7	3801.8	11416.9
58797.2	47037.7	19603.0	23518.9	70556.6	15675.3	3915.9	11759.4
60561.0	48448.8	20191.0	24224.4	72673.3	16145.6	4033.4	12112.2
62377.9	49902.3	20796.8	24951.2	74853.5	16630.0	4154.4	12475.6
64249.2	51399.4	21420.7	25699.7	77099.1	17128.8	4279.0	12849.8
66174.2	52939.4	22062.5	26469.7	79409.1	17692.0	4407.2	13234.8

CUADRO No. 24

POBLACION URBANA Y RURAL DE CENTRO AMERICA* Y PANAMA* AL 30 DE JUNIO DE 1964

(Expresada en miles de habitantes y en %)

País	Urbana	%	Rural	%	TOTAL
Guatemala	1451.3	34.0	2852.8	66.0	4304.1
El Salvador	1106.3	39.0	1722.1	61.0	2828.4
Honduras	550.4	25.0	1642.5	75.0	2192.9
Nicaragua	652.8	41.0	929.2	59.0	1582.0
Costa Rica	501.9	35.0	943.8	65.0	1445.7
Panamá	508.0	45.0	621.0	55.0	1129.0
Centro América y Panamá	4770.7	35.0**	8711.4	65.0**	13482.1

* Véase notas al pie de los Cuadros Nos. 4 y 5.
** Porcentajes redondeados a la cifra más próxima.

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LA NUTRICION EN LOS PROGRAMAS DE DESARROLLO

José Figueres Ferrer

Many nutritional problems are not technical; they are really economic problems. Further more, I have long come to the conclusion that many economic problems of today are primarily political problems.

We live in a period when the human animal has nearly finished conquering this planet and is trying to visit the moon, only to find himself underfed at home. Technology has made more progress than politics. This is probably due to the relatively easy intimate connection between technology and science. The intimate relationship between politics and human well-being is more difficult to accomplish.

In my anxieties about the development of Latin America, I have carefully observed the qualities of the Latin American peasant. We are in a continent where, in some nations, 60% of the population are still country people. To speak of our peasant population is to speak of Latin America. Contrary to the common assumption of those of us who belong educationally to the privileged minorities, Latin America is still a rural continent.

We encounter enormous difficulties in development. I was at Punta del Este when we launched the Alliance for Progress. I now realize how optimistic we were in our timetable. Things, that will require maybe fifty years, were planned for the next ten years.

Why are some Latin American people difficult to stimulate, to bring up to the surface? Why have they not attained political stability? I have a theory which may not be orthodox, but recent readings in non-specialized magazines lead me to believe that there may be something to it: there seems to be a basic mental limitation that comes from under-nourishment in the early stages of life.

People tend to be more intelligent when they are brought up in an environment in which, among other things, they have a proper diet since childhood. How is the Latin American infant fed? At first, from the breast of his mother, a mother herself undernourished and who is old at 30. As soon as the nursing period finishes, when that infant has really eaten up his mother, what diet does he receive? Tortillas, chile, rice: the most inadequate diet.

Maybe this explains, at least partially, the mental and spiritual limitations of some peasant people of Latin America. Unless governments pay more attention to the nutrition of the peasant child, the whole problem of development will continue to be difficult. Even political stability is impossible with a badly undernourished population.

Part of the undernourishment has economic causes. People are poor, therefore, they cannot afford to buy nourishing food. And, of course, since they cannot afford to buy nutricious food, they continue to be poor; hence, we have a viscious circle.

Undernourishment is also due to defective education. We would take a great step forward if we could improve the eating habits of people, if we could in our educational systems bring up a generation that would know how to feed themselves more wisely on their environment.

I can give you an example. There are extensive highlands here in Central America where people eat a large amount of rice produced in the lowlands. Nutritionally rice is inferior to carrots, or beets, which grow easily in all our highlands. Why don't our peasants eat carrots? Because they were never taught to like them when they were children, because they did not develop the habit. It is difficult to change the eating habits of adults.

How do we tackle such problems? How do we develop the right eating habits, according to the environment? Perhaps a comprehensive program of "school luncheons" would be equally important to our countries as the efforts to teach people to read and write.

There are good pilot projects under way, in Puerto Rico and in other countries where, through school luncheons, a new generation is being brought up with better eating habits. This should greatly complement the economic and social measures that tend to increase the family income and to make it possible for people to buy the right food.

There is really no lack of a market for anything; there is no overproduction of anything; there is only underconsumption, due to poverty, due to lack of family income.

It is my impression that we have done too little towards feeding our population out of the sea. There has been little investigation on the

possibilities of sea food. Because I am a farmer and I know how difficult it is to plow the land, perhaps I tend to oversimplify the problems of sea food production.

Turtles are an example of how badly we are using the resources of the sea. Dr. Archie Carr, of the University of Florida, who has devoted a lifetime to investigate the green turtle's life in the Caribbean, assures me that these animals feed on thousands and thousands of square miles of undersea grazing land.

Governments have not cooperated sufficiently with scientists. Turtles are being slaughtered in a barbarous manner in my own country. What could be a source of incalculable amounts of protein food is being destroyed. Several other examples could be mentioned where we are wasting the wealth of the sea.

I claim that massive production of food for a country, for Latin America, for the world, is not exclusively a technical problem; it is also a problem of economic organization.

Latin America is producing less food per capita today than twenty years ago. Many people are worried about this. All kinds of remedies are recommended to reverse the trend.

There are two sets of measures to increase food production. One is technical measures: seed selection, fertilizer, machinery. Here we have been relatively successful. The other measures are economic: a guaranteed market, stable prices, credit, etc. Here we have to begin.

Paradoxically, in countries like the United States, where sound economic policies have been successfully applied to agriculture, they are severely criticized. Newspapermen and politicians are often city people without rural experience.

The farmers of the world are expected to gamble, to run the risks of nature plus the risks of the market. When society has taken over some of the risks, as in the United States, and other countries, it has succeeded in building ample reserves and even food surpluses. Some people have called that the "scandal of agricultural subsidies". At the height of the "scandal", I remember telling friends in the U. S.: if instead of several billion surplus you had a one billion shortage, you would be feeling different.

Look at what is happening now. The gap between the farmer and the urbanite has disappeared. In the world picture, if it had not been for the criticized United States surpluses, brought about by guaranteed markets, three large countries of the world would have starved. China, Russia and India would have starved in 1965/66 if it had not been for the surpluses produced in the United States, Canada and other countries. Surpluses produced how? Of course, by technology, but mainly by guaranteed markets to the farmer.

I do not deny that the methods used to stabilize U.S. agriculture have defects. Many of the decisions are made by political bodies, instead of by economic institutions of the nature of the Federal Reserve Board. The over-all success, however, is undeniable.

If we would establish buying centers in the different agricultural regions of the world, and food reserves in the major ports, production would go up in spite of all difficulties. Applying economic measures would create and immediate increase of production. Without a guaranteed market, technical assistance has to be spoonfed to the farmers. With price security, they grab it.

What we need is a World Food Bank. It should have at least as much authority and resources as the International Monetary Fund. Without the policies and the institutions needed to stabilize the food markets of the world, we are not going to meet the challenge of our growing population.

The underdeveloped countries have made the mistake of importing one aspect of another culture, without the rest of the advances that go with it. They have imported medical science: they have increased the life expectancy and the number of children who attain mature age. But, they have not adopted the techniques that supply food and other necessities. This has produced the present unbalance. We need new policies and new institutions to establish the balance.

TERCER TEMA

LA SITUACION NUTRICIONAL DEL HOMBRE Y LOS ANIMALES EN AMERICA CENTRAL

Moderador: Dr. M. Behar

Dr. Behar: Following our discussions we'll start this morning the subject of the nutritional status of man and animals in Central America. The first part of the meeting will be devoted to the nutritional status of human beings in the area and we are very fortunate in having with us to make the introduction to the subject Dr. Arnold Schaefer.

Dr. Schaefer is a well known authority in the field which he is going to cover and in nutrition in general. His present position is Director of the Nutrition Section of the Office of International Research at the National Institute of Health in Bethesda, Maryland. This office is really the continuation and extension of the original ICNND, originally the initials for Interdepartamental Committee in Nutrition for National Defense, which started its work in 1954 by surveying the nutritional status, particularly of the armed forces and some civilian populations in different countries following a program of identifying the major problems in different countries and with the idea of what could be done about them in terms of foreign aid. This original organization changed its name later, maintaining the same initials of ICNND to Interdepartamental Committee in Nutrition for National Development, which I think indentifies very clearly the change in the philosophy that originated as a program of national defense and then was changed to a program of national development. It has expanded its responsibilities and is now part of the National Institutes of Health in the Office of International Research devoted to nutritional programs. Up to the present time they have made 32 surveys in 32 different countries all around the world.

With the one that is being carried out at present in Honduras, there will be 33. The countries of Central America have been surveyed in cooperation with INCAP. We have already finished the surveys of Guatemala, El Salvador, Nicaragua and Costa Rica. As indicated right now . now we are doing the survey in Honduras and Panama is scheduled for the first quarter of next year. In addition to this specific responsibility, Dr. Schaefer and his group particularly feel that their great enthusiasm has been influential in determining the policy of the United States in the field of nutrition, and many of the changes that have recently occurred in that policy have originated primarily from Dr. Schaefer's office. So, it is a great pleasure to have Dr. Schaefer among us and he is going to make the introductory remarks on the subject.

REVISION DE LOS ESTUDIOS EFECTUADOS EN LAS POBLACIONES HUMANAS DE LA REGION

Dr. A. E. Schaefer

I should certainly like to pay tribute and congratulations to Señor Figueres, for what I consider one of the most enlightening addresses and really I think the summary of what this meeting hopes to accomplish. As I reviewed my thoughts last night on all your statements, Señor Figueres, I think that you covered all the key points, and if they could be implemented, our problems would be solved. Anything I have to say, I am sure is going to be anticlimactic, because I can't present it in the excellent fashion that you did.

I think beyond any doubt, malnutrition is the major public health problem confronting our civilization today. It means stagnation and death to the civilization in which it is allowed to exist. It literally kills almost half the infants in a significant part of the world before they reach the age of six. The President of the United States in a message to Congress over six months ago in referring to the AID bill stated: "... The most grave health problem of the world remains hunger and malnutrition... We have long recognized that an insufficient food supply is a leading contributor to human misery and political instability. More recently we have begun to recognize that it is also a major deterrent to economic and social development..."

In a challenging presentation addressed to the III Inter-American Seminar on child feeding, the Honorable Herbert J. Waters, Assistant Administrator for Material Resources, AID, stated that "... Malnutrition is the silent, but most lethal enemy of mankind." He encouraged immediate action programs designed not only to combat infant malnutrition but also to close the ever-expanding gap between food supply and the population explosion. Mr. Waters proposed a number of approaches to the problem, such as the encouragement of private enterprise; the development of formulated nutritionally complete foods; tax incentives to small industries developing low-cost, nutritional foods; programs and regulations designed to prevent food wastage; and a greatly expanded program in food production, distribution and marketing.

Programs to combat malnutrition are preventive medicine. The Nutrition Section of the Office of International Research, formerly known as the Interdepartmental Committee on Nutrition for National Defense, ICNND, since 1955 has assisted over 30 countries in conducting

nutrition/health epidemiological surveys in Latin America, the Middle East, Africa and the Far East.

In Latin America, especially in Central America through INCAP, immense progress has occurred in combating malnutrition. Latin American scientists have conducted one of the most sweeping, broad-based nutrition research and public health programs to define the magnitude and causes of malnutrition that have ever been conducted anywhere in the world. Through the combined efforts of health departments, nutrition institutes, PAHO, and bilateral nutrition programs, extensive programs to assess the nutritional status have reached every country in Latin America. There are Institutes of Nutrition for training, research, and public health action programs in virtually every one of these countries. The Nutrition Section has assisted in conducting comprehensive nutritional surveys in: Ecuador, Chile, Colombia, the West Indies, Uruguay, Bolivia, Northeast Brazil, Venezuela, Paraguay, and recently with INCAP, all of the Central American countries. These surveys have been primarily to assist these nations to (1) define their major food and nutrition problems; (2) train their personnel in nutrition techniques and procedures; (3) afford the opportunity to U.S. and Latin American scientists in the various disciplines of nutrition and health to receive experience and training in working side by side in field situations; and, perhaps most important, (4) to develop practical recommendations for maximum utilization of local in-country resources. The baseline assessment procedures for the Nutrition Section's nutritional surveys are described in the Manual for Nutrition Surveys [1] which was developed by the ICNND.

The magnitude of the problem of malnutrition can be clearly demonstrated only when we analyze the data involved concerning the current population explosion versus food production. In 1830 the world's population reached one billion people. It took approximately 100 years beyond that date to produce two billion and 30 years more to reach three billion in 1962. It will take only 11 more years to produce the fourth billion. Furthermore, the population of Latin America is growing even faster than the world rate, with an average annual increase of 2.5 percent. The rate of population increase, of course, varies from country to country. For example, the temperate region of sourthern Latin America shows an annual rate of increase of 1.4 percent for Argentina and 1.3 percent for Uruguay, as compared to 3.5 percent for Central America. The estimated rate of increase for the next 50 years for the world as a whole is 150 percent, whereas for Latin America it is 265 percent. It is due to population growth that food production per capita is slightly less today than it was before World War II. During the last two decades, food production in Latin America has increased at a rate among the highest in the world, namely, 69 percent. However, due to

the population growth the amount of food per capita has decreased[2]. The fact that only 7 percent of the arable land of Latin America is under cultivation gives rise to the hope that the critical demand for additional food can be met. This demand is and will be for quality (nutritional adequacy) as well as for quantity.

It has been estimated that approximately 70 percent of all pre-school children in the developing countries suffer from various degrees of malnutrition. Height-weight measurements for age provide the simplest index we have for assessing nutritional status. The average growth of the preschool child in many of the Latin American countries is retarded by approximately two or three years by the age of six. Recent studies of skeletal development further substantiate these findings by revealing retardation of bone growth due to malnutrition and disease. Of perhaps even greater consequence are the undetected, possibly permanent effects of malnutrition on learning ability, mental capacity and behavior. This problem was brought to the forefront by Latin American investigators such as Dr. Joachim Cravioto, Dr. Gomez and others whose studies indicate the great possibility that, without protein, calories and essential nutrients, malnutrition will have an adverse effect on the development of the central nervous system and brain function. It is during the first four or five years of life that the brain matures to 90 percent of its capacity. Tests with experimental animals have shown clearly that the brain is irreversibly damaged by severe malnutrition in infancy.

The qualitative problems of malnutrition are as important, if not more so, than the quantitative ones. Correction of calorie deficiency with carbohydrates alone may exaggerate protein deficiency. Correction of calorie and protein deficiency while neglecting vitamin and mineral requirements may exaggerate the symptoms of specific nutrient deficiency. Infants and pre-school children's nutrient requirements per pound of body weight are much higher than those of adults. These groups are uniquely susceptible to nutritional deficiency or imbalance. This susceptibility is accentuated when the child's mother has received an inadequate diet during pregnancy and lactation. The most widespread and severe forms of malnutrition in infants and young children are kwashiorkor and marasmus. These diseases (a multiple deficiency syndrome due to insufficient protein and/or calories, vitamins and minerals) usually begin in the first year of life. They result in the serious impairment in physical growth frequently seen in Latin America and other surveyed areas.

Malnutrition and infectious disease (usually brought about by the low resistance to infection caused by malnutrition) combine to kill a high proportion of the children in the developing countries by the age of five. Mortality rates of infants (1 year or less of age) in a developing country

may be only six to eight times as great as those in technologically advanced areas, but the mortality in the one-four year age group may be 50 to 60 times greater.

It has been estimated that serious protein malnutrition afflicts more than 20 percent of the pre-school children in Latin America. Similarly vitamin A deficiency, goiter, and anemia are equally prevalent.

Vitamin A deficiency accounts for widespread blindness or impaired vision and to a large extent for high mortality. Night blindness, xerophthalmia (dry and lusterless eyes) and kerotomalacia (softening of cornea) are common manifestations of vitamin A deficiency. The world-wide toll in human misery and loss of productivity due to this single nutritional deficiency is truly astounding. It is also a great economic loss to society in that each child blinded as a result of this deficiency becomes an economic liability; whereas, the total vitamin A requirement of any child in the world could be supplied at a maximum cost of less than 10 cents per year. This nutritional deficiency is prevalent throughout Asia, the Middle East, parts of Africa, and Latin America.

On the basis of our studies and surveys made by the World Health Organization, it is estimated that there are 200 million people suffering from iodine deficiency which results in goiter. Latin America is one of the most severely afflicted areas in the world. Through the Andean chain endemic goiter is found, but is is not limited just to the Andes, because it is found also in the interior; the plains of Brazil and Argentina and elsewhere in Latin America. Although the scientific world has long recognized that goiter can be prevented by iodized salt, the incidence of goiter throughout Latin America is appalling, often afflicting 80 percent of population groups. A few countries, especially Guatemala and Colombia, have made concerted efforts to combat this disease through salt iodization with dramatic success.

The assessment of suboptimal nutrition by biochemical parameters enables us to predict more accurately the individual's nutritional status. These data illustrate the nutritional status of civilian populations in Latin America. By and large, the military populations which were sampled throughout Latin America were young recruits. In general, they are assumed to be better fed than their civilian counterparts. This is not true in all cases. Levels of urinary riboflavin, for example, which were indicative of suboptimal riboflavin nutrition, were found in as high as 62 percent of the military forces of Bolivia.

As a part of the larger surveys of the status of nutrition in Uruguay and Venezuela, studies on the prevalence of diabetes were conducted

by Drs. Kelly M. West and John M. Kalbfleisch from the University of Oklahoma. The prevalence of diabetes as determined by impaired glucose tolerance was crudely estimated. All the subjects tested were over 30 years of age. In Uruguay the prevalence of diabetes (two-hour venous blood glucose levels greater than 149 mg. per 100 ml.) was 6.8 percent. The prevalence of impaired tolerance in Venezuela was 7.3 percent. The most consistent relationship found was between over-nutrition (excess of calories in relation to energy expenditure) and the prevalence of diabetes regardless of the source of the calories.

Now that I have attempted to show the major prevailing problems of malnutrition in Latin America, the question is "What must be done?" Preventing malnutrition is not merely a health responsibility but a social and economic one. The economic repercussions of prevention versus treatment are staggering. For example, in Guatemala, the cost of the treatment of kwashiorkor, which requires hospitalization usually for a minimum of 90 days, is nearly $600; whereas this same child could have been furnished a nutritionally adequete food supplement for approximately $10 per year. Vitamin A blindness can be prevented in children at a cost of approximately 10 cents per child per year. It is estimated that in the United States the cost required to care for a person blinded as an infant can conservatively reach one quarter of a million dollars. Goiter can be prevented for less than 3 cents per individual per year.

Tremendous resources of the critical nutrient component of foods, namely, protein for infants, are currently available in almost every country in Latin America. That is, they are potentially available but not used. These protein sources, supplemented with the critically essential vitamins and minerals, can through technology be prepared as substitutes for milk (in fact they even may be nutritionally superior to milk) in a cheap, acceptable form.

Numerous countries in Latin America have become leaders throughout the world in developing such infant food formulas. This is step one. The real challenge is step two: distribution to the needy child. There is an extreme urgency for active Government and private programs to help reach the pre-school child. Again, to reach the pre-school child one must first reach the mother. Mothers often do not know what to feed their children to maintain normal growth and development. The conspicuous effects of malnutrition are attributed by the mother to other causes. Many families cannot afford to buy the food required by children. Ill-advised crop practices, emphasis on raising of non-food cash crops, lack of transportation, lack of food processing, storage and preservation, all conspire to put the required foods beyond reach.

There is an urgent need for immediate short-term programs which may require subsidization of sales of infant food products or the purchase of raw and processed commodities. Such programs will require technical manpower skills and maximum utilization of local food resources. Long-term programs are urgently and immediately needed to insure increasing local food production on a self-sustaining basis and the development of a food industry to prevent waste, assist in distribution, and equally important, to feed the masses migrating from the rural to the urban areas. It is for this role that it is vital to amalgamate agriculture, health, education, the food industry, marketing, storage, and distribution.

The cadre of nutrition workers throughout Latin America has assisted in defining the problems. They are familiar with local resources, food habits and customs. Now more than anything else action is required. As the problems of malnutrition vary widely from country to country, and even within countries, so must the ultimate solution of these problems vary according to the needs and resources of each.

In 1964 a five-year contract was negotiated between ARPA (Advanced Research Projects Agency) and the Nutrition Section, to continue the program of the former ICNND in world epidemiology of nutritional diseases and to support research on health problems identified by epidemiological studies so as to provide the information required to implement curative and preventive measures. The nutrition surveys, although having as their prime objective the assessment of nutritional status and definition of the incidence of malnutrition in the areas studied, include the assessment of related health problems to nutrition, such as the incidence of infectious and parasitic disease, diabetes, and cardiovascular diseases, dental disease and special research on improved methodology for certain techniques employed in the surveys.

Under the terms of this agreement, a recent nutrition-health assessment project has been completed in Paraguay. In 1965, in conjunction with the Pan American Health Organization (PAHO) , and specifically the Institutes of Nutrition of Central America and Panama (INCAP), nutrition-health surveys were initiated to cover all the Central American countries. To date, Guatemala, El Salvador, Nicaragua, and Costa Rica, have been surveyed. Honduras is next on the schedule with the survey beginning this month and Panama will be surveyed in January of 1967. Each country is being studied for a period of approximately two months. In addition to personnel from INCAP and advisory scientists assigned by ICNND, scientists from the individual country concerned are participating in these surveys.

With the excellent facilities and the professional competence that exist at INCAP, the nutrition-health surveys in the Central American region have enabled us to incorporate many research components directly into the epidemiological studies. A few of these are: (1) the etiology of anemias, including total serum iron-binding capacity, serum folic acid, serum vitamin B_{12} and differential RBC counts; (2) evaluation of urinary creatinine, urea and total nitrogen as a potential index for protein metabolism and nutrient excretion; (3) evaluation of serum amino acid patterns as potentially related to protein nutriture; (4) urinary iodine to creatinine excretion as related to the incidence of goiter; (5) the assessment and feasibility of utilizing a two-lead EKG to study the incidence of cardiovascular disease, as related to serum cholesterol and total lipids, dietary components, sodium and potassium urinary excretions, and hypertension; (6) the assessment and use of a modified glucose tolerance test adaptable to field surveys as a test for diabetes; (7) the relationship of diet to periodontal disease and incidence of dental decay; (8) the assessment of mycotoxin contamination of foods; (9) the establishment of a serum bank for immunological typing and potential relation of infectious diseases and diet; (10) effect of parasitic infestation on nutritional status; (11) the assessment of growth and development by utilization of wristbone x-rays for determining bone density, bone loss and abnormalities as related to diet and especially calcium metabolism; (12) the evaluation of anthropometric measurements in addition to height and weight for age, such as chest, sitting height and head circumference measurements; (13) evaluation of improved methods for data collection and computer processing techniques for tabulation of findings, especially for dietary intake studies and for more precise correlation of dietary, clinical, biochemical, immunological, parasitic, anthropologic and anthropometric measurements. When the surveys of these six countries are completed the results will give representative findings of the nutritional status for the population of the region as a whole in addition to that of the six individual countries.

To date, two preliminary reports have been written as a result of the Central American surveys. The data for Guatemala and El Salvador are in the process of undergoing statistical analysis and at the present no preliminary tabulations enabling us to define the nutritional problems generally have been completed. Thus, the preliminary tabulations for Nicaragua and Costa Rica can only be presented at this time.

The nutritional survey of the Republic of Nicaragua was conducted during the months of January to March 1966. For this purpose, a trained team composed of Nicaraguan, Costa Rican, OIR, and INCAP personnel studies the nutritional conditions of the Nicaraguan population by means of appropriate clinical, anthropometric, dietary, biochemical and immunological examinations. The social, economic, environmental, agricultural and parasitological factors which may affect the nutritional

conditions were also studied. The work was carried out with a representative sample drawn from 30 communities throughout the country and four military establishments. In addition, the food production and technology and the agricultural economy aspects of the survey were carried out at the national level. The findings which are presented are only preliminary tabulations and must be considered such; final conclusions and recommendations must await the completion of detailed statistical analyses.

First of all, it is important to note that the classical manifestations of nutritional deficiencies such as beriberi, pellagra, scurvy, kwashiorkor, and marasmus were not found in the population examined. However, somewhat inadequate dietary intakes, some low biochemical levels, as well as minor clinical manifestations were observed. The most important problems of nutritional significance as determined at the local level can be summarized as follows: (1) iodine lack leading to high frequency of endemic goiter (the prevalence was usually in the range of 20 to 50 percent of the subjects examined); (2) vitamin A lack as suggested by dietary and biochemical values (ranging from 6 to 69 percent of the recommended amounts); (3) riboflavin deficit as suggested by dietary, biochemical and clinical findings; (4) thiamine deficiency as suggested by low thiamine urinary excretion, but the calculated thiamine intake does not appear to be low. (Cooking losses may be revealed upon completion of the analyses of food composites); (5) protein intake seems to be marginal, but can be insufficient in areas where the proportion of dietary proteins of animal origin was low in relation to total proteins and therefore the biological value of the total protein is probably low; (6) a high prevalence of caries and periodontal disease (there was a striking lack of accessibility of the population to oral care in the health centers); (7) a high prevalence of Entamoeba histolytica; (8) a deficiency of general public health measures and lack of attention to specific factors as revealed by this survey, which could contribute to the solution of some of the general health problems which are related to nutrition.

The studies indicate an insufficient total availability and consumption of some food items, particularly those that are adequate and inexpensive sources of Vitamin A, such as green and yellow vegetables and fruits; and those that are adequate dietary sources of protein and other essential nutrients.

Immediate action is recommended for correcting iodine and Vitamin A deficiency. Although the other nutritional problems do not seem to be as serious from this preliminary analysis of the data, they could become more serious if the present trends of population growth and food production continue. Of special interest and value is the great potential for increasing the amount and quality of food production in Nicaragua.

It is immediately apparent that population growth has been progressively faster than agricultural and cattle production. Although at present the nutritional status of the population is not seriously inadequate, the balance is precarious and action should be taken to increase the availability of some critical foods. When comparing food supply with food demand it was found that greater attention should be given to meats, beans, vegetables, fruits, potatoes, rice and wheat where availability at the national level is not enough for the present needs of the total population.

A study of food production, processing, and marketing facilities was carried out in all departments of Nicaragua with the exception of Rio San Juan. These general comments are based upon observation, interviews, and data: (1) food supplies at markets and rural home sites appeared to be adequate and well balanced, with few exceptions; (2) there is an apparent need for development of preservation industries for vegetables, meats, and seafoods; (3) standards of identity, quality standards, and quality control procedures are urgently needed for the dairy industry; (4) maintenance of public health requires establishment of basic sanitation codes for the food industries; (5) governmental and private developmental agencies need to initiate and support programs designed to utilize Nicaragua's vast food production potential.

The data from the modified glucose tolerance tests and electrocardiograms, the wrist X-rays, the Harvard Step Tests, the anthropometric measurements, and the immunological survey are not available at the present time.

The team was pleased to notice that in Nicaragua there is a general attitude towards development, taking into account the internal demands of the national population. It was also found that the amount of food products among imports is increasing. As soon as the statistical analysis is completed for the survey, we will be able to define more clearly the nutritional problems present in the country and present our recommendations more satisfactorily. Without the cooperation we received from the Government of the Republic of Nicaragua, and especialy its Ministries of Health, Agriculture and the National Guard on this project, the work could not have been carried out.

The nutritional survey of rural populations in Costa Rica was conducted during May and June 1966. The trained team of health related personnel conducting this survey were from Costa Rica, Honduras, OIR and INCAP. Studies of individuals, families and communities were carried out in a representative sample of 30 rural communities throughout the country and one police establishment. An additional three communities were included from towns in the International Center for Medical Research

and Training (ICMRT) program to complement studies being undertaken under that project. The findings that are presented are preliminary conclusions reached from some of the basic observations available at the close of the survey, and from approximately two-thirds of the locations and population examined.

Here again, as in Nicaragua, the frank classical manifestations of nutritional deficiencies such as beriberi, pellagra, scurvy and avitaminosis A were not found. However, about 20 percent of the population show clear-cut evidence of iodine deficiency through the presence of endemic goiter. Immediate action is recommended to increase the iodine intake by means of a national sale iodization program.

The most important problems of nutritional significance as determined at the local level can be summarized as follows: (1) a high prevalence of endemic goiter due to iodine deficiency in most areas of the country (endemic goiter was found in 1/5 of all people examined); (2) in the pre-school population a small but important segment revealed protein-calorie malnutrition; (3) Vitamin A deficiency as suggested by dietary, clinical and biochemical values, especially in pre-school children; (4) thiamine deficiency is suggested by low values of thiamine urinary excretion but not confirmed by dietary or clinical findings. Further investigation of this aspect is necessary; (5) hematological values suggest a low prevalence of anemia. The cases found seem to be due mostly to iron deficiency; (6) a lower prevalence of periodontal diseases and a higher DMF index (decayed-missing-filled) than in the other Central American countries already surveyed. Eight to twelve percent of the population is edentulous, due in large part to the influence of empirical dentists; (7) due to a very high population increase, food production is lagging behin , especially in regard to animal protein, fruits and vegetables; (8) a high prevalence (about 75%) of intestinal helminths. (Based only on data of seven locations in the "meseta central")

The sample studied consisted of rural populations entirely because cities with more than 25,000 inhabitants will be studied at a later date when INCAP-OIR returns to Costa Rica for a special study of very urban communities. In surveying food availability versus food demand it was found that Costa Rica has one of the highest rates of population growth in the world (above 4 percent yearly). This explains a trend towards a lower availability of basic foods per person. Thus, carbohydrate and meat per capita availability has dropped. Other items found deficient in production are eggs, vegetables, fruit, roots, wheat, and edible oils. The Costa Rican people are concerned about the situation of the population growth and are interested in raising productivity. In general, the situation is satisfactory but it is necessary to increase production in order to prevent further deterioration of the critical foods.

Particular gratitude has to be expressed for the cooperation in this endeavor to the Government of the Republic of Costa Rica and especially the Ministries of Health, Agriculture and Education. Without the assistance of the people of Costa Rica the work would not have been possible.

As has been mentioned earlier, the findings for Nicaragua and Costa Rica are only preliminary tabulations. Once the surveys of all six of the Central American countries have been completed and the statistical data finalized, the results will give representative findings of the nutritional status for the population of the region as a whole, in addition to that of the six individual countries.

Now that we have reviewed the findings of the surveys that have been conducted of human populations in both Latin America and Central America, it is time for the individual governments of the countries concerned to meet the challenge. The battle against malnutrition must be won. The nutritionists, dietitians, physicians, biochemists, agronomists, and economists who conduct these world wide nutritional surveys can only present their findings and recommendations. It is up to your governments to see that these recommendations bring results. The key word in your programs must be "action". For malnutrition is the silent, lethal enemy who will overcome its passive foes. As President Johnson has said: "We ask you here, and every nation, to join us in a worldwide war against hunger--a war against the malnutrition that afflicts over half the earth's people. It is only when we have won that war, against the quiet enemy of humanity, that we can truly call ourselves modern and peaceful men."

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DISCUSION

Dr. Behar: Thank you very much Dr. Schaefer. We will ask first the two discussants to make short comments on any topic that they would like to in relation to Dr. Schaefers presentation or related to the general program to the situation of the human nutrition of the population in the area and then we will open the subject for discussion.

Dr. Alvarez Zamora: I would like to comment a little more the three important things regarding the feeding of the pre-school child in the Central American countries made in a statement by Dr. Schaefer. First, according with the data collected by INCAP, the intake of protein and calories in the Central American countries as a family group or as a family unit is relatively adequate but breaking down within the family we find that the pre-school child will get the smallest share although his requirements in protein are two or three times more per kilo than the adult. This small share of the proteins available and consumed by the family is due in part to wrong believes, attitudes, habits, etc. of the mother. Always she is limiting the food intake of the children. For instance, protein rich foods like meat or eggs are not given to the children although if they would give a little part of the egg or milk during the day the value of the other proteins would be much more and would be better utilized. Frequently this practice is based on previous experience, for example, if milk is used and due to its contamination the children will develop diarrhea and immediately the mother will blame the milk and will cut the milk and will give no more. The second thing is that when the child gets fever or gets some diahrreal disease the mother immediately puts him on longer periods of fasting and with this will begin the vicious

circle of nutrition and infection. Sometimes not only the mother but even we, doctors, put the children in longer fasting periods than required. I am sure that these two important things could be modified by education of the mothers, by mass education of the population and in that way, I am sure that the applied nutrition programs in Central America will make a lot to modify this situation in the Central American countries.

Dr. Behar : Thank you Dr. Alvarez. Dr. Braham, would you like to add anything to the discussion?

Dr. Braham: I would like to add something to supplement what Dr. Schaefer mentioned previously with respect to Incaparina. I think that we should concentrate on this important subject in reference to the diets that are eaten in the Central American area. Not supplementation in a big way but supplementation with small quantities of the protein that will contribute with the nutrients to balance a diet as the ones that we find in Central America.
For example, we have done in the laboratory at INCAP, experiments with rats, in which we have taken the diet as it is consumed in the field and we have supplemented it with either small quantities of Incaparina or milk or some other source of protein. In all cases we get responses that are extraordinary in the sense that the Protein Efficiency Ratio to almost double that the unsupplemented diet. The other point that I would like to mention is with respect to the quality control laboratory. As Doctor Schaefer mentioned it, it is really a must. We must have this kind of outfit in Central America if we are going to have the storage and production of food for adequate human consumption. Dr. Schaefer talked about this in the sense of foods only. I would like to extrapolate it to the animal industry. Evidently we have to increase animal industry since our main of nutrients is animal protein. However, as you know, in Central America feeds have not been standardized. Perhaps I am thinking only in Guatemala, but we need this uality control which is essential for human foods and is also needed for animal food, in order to have the uniform economic production that will increase meat, eggs and milk for the hu an population.

Dr. Behar: Thank you Dr. Braham. I would like to expand a little more the last point that Dr. Braham made, which I think is a very important one and will be of interest to many of the persons participating in this discussion. We get almost constantly at Incap, personal requests from animal production men asking us to help them in analysing the feeds which are available commercially. The problem

is that they cannot rely, because there is no legislation, on what the producer says the feeds contain. And they have had some bad experiences. They say that sometimes they obtain adequate results and sometimes the results are bad, with theoretically the same stuff, which undoubtedly is not controled in terms of composition, nutritive value, etc. and as happens with human food, any producer is allowed to say that it contains so much protein, so much vitamins, etc. as they wish and nobody will question it. This is beginning to be a very serious problem in animal production and of course also in human foods as the industry develops. There are many other interesting points that have been made in the presentation by Dr. Schaefer and the discussions but I would ask the other members of the panel to make their questions and comments at this time,

Lic. Ramírez: I would like to comment on the statement regarding the adequacy of the diet for the whole family and within the family made by Dr. Alvarez Zamora, a question that arises is that the problem would not be as serious if the matter could be solved by education for a better distribution of the available foods according to the needs. I think that in addition to this the surveys point out that there is an insufficient amount of calories, proteins and other elements for the total family and in the investigations made by us we concluded that a family of five persons would require about $1.50 - 2.00 a day for an adequate diet and that would mean that the family income could come to about $700 per year and the story of the income distribution is different in Central America. That would also cover the fact that there is inequal income distribution, so the two factors of insufficient availability agravated by inadequate distribution should be considered. Thank you.

Dr. Behar: Dr. Schaefer.

Dr. Schaefer: As I stated, it was a broad term assessment that by and large the diets were adequate for a family, we certainly have seen evidence that there is a percentage, whenever we say that the average is adequate there's a fair percentage below this level that are not getting what we consider is adequate. So there is evidence that there's a deficit in calories, protein, etc. With this I agree, but by and large I think that what you said that education for proper distrbution and use, I'm talking of foods that they are producing or could produce a little more or would make a tremendous contribution. By indication we could solve a tremendous amount of the problems. As far as the amount of money requiered and spent in food, there are two things that we should keep in mind. One is that the rural population obviously doesn't make $700.00 per capita but they do raise food and this usually is not considered as income but is subsistence farming.

I think that they have an opportunity of supplementing their salaries for the purchase of food and one of the major problems is that high cost food items are given to their dogs, and this infant from the weaning period, or school age, or even a little older, does not get his fair share or his priority needs of food items. I agree with you, I'm glad you brought up this point.

Dr. Behar: Dr. Bates

Dr. Bates: I have a question for Dr. Schaefer. Over the past twenty years ICND has conducted a great number of various surveys in countries of the world. I am somewhat familiar with reports of these surveys. In each one there's a list of recommendations that cover pretty well the situation in a specific country. Now, the question I have is: Are there samples of implementation of these recommendations in a general rule, not specifically with respect to one country? Because I think that many of the points that we are discussing today and the recommendations that will probably come from this meeting are quite similar to those that exist in the ICN&D reports.

Dr. Schaefer: One thing that has kept me in this business has been the tremendous opportunity of seeing the progress that has occurred in countries since the time we started our survey. I can take two: Iran and Pakistan. The word nutrition wasn't even defined in their language. Now, learning nutrition, improvement, and health, does take time. You can not expect to improve nutrition in a two year term, like you go out and lay a brick.

EL MEJORAMIENTO DEL VALOR NUTRITIVO Y EL RENDIMIENTO DE LOS CULTIVOS ALIMENTICIOS BASICOS:

CEREALES

Dr. J. H. Lonnquist

It's a pleasure for me to have been invited to participate in this panel. We know that food is important to the many residents of the world and I suppose I get like many others who made their presentations, eating a little of the statistics, the food prices as we call them, and I am not going to go over these statistics which are well known to everyone here, except to point out the fact that the agriculturists have a tremendous job in their hands not only in catching up but in trying to stay ahead of the percentage growth in population numbers. If it's true what they say, that almost half of the $3\frac{1}{2}$ billion people that live on the face of the earth today go hungry to bed every day, and these numbers are increasing every day. I don't think that the possibilities of making substantial progress in alleviating the food shortage seem to be encouraging. I think we have the knowledge and in most cases the materials, but what we need badly is action, immediate action. We know that the majority of the world's population today depend on plants to get their food and their source of protein and we also know that protein from animal sources is much better, or has a much better nutritional value than that of plants. Nevertheless, the protein from plants is cheaper because the production costs are cheaper.

The cereal with which I am most familiar with is corn (maize) which has an extremely wide area of adaptation and is used as a basic food crop in many areas of the world today. In Latin America 85% of the maize produced is used directly as a source of human food and of course it is known that in some areas 70% of the protein that they obtain is from the maize that they eat. This is really not so good because as most of us know, maize has an unbalanced protein content biologically and people who rely entirely on maize for their protein supply are going to be malnourished. I might also add that along with this poor protein thing, one thing that concerns me is that the yield of maize in many areas is extremely low, much lower than it should be. I think that now the improvement in productivity, as well as the improvement of protein quality of maize, are within the realm of possibility because of recent findings, present knowledge and the material that we have, and I don't think that it requires a lot

of time to make these improvements before the people. I know that whenever we talk about improved maize production we always think of hybrid corn and there's no question but that it has contributed tremendously in the United States for example, in improving feed production, but it has also contributed substantially in other areas of the world. In the United States I think that one of the reasons why we had such a tremendous improvement in productivity with hybrid maize is that we had a tremendous amount of effort put in breeding by the raisers. When they were shown to be possible, and we had a wealth of trained technicians who could take the current lines that were involved and produce the hybrid seed on the market for sale to farmers. We also had an enlightened farming populace who could understand the requirements in utilizing this new seed and putting all this things together it was found to be successful.

There has been a tremendous increase in the use of commercial fertilizers and all these things put together are part of the pattern of production of corn increase in the U. S. A. To an extent that these other practices have been adopted in many other areas and an improvement in productivity has been obtained. In other areas there have also been attempts to increase the production of maize through the development of hybrids and these have met with a variable degree of success. When they have not been quite successful we can look around and find pretty good reasons for this. One is that there has been a lack of trained personnel and get ready for market the hybrid seed that was developed, and then we had the system of land tenure in those agricultural units that were really not suitable to large scale farming methods where hybrid corn was peculiarly adopted. In many cases there were agricultural extension programs that were necessary and this was very hard to get, there's a matter of economics involved. And wherever these have been in short supply, the advantages of hybrid corn have not been realized. One of the disadvantages of hybrid corn is the technology involved in developing hybrids and it has always been a point with me, at least, that when people are hungry that they should not and cannot be expected to wait for 15 years for some plant breeder to develop corn hybrids. And it's really unfortunate that so many young scientists who were trained on hybrid corn and others who have similarly indoctrinated have gone into many areas and advised on the development of corn hybrids to the conveyed exclusion of simpler and much more rapid ways of corn improvement and it has been known recently that corn breeders were forced to reappraise one of the old systems that man has known: simply mass selection, which requires improvement and very little technique except to know what they were doing and be able

to practice seed husbandry, but the situation has changed a little bit and now we have people looking into this system of corn improvement.

We started a program of mass selection in 1955 and continuing this program for 9 years. Now, we have 9 years in which the regression of grain in yield for generation of selection is $2\frac{1}{2}\%$ per year and the thing I need to reemphasize is that each year when the seed is selected it is immediately available for distribution to farmers, either through their neighbors or through the local market; it depends where they happen to be. They don't have to wait to utilize the improvement, it starts immediately. Some of the works with the mass selection have indicated that maybe some of the components in yield might be of value.

It is rather interesting to note that we have been able to realize a yield of 8% per year in improvement in production with the use of this type of mass selection, so that there is no question that we can improve production substantially with a minimum amount of effort with a continuing program.

EL MEJORAMIENTO DEL VALOR NUTRITIVO Y EL RENDIMIENTO DE LOS CULTIVOS ALIMENTICIOS BASICOS: CEREALES

Dr. J. H. Lonnquist

In many areas of the world today the food crisis is growing in immensity and importance as population numbers continue to rise and the supply of arable land decreases. The current food crisis involves not only insufficient amount (starvation) but also inadequate protein supplies (malnutrition). In order to supply the world's food needs, therefore, the agriculturists must somehow obtain higher yields of higher quality crops.

There are nearly 3.5 billion people in the world today half of whom do not have enough to eat. It is estimated on the basis of our present growth rate that by the year 2000, there may be 5 billion people in the world. Since there are less than 4 billion acres of arable land, much of which is not very productive because of its inherent properties and/or unfavorable climate, the future is grim, indeed.

Approximately two thirds of the Latin American countries are diet-deficient and the per capita food production is falling behind in several countries. It is apparent that population control of some kind as well as increased food production are matters of extreme importance.

The effects of malnutrition are more serious than most people who are not close to the situation realize. Inadequate food quality can result not only in the crippling of affected individuals but protein malnutrition in children has been suspected of causing mental retardation, leaving those having improper diets permanently affected. Malnutrition appears to be more common in children probably due to their greater needs for growth and body maintenance. A child's stomach does not require a large quantity of food to satisfy hunger, but a starving body (malnutrition) puts a call for more and more substance into the stomach so that if the growing body's needs are not met we have the picture of a child with a distended abdominal region while the body itself is shriveled and badly crippled. These individuals will never be able to attain normal mental and physical maturity and thereby enjoy normal social behaviour. The mortality of children suffering from chronic malnutrition is high. One thus, gets the false impression that adults are less afflicted, which is not so. Those surviving to adulthood are those who somehow were not so severely starved in youth. The food problem is so serious that the

world can ill afford to neglect it. The world's most compelling need is food production of adequate nutritional quality. As mentioned earlier, not only must the population explosion be contained but world food production must be doubled and redoubled on our cultivated lands.

Population control and food production problems require the aid of an educated public for their solution. Health and education go hand in hand. Thus we are faced with the enigma of trying to educate hungry, malnourished people so that they can learn to help themselves. Trying to educate hungry children is almost hopeless and teaching hungry people to help themselves is likewise extremely difficult. As the Roman philosopher, Seneca, said more than 2000 years ago, "A hungry people listens not to reason, nor cares for reason, nor is bent by any prayers." With the size of the world reduced so drastically by recent advances in transportation and communication, it is evident that hunger in any part of the world presents a potential danger to all other parts. Recognition of this concept is reflected in the attempts recently to send surplus foods from the "have" areas to the "have not" areas where people are starving. This is a temporary stopgap measure at best. It will never solve the problem.

The possibilities of making substantial progress in alleviating the food problem seem encouraging. I believe we have the knowledge and the materials. What is needed is concerted action. The majority of the world's population today, depends upon plants for their protein needs. We are all aware of the fact that protein from animal sources has a better nutritional value than that from plant sources. However, the lower cost of cereal protein due to lower production costs as compared with animals make it more readily available to more people. As world population increases, the importance of cereal proteins is likely to increase.

Maize is a cereal of extremely wide adaptation and is used as a basic food crop in many areas of the world. In Latin America generally, as much as 85% of the maize produced is used directly for human food and it has been reported that up to 70% of the average person's protein is obtained from maize in some areas. The fact that most races of maize contain a biologically unbalanced protein complex leads to malnutrition where the crop is relied upon as the primary source of food. In addition to its poor protein quality, the yield of maize in many areas where it is grown has generally been low. Usually the development of new genetic strains having higher yield potential is a long slow process. However, the improvement of productivity as well as the improvement of protein quality in maize need not require excessive time. Both can be accomplished fairly rapidly with relatively little effort.

The possibilities for improving production of maize wherever it is adapted are great. Improved genetic yield potential and husbandry are needed. Improved production of maize is frequently associated with development of hybrid maize. The contribution of this development to increased production in the cornbelt of the U. S. A. and elsewhere has been tremendous. In the U. S. A. especially, the success of hybrid maize was due to 1) a tremendous amount of effort devoted to breeding and development; 2) the presence of people with adequate technical training; and 3) an enlightened agricultural populace who were quick to understand the implications and the requirements needed for successful utilization of this type of seed. Subsequent developments in agricultural equipment were soon adding to a greater efficiency of production with the use of hybrid maize. Cultural practices were changed including, a vast increase in the use of commercial fertilizers. All of these changes contributed to greater and more efficient production of this crop.

Attempts have been made to improve the productive potential of maize in other areas of the world through hybrid development with varied but generally limited success. The difficulties involved have included 1) the lack of trained personnel able to produce and market hybrids once developed; 2) agricultural units and practices unsuited to large scale farming; 3) lack of agricultural extension programs; and 4) economics. The development of suitable maize hybrids is perhaps the easiest part of their successful adoption and utilization in a new area. In an area where people are already hungry, a tremendous disadvantage of hybrid maize has been the time required in developing superior hybrids. People cannot and should not be expected to wait patiently for 10-15 years for a new development while they continue in hunger. Unfortunately, too many young scientists have been taught hybrid maize principles and together with others have advised programs in this line of endeavor while more useful and simpler procedures were ignored.

Only in recent years have maize breeders been shown that mass selection could be extremely effective in improving productivity of maize varieties. The improvement effected is an immediate and a continuing process. No special equipment is necessary and no special group of technicians are needed to handle and increase the seed. A good technician working with a farmer can do the selection each year leaving the farmer with the remaining portion of the seed produced for sale or trade to his neighbors or in the local market place. Each year a rather significant improvement in productivity potential will be had and no delay is involved in getting it to the farms. The only principle involved in successfully carrying out a mass selection program for yield is that of good husbandry. Adequate control of

environmental effects through equal competition among the plants in an isolated selection block is required so that differences noted among plants in productivity are due primarily to differences in genetic endowment.

Mass selection based upon yield per plant has been carried out at the Nebraska Experiment Station for a number of years, starting in 1955. The results obtained where the selected population has been compared with the original variety, Hays Golden reflect continued improvement. Over a nine year period, the regression of gain in yield on generation of selection is 2.5% per year. Quantitative genetic studies underway indicate the prevalence of sufficient genetic variability for expected continued progress from this type of selection.

Other work on mass selection at Nebraska gives evidence of even more rapid gains possible through certain modifications of the procedure. One modification represents a simplification of the above mentioned procedure. This is selection for prolificacy, a component of yield. Over 4 generations of selection the gain in yield has been about 8% per generation. In several other localities in Central and South America the rate of gain has been greater than that obtained at Nebraska. There is little doubt that the system merits extensive use wherever maize is grown.

The improvement in productivity of the crop through breeding may frequently result in motivating the agriculturist to further improve on his production by use of better cultural practices. Cases have been observed where a new adapted hybrid strain was grown which stimulated the use of other cultural improvements so that a 200-300% increase in yield resulted. Under comparable, good, cultural conditions, however, the hybrid strain exhibited no more than 30-50% higher yield than the local varieties. This then, means that something is needed to stimulate farmers into using the best known technics in their farming operations. The possibilities are tremendous but the realization of full potential will be a long slow process. It is so everywhere.

Improvement in production of maize per se is a worthwhile goal but it is not enough. Especially so when improvement of protein quality is now a reality. The possibility of improving the protein quality in maize through breeding has been studied for many years but analytical costs prohibited intensive efforts in this area even though it appeared to offer some promise of success. Some 30 years ago a mutant endosperm gene was found in maize which was readily followed in segregating ears of the dent varieties because of its floury nature.

It was named opaque-2 being the second mutant of this general type found. The mutant, like hundreds of others, was maintained by geneticists as a routine matter. With the advent of improved methods for separating maize proteins, Dr. Mertz of Purdue University became interested in searching for maize with lower zein and higher lysine content. He together with his colleagues began a study of maize stocks from various sources including a series of genetic stocks involving known endosperm mutants. A rather surprising result was the finding of a substantially greater percentage of lysine in the opaque-2 mutant stock as compared with normal maize. This was the first demonstration of a large, genetically oriented, change in the protein composition of the maize endosperm. The possible value of such a change in human and animal nutrition was recognized immediately. Further work by the group at Purdue bore out the initial observation and in addition revealed a second mutant, floury-2, as being similar in lysine and perhaps superior in other respects. The flour-2 mutant differs from normal maize in that it shows increases in lysine, tryptophane and methionine, all essential amino acids. The fact that the lysine content in floury-2 appears to have a different biochemical basis than that of opaque-2 has raised the question as to whether both mutants combined may result in even higher amounts of lysine. Such a possibility is under study.

Feeding trials using monogastric animals, rats and swine, have been carried out. The studies on the nutritional value of opaque-2 maize using young rats and swine have shown these animals to gain three times as rapidly as those fed normal maize. As a matter of fact, the opaque-2 maize was equivalent to normal maize plus the necessary protein supplements to provide a balanced diet.

Experiments have also been carried out here in Guatemala where children have been fed opaque-2 maize with the disclosure that the protein value was equivalent to that of skim milk. Such findings are a cause for rejoicing. Rapid transfer of these mutants should be made into maize varieties everywhere.

It is believed by some, that the development of high lysine maize is possibly the most significant discovery in agriculture since the development of hybrid maize some 40 years ago. The implications of high lysine maize in the feeding of livestock have resulted in a concerted effort on the part of maize breeders in the U. S. A. to incorporate the mutant into parent lines of commercially grown hybrids. As the use of these new hybrids begins to enter the picture in agricultural production the concept of rations fed to swine and poultry for the production of meat will undergo a drastic change.

What is the outlook for utilizing these new mutants in the improvement of maize in areas where the crop is an important food source for humans? The introduction of the mutants into maize populations undergoing selection for increased productivity is simple. Inasmuch as the mutants can be followed easily in some types of maize, the development of higher yielding strains having an adequate level of essential amino acids will be no problem. Where flint or flour endosperm types are important in an area problems will arise. If flint types are preferred, the people may be reluctant to change to a floury type endosperm regardless of the nutritional qualities of the crop. It is possible that breeders may be able to incorporate the high-lysine mutants and effect selection so that endosperm types are not greatly altered. This remains to be tried. Where flour types are already being utilized, the incorporation of high-lysine mutants will require the use of biochemical analyses to detect the presence of these mutants in selected stocks as visual detection will not be possible. The transfer of the mutants through use of translocation stocks is also a possibility. It appears now that high-lysine maize with greater yield potential can be developed as a means of alleviating hunger and malnutrition wherever maize is grown and used for food. We have the materials and the information needed to do the job. We must proceed with the task as rapidly as possible. We can and we must start now. There is no reason why we should not expect to find similar genetic changes in our other important cereals. A waxy mutant first found in maize was subsequently found in sorghum, barley and rice. The search is now underway in sorghum and wheat and possibly other grain crops for protein mutants such as opaque-2 found in maize. Technics available for analysis of grain for amino acid content will aid in the search. It is only a matter of time. Meanwhile extensive utilization of what we have in maize must be made.

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LEGUMINOSAS

Dr. M. W. Adams

First, let me refer to some of the productive and genetic characteristics of beans and other edible legumes. With respect first of all to the varieties, that is the diversity of edible legumes you might look at table 1, (he gave some tables to each of the persons present), which I have taken again from the FAO publication "Important Legumes in Human Nutrition". On the back cover are directions indicating how you might obtain a copy for yourself. In Table 1 are listed 18 of these legumes, which throughout the world are used to a very large extent in human diets. Given are the Latin and common names, the areas of cultivation, and some notes and comments. Now, may I ask you to turn with me to page 3. And at the very bottom of your page you will see Phaseolus vulgaris, this is the bean with which we work in Michigan and the bean thatis dominant in Central America. Note what is said here about its area of adaptation: "grown throughout the world, but particularly in the Americas". And in the next column: "it is an anual, maturing period 2-5 months. Susceptible to high temperatures, frost and drought. Includes many varieties, varying in color and size. More productive in cool climates where plant matures slowly." The gentleman who composed this particular table is paying service here to a concept of ecology that all plant breeders must bear in mind constantly in breeding and research work. And we in Michigan, where we produce about 35% to 40% of all the beans produced annually in the United States, are very conscius of this. Most legume crop varieties are grown in very specialized regions, which we recognize as ecologic sites. Now they are not fully homogenous sites by any means, but certain characteristics of the climate and soils of the area are important in relation to the distribution and the successful growth of any crop, in this case, beans primarily.

Now, we may say of edible legumes that they are high in protein, that they are relatively high in carbohydrate, that they may be either high or low in fat and they may be variable with respect to some of the other things like vitamins and anti-growth factors.

I will refer now to another table, Table 2 in this collection. Not shown in this table are such things as the antimetabolites and the antigrowth factors of the legumes. I am going to pass over what I have written relative to the chemical composition of the legumes. I will be coming back to some of it a little later in another context. What I would like to say here is that for many nutritional characteristics, considering both the favorable and the unfavorable components, there is evidence to plant breeders that genetic variation exists. Certainly for the antimetabolites that we are now identifying, genetic variation exists for them. We're not so sure for protein components at this time, but if corn were taken as an example, we might infer that possibly genetic variability exists for distinct amino acids. As yet, for the evidence of this particular variability, is very thin. I am not mentioning anything about minerals, but I would like, since I am interested in minerals, and mineral intake and mineral transport in legumes, we are finding that considerable genetic variability exists here. Not in any particular collection of varieties that are strange. That is, you might have a collection which contains very little variability, but let me assure you that variability does exist if you put your finger up on the right variety.

Now, with respect to which effect nutritive vitamin yields, I've listed a number of these for my own purposes. I've classified these as environmental to begin with. Environment versus genetics as you will see. I want to point out again that variability does exist in minerals, mineral composition, total protein, and some other components in response to changes in fertility matter. What I'd like to say here is that the usual effect of mineral fertilization is to greatly increase the quantity of plant product with relatively minor effects upon quality. Except in cases where there are known mineral deficiencies and a plant must have, let us say, zinc supplied to it, when it is not available in the soil. So mineral fertilization does not necessarily mean an improvement in quality, unless there has been a particular deficiency. Furthermore, with respect to protein, there is very little change in the proportion of amino acids. The values of one with respect to others. Of these we don't know for sure that we can induce with any particular fertilization scheme. So I am forced to conclude with respect to mineral fertilization that there are different responses to fertilizers, and this is an important and I hope, productive fear for research in the future, that we must not look to this as a means of improving quality. Now, there is one very important exception to this point that I'm just stating. And I would like to introduce it at this time. The research is always moving ahead, we hope; but

particularly in the area of biochemical synthesis of the proper plant and living - Research is the delineating pathways and mechanisms, control substances, and there is the possibility that something may happen within the next years that would give a light to something I already said. That is that there is little to be done right now with fertilizers or with new substances or if any other kind of technological magic to change the original value of the eatable legumes. Let me go next to the climate and the weather. I've put on the board something that we may call the biological yield concept.

$$P = N.A.R. \times L.A.I = x.y.z : y$$

From left to right, let me first state that the far right is the yield that we are after. The large P stands for the growth period. So many days of function activity, maturity, agronomists call this. Then, within the bracket N.A.R. stands for not assimilating rate. This is multiplied by L.A.I. which is the leaf area index. L.A.I. is the leaf area, the whole leaf area over a given, let us say, a square meter of land, land surface in the field. In most of the crops this will vary from about 2 or 3 to even 8 or 9. That is it may be 2 or 3 or 5 or 9 times as much leaf surface, this plant through the elements as there is ground on which the plant is growing. But knowing how a plant behaves with respect to these things helps us fit a given plant to a given ecologic site. And so the agronomist endeavors are to make this marriage of the environment and of the genotype so that an optimum value of yield will result. Now, here, what's in the bracket represents the of dry material in an area to the reproductive system in these. This is the number of parts that I have here by simply writing the number x, the number of seed per part represented by the symbol y, and the seed side or seed weight denoted by the symbol z. These three things, x, y, and z, are not in themselves capable of very much production on their own part. They simply store, by the most part in the legumes, they simply store what is fed into them from the leaf and stem petty old system. Now, there are some exceptions to this, but I won't trouble you with them at this time. There are some things with respect to this diagram that allow us to hang on to it some of the cultural, some of the ecologic factors, that affect crop production. For example, the lower part is the maximum rate of very short days, low and high temperatures, soil moisture. Another interesting phenomenon turns out to be important here, and that is the relationship between N.A.R. and L.A.I. As L.A.I. gets larger and larger, and we can do this by adjusting the planting rate; for example, it has depressing effect on the value of N.A.R. So there is an internal compensatory relationship that might exist between N.A.R. and L.A.I. Just to make the point slightly more

clear, as we get larger and larger amounts of L.A.I., there occurs so the light intensity i. decreased, and so N.A.R. goes down. So there is this internal balance. Again this implies we must find an optimum with respect to the variety we choose and its ecologic situation. Furthermore, x, y, and z, also show internal compensation in the legumes and in fact, in many other crops as well. A selection that has a large number of parts, for example, can't at the same time have a large number of seeds per part and the large seed's By collecting, we've done some selecting work with an interesting population between Michigan and Colombia, the Michigan bean and the Colombian bean. Whenever we select for down we go for the number of seeds per part. If we go for low number of parts, it's more easily obtainable the large number of seeds per part. So the feeder had to balance out the subtle behavior of the plant with which he is working. I have some interesting ideas to read, which I'm going to pass over here, and I say I'm not really Another, what I consider to be a summarizing statement, concerning the environment on there is little evidence that these That is, any variation which can be regarded as significant from a nutritional standpoint. Now let me ask you to turn again to the series of tables, and table 3 is the first one to which I would like to direct your attention. Here we have 5 varieties of native beans all produced in Michigan State University by the breeders there and all of them are similar. They belong to the class of native beans, small round white bean, happen to be the best bean produced. I'd say this with great pride. Look at the dull monotonous contents of this . Only with respect to protein there is an interesting difference. Let's compare it with our standard which runs from about 24, 25 or 26%. We had absolutely no idea at the time we produced these varieties that they had appreciable protein values.

Let us turn to the next table, look at some of these varieties again. Now, with respect to their amino acid contents. Again, dull and monotonous. These also belong to the same class, were grown in the same area, and if I happened to depend on the table, you could not tell one variety from another. Note that the methionine level is less than 1% of the nitrogen in proteins found in methionine. I'm sure no plant breeder could start a breeding program with that very little variability in methionine content. I think that at this time I'll skip over Table 5, it shows feeding differences of these varieties. And again, not much difference. Now we look at a number of other varieties. The amino acids levels in a number of other varieties including from left to right, the Sanilac Again not very much difference. Referring to the methionine row,

most of them are about 1% of the nitrogen amount in protein associated with the methionine. Except for one exception, and this is a rarety, the first crop, 6.34 per cent. I should point out in passing that we don't need much for an opaque 2 or flowery 2 for lysine, we already have an amount of lysine in beans. Now, let me turn to methionine. Here is something that the biochemist has done, I haven't done it. They have rechecked our figures here is about 6 times as much methionine in this particular lot of beans as we already found in a lot of beans before. There is a story here, I'm not going to tell you all about it here, but the biochemists believe that this is a true value and it was in all samples of beans produced in a rather unusual way. We have to trace it down completely but it has to do with a combination application of the element manganese along with the growth regulator. Table 7 shows even a larger group of things. Great Northern, Pinto, Kidneys, Trag; here is a Central American bean; Algarrobo from Colombia. With respect to their amino acid composition, I might say that for example, the Algarrobo here, the Colombian bean, as from the preceding table, the Michelite bean, are very similar in their protein construct. But if you look at them economically, they are completely different. One is a one is a one has different responses to the environment; the other does not. One is a very large seed with moderate seed color, different flavors. Anything that I say economically, morphologically, production-wise is different about these two crops. Yet, their amino acid composition is very much the same. Well, Table 8 is the last one on which I'll refer. Again, let us look at the methionine column, which have different responses to zinc. The Sanilac without zinc, the Saginaw without zinc, Sanilac with zinc, the Saginaw without zinc. The Saginaw with the zinc as in comparison with the Saginaw without the zinc shows a significant rise in methionine level due to the application of this one element. The very last of the table, tryptophan, Sanilac without zinc, Sanilac with zinc. Again, a small but significant rise, due to zinc in this particular variety. We see here not a real striking thing, but nevertheless a genetic specific environmental fact of interacting, which leads us to suspect that if we look for such interactions, and we develop enough of these specific effects, like matter elements, perhaps like hormones as well, with a variety of types, perhaps we might come along with something that will be of value. Where are we to look for the genetic variability for the nutritional components in the if this sample is in any way typical. I think we need to look for the interactions that I have just mentioned. Of which I have given you only one example. The field of interactions can be very, very large. Take a very few factors at a very few levels and when you multiply these in terms of numbers of

combinations of such factors, such levels, you will find there are large numbers of things which we have not yet looked for. And we have not really exhausted the possibilities of searching for mutants. Without exaggerating, maybe a dozen or maybe at the most fifty strains, for their amino acid levels and we know that literally thousands of these things do exist. And so as a plant breeder I'm not dismayed by the lack of genetic variability. The did not know that they had the opaque 2 factor for a long time either. And so, I think that the plant breeders, like the farmers, should turn optimistic. and I'm an optimistic in this regard as well.

Thank you very much.

Documento presentado por el Dr. M. W. Adams

THE IMPROVEMENT OF NUTRITIONAL QUALITY AND YIELD OF EDIBLE LEGUMES

Introduction

The human cell is dependent for its proper functioning upon a continuous outside supply of nutrient molecules. The "Breath of Life" is no idle phrase, having nutritional significance as well as religeous. Water is a second "sine quo non" without which man would surely perish. The rest of the nutrient molecules, except ordinary salt and iodine, required by man can be supplied, directly or indirectly by plants.

The task of the agronomist, whether he is a cereal agronomist or a legume agronomist, is to seek to understand how this array of essential nutrient molecules is formed in the first place, and how they are affected by the genetic and environmental regulators that operate in and upon food plants.

My particular task here is to outline briefly with you the nutritional and production characteristics of edible legumes, so that we might more properly evaluate and use that which we do know, and mark out for future study those problems in legumes about which we know so little.

Characteristics of the edible legumes

Eighteen of the most widely cultivated legumes are listed in Table 1, taken from the F.A.O. (1964) publication entitled "Legumes in Human Nutrition". Table 2, from the same source, presents comparative figures on caloric values and the broad compositional factors important in nutrition, for certain cereals, legumes, and animal foods.

a. In general it may be said of legumes as a class that they are:

High in protein;
relatively high in carbohydrate;
either very low or rather high in oil;
variable but relatively high in minerals and certain vitamins and growth substances.

Now shown in the table are the presence of certain growth inhibitors and depressants in legumes, about which some details will be given later.

b. More specifically, though edible legume seeds are moderately proteinaceous, legume protein is too low in the amino-acids methionine and cystine to serve as the sole source of protein in the diets of either rats or people. (See Appendix 3 from the F.A.O. publication "Legumes in Human Nutrition").

Legume carbohydrates account for 55-60% of the seed weight, except in soya and peanut which are much lower. Their carbohydrates are in general well absorbed and utilized, though the dry beans of Phaseolus vulgaris and lunatus do contain some sugars such as stachyose which are non-metabolizable. The soya bean, however, is reported to contain a considerable proportion of carbohydrates such as galactans, pentoses and hemicelluloses which are poorly utilized.

Legume oils, in general, are rich in the essential fatty acids, the only deficiency being in amount, which is between 1-2 percent in the Phseolus beans and approximately 20 and 40 percent in soya and peanuts, respectively.

Legume seeds are low in carotene, variable in thiamin among species, low in riboflavin and ascorbic acid, a little better in tocopherol and pantothenic acid, and well supplied with folic acid. The green forage legumes may be quite high in the growth promoting coumesterol. Genetic differences between and within species have been noted in several cases.

On the other hand, both dry legume seeds and green vegetative portions are now known to possess various kinds of growth inhibitors. Among these are the trypsin inhibitors, the hem-agglutinating factors, Favism, Lathyrism, Aflatoxin, the heat-libile factor in navy beans, and several anti-metabolities, an example being the anti-niacin factor in alfalfa.

For at least some of these genetic control is known or implied.

Legumes are good sources of calcium and phosphorus and several of the minor elements. Genetic regulation of ion uptake and accumulation has been shown in several instances.

Factors affecting nutritive value and yield

a. Environmental

1. Soil fertility. Unquestionably, soils that are seriously deficient in any of the essential minerals will render

plants grown on such soils abnormal both physiologically and morphologically, and their chemical composition as well as yield will be grossly altered. Obviously, additions of needed mineral elements to the soil will be reflected in the mineral quality, and sometimes, protein quality of the plants growing thereon. But in soils of normal sufficiency and nutrient balance, the usual effect of mineral fertilization is to increase the quantity of plant product, with relatively minor effects on quality. This may be illustrated by the effects of sulfate additions to alfalfa in a nutrient solution culture. Large increases in growth were obtained as a result of sulfate additions to a sulfur-deficient solution, up to an adequate level (about 10 ppm in this case), and sulfur concentration in the plant continued to increase. The principal sulfur-containing amino acid, methionine, however, increased only at the threshold levels of sulfur and remained at a constant level thereafter.

Where nitrogen fertilization is practiced on soils of moderate fertility we have come to expect more total dry matter with higher overall protein content. This does not automatically mean higher quality, however, since the relative proportions of amino-acids are not appreciably altered. The array of different amino-acids comprising the protein of Phaseolus vulgaris is primarily determined by genotype, not by external forces.

There is an important exception to this generalization that might as well be introduced at this point. And that is that research in the fundamental genetic regulation of protein synthesis may lead to non-genetic means of altering the process in significant ways so as to cause treated cells to produce more or less of a given protein or class of proteins, perhaps of a single amino-acid, than untreated cells.

Appropriate mineral fertilization may improve the vitamin content of legumes - for example, iron on chloratic alfalfa and carotene as precursor to vitamin A.

Fertilization per se has very little effect upon the B-vitamins or vitamin C.

When the plant is growing normally and producing satisfactory yield, the vitamin content of its tissues will depend primarily upon the kind of plant and upon the weather.

2. Climate and Weather

In terms of the biological yield concept the controlling elements in climate and weather are temperature patterns, day length, insolation, and availability of moisture. These factors exert their effects on net assimilation rates (N.A.R.), and on leaf area index (LAI).

The lowest values of NAR are generally associated with short days, low light intensities, low daytime temperatures, and, of course, low levels of soil moisture.

Low values of NAR are frequently associated with large values of LAI, so that the net carbon fixation per square meter per day does not change much. In an experiment with sugar beets under various levels of water stress, the NAR remained about the same for all treatments, but leaf area increased with higher moisture, and this led to higher yields.

Values of relative growth rate, the product of NAR x LAI, are found to be higher in tropical and subtropical regions than in temperate zones, a result attributed to higher temperatures and higher insolation.

However, LAI is increased to a greater extent than NAR. The narrow range of NAR values found in widely separated localities may be explained in part by the fact that the amount of light received per 24 hours is about the same in the tropics, the temperate zone, and the arctic regions, during the growing seasons.

It may also be a reflection of the fact that all plants, whatever the location so long as conditions are favorable for growth, depend on the same photo chemical reactions of CO_2 reduction. One of the gross effects of high temperature and moisture stress upon field beans is to cause extensive blossom drop, with consequent poor seed set; this may be followed by a second period of blossoming or even a third. In the navy bean yields are low because of low pod set and few seeds per pod.

In some cases, pod abscission can be partially prevented through the spray application of phytohormones; however, the usual result in these cases is reduced pod size and

seed weight, so little is gained. This suggests that the high temperature and/or the moisture stress has really interfered with some physiologic processes more comprehensive in operation than just the maintenance of endogenous phytohormones.

As one example of what I mean in this respect I can point to the effects of temperature on the activity of nitrate reductase. This enzyme, which is the first in a series of enzymes which catalyze the reduction of nitrate (NO_3^-) to amino-nitrogen, has temperature optima for various species and at higher temperatures loses activity very rapidly. We often find high levels of free nitrate in bean leaf tissue - NO_3 is the substrate for and inducer of the enzyme with no or little measureable reductase activity, when air temperatures around the plant are high (> 90° F). Activity is likewise dependent upon an availability of soil water.

One might speculate as to the relationship of blossom drop during high temperature periods to the depletion of the amino-acid pool.

Having referred to nitrate (NO_3^-) in respect of inducing the enzyme, nitrate reductase, I might also point out the effect of another environmental factor, light. It has turned out that light is necessary for induction of the enzyme but only indirectly through its effect upon uptake by cells of nitrate. It has been suggested, on the basis of some data but no rigorous proof, that light somehow regulates the permeability of cellular membranes to NO_3 and hence controls its cellular uptake.

3. Management.

This term refers to the decision-making role of the grower, wherein he is confronted with alternate or multiple choices at the several stages of crop production. These choices involve such things as soil preparation, choice of variety, row and plant spacing, date of planting, kind and amount of fertilizer, pest control practices, and irrigation time and frequency.

Where yield is the primary concern, these management choices can be seen as related events tied together in this symbolic representation :

$$P\,(N.A.R. \times L.A.I.) \rightarrow (X.Y.Z.) \rightarrow \text{Yield}$$

Let us start with yield at the right and work our way back. Yield of a legume seed crop is best seen as the product of seed weight (Z), average number of seeds per pod (Y) and average number of pods per plant or per unit area (X). X, Y, and Z, are the morphological yield components and there can be no variation in yield that does not follow as a result of variation in one or more of the components. It should be noted that there can be variation in the components not reflected in yield. This happens when, for example, seed weight, in a given case fluctuates in a downward direction just enough to offset an upward deviation of pod number. This we call component compensation, and it is a fairly common occurrence in many crops.

The X. Y. Z. system is generally not the major or primary food synthesizing system. Biosynthesis of protein from raw materials does take place in the pod wall and further syntheses and conversions occur in the maturing ovule. Nevertheless, the leaf and stem comprise a major photosynthetic, assimilatory, and transport system which, in beans at least, determines the size of the X. Y. Z. system, and is prior in time to that system. This major input system we designate by NAR for net assimilation rate, and LAI for leaf area index. Finally we introduce the symbol P to indicate length of growing period. The product of P. NAR. LAI then stands for total dry weight accumulation of which some fraction funnels into the XYZ construct, which equals yield.

Moisture	Row Spacing
Sunlight	Seeding rate
Temperature	Insect control
Minerals	Foliage Disease control
Hormones	Weed control
Weed control	Fertilizer
Genotype	Genotype

P (NAR . LAI) -- (X. Y. Z.) = W

Planting Date
Variety

I will not at this time discuss this diagram in detail since the relationships expressed are no doubt familiar to most of you. Suffice it to say only that most if not all of the

environmental factors affecting yield operate on these growth components: I have left the diagram simpler than it really is; if there is need we can go into some of these relationships in more detail later.

Whereas it is quite evident that environmental factors influence yield, there is little evidence that these same factors cause any variation in quality components which can be regarded as genuinely significant in human nutrition.

A typical finding in this respect is the following: Green leaf samples from 9 different species harvested under different conditions of fertilization and maturity showed little variation in amino-acid contents.

The vitamin content of peas and beans (Carotine and riboflavin) has been found to vary with localion where grown and from season to season. Thiamin in lima beans also varies with locality of growth. Most such variations are insignificant in a nutritional sense.

Nitrogen fertilization raises the total protein content in several legumes (soybeans, peas, beans) but without appreciable changes in amino acid ratios.

The following table gives the amino-acid analysis on two varieties of navy beans grown on a zinc deficient soil (- Zn), and with 3 pounds of added zinc (+ Zn) near Saginaw, Michigan. Zinc has been shown to stimulate protein synthesis in these two bean varieties in leaf cell cultures. Of interest in Table are the changes in methionine and tryptophan in Saginaw and Sanilac varieties respectively, as a result of zinc fertilization.

b. Genetic

I direct your attention now to several tables (3, 4 and 5) showing chemical composition of several navy bean varieties, their amino-acid values, and their feeding values. Although there are some differences in total protein, the data are strikingly similar in most aspects. This is not unexpected since these five varieties are of the navy bean class and more or less related geneticaly. Let us look carefully at Tables 6, 7 and 8, in which are shown amino-acid values for several varieties of quite distinct commercial categories. The slight variations from variety to variety are

trivial (with one exception) as compared with the great uniformity across the board. Such low level variation is not, on the face of things, encouraging to the plant breeder looking for big genetic differences in protein quality components.

But let me hasten to remind you of some additional consideration. For hundreds of maize varieties and hybrids variation in lysine was quite low and unpromising to plant breeders. Then was disclosed the effect on lysine of one mutant gene. We have looked at, in beans, only a small fraction of the hundreds of types and varieties known. Does there exist somewhere in the species a mutant factor capable of conferring new levels of lysine, or of methionine or cystine to their seed proteins? Do we look for seeds of unusual cotyledonary appearance or structure, as in opaque #2 maize?

Seed coat color and pattern mutants, and seed size and shape genes are numerous in beans. The varieties Michelite and Algarrobo (from Colombia) are quite diverse genetically in these genes, yet their amino-acid composition are so similar as to be almost indistinguishable one from the other.

Possibly, in legumes, it is not the amino-acid per se --its presence or absence in the amino-acid pool -- for which we are likely to find appreciable genetic variability, but rather distinctive proteins. Certainly, different proteins are one of the criteria of species differentiation; studies of serotype specificity among varieties within species are often based on differences between their proteins.

I do not mean to imply that amino-acids are not genetically determined; only that each one is so essential to all protein formation that the organism could not tolerate very much genetic load at this fundamental level and still function adequately as a crop plant.

With respect to different edible legumes, it is obvious there are certain genetically determined potentialities for differential nitrogen metabolism, but these may be modified during development by effects of different environments including mineral ions and growth regulating substances. I know of no breeding experiments in legumes comparable to those in cereals to indicate how much change in protein and its components can be expected from hybridization and selection.

I believe the evidence is clear, though not abundant, that ion uptake and accumulation is under genetic control and amenable

to selection. It is also probable that toxic and bitter substances and anti-metabolites can be removed via genetic selection.

There is new research on the problem of gastro-intestinal distress induced in many people by some of the edible legumes. Flatus, as the condition is now called, is believed to occur because of a substance in the ingested legume that inhibits the absorption by the blood of CO_2, released by the ingesta from natural ocurring carbonates in the body. In fractionation studies, the inhibitor separates out with a carbohydrate fraction that contains some of the non-metabolic sugars, such as the tetra-saccharide, stachyose.

In lima beans, Phaseolus lunatus, the factor is present, if at all, only in very low levels in immature seeds but develops in the last several days of seed maturation. It is more prevalent in the dry white than in the green seeded lima. This fact alone offers promise of removal by selection, but the possibility of character association with green testa is not excluded at this stage.

If a gene complex exists in a cell for the symthesis of a particular compound-- a component of nutritional quality -- what is it that regulates whether that gene complex functions to produce a little of the substance or a lot of it? There is a growing body of evidence that implicates the plant hormones as agents which in some way act to stimulate gene activity -- to release inhibition of a gene or section of DNA -- which results in synthesis of a particular polypeptide or protein.

If ways can be discovered of artificially stimulating certain genes or complexes to function for longer periods, or under more adverse conditions, or at an earlier or later stage of development, for example, we might at last exercise the kind of control over the formation of nutrient molecules that masters once exercised over slaves.

Concluding Remarks

Most attributes of nutritional quality in edible legumes are characteristic of the genotype of the plant in question, but modifiable by numerous external forces.

Some of the external forces themselves are under the control of the agronomist, bug others are only remotely under man's control. The genetic system underlying many essential components of quality may be fundamentally inter-related with other essential physiologic and developmental processes in the plant, and can not readily be manipulated genetically because of trivial genetic variability in populations of

genotypes. Nevertheless, a number of specific attributes of quality are amenable to change by genetic selection; and the possibility remains that the plant breeder, even in the case of the more difficult genetic situations, might find genes of major effect in larger more diverse samples.

Finally, the hope may be expressed that means may be found for inducing the "turning on" or "turning off" of genes that regulate the formation of nutritionally important substances.

LAS LEGUMBRES IMPORTANTES Y SU COMPOSICION QUIMICA

Table 1. Important Legumes

Legumes				
Latin name	Common name	Areas of cultivation	Notes and comments	Reported yiel (kg/ha)
Arachis hypogaea	Groundnut Peanut Monkey nut	Tropics and subtropics throughout most of the world	Annual. Maturing period 4-5 months. Highly susceptible to frost and needs hot dry conditions for maturing. Primary use as source of oil. Whole seeds eaten directly in many ways. Presscake used as fodder and manure but may after suitable processing be used as human food.	1500-2000
Cajanus cajan	Pigeon pea	Grown in tropics and subtropics in Asia and Africa. Widely cultivated in India and Pakistan. Introduced into tropical America, Pacific Islands, and Australia.	Short-lived perennial but also grown as an annual. Maturing period 7 months. A dry crop resistant to drought and high temperatures.	800-1500
Cicer arietinum	Chick pea	Grown in tropics and subtropics in Asia and Africa. Widely cultivated in India and Pakistan mainly as a cold weather crop. Also cultivated in Mediterranean countries and South America.	Annual. Maturing period 6 months. Moderately resistant to drought and high temperatures.	800-1200
Dolichos uniflorus	Horse gram	Tropics and subtropics in Asia and Africa.	Annual. Maturing period 7-8 months. Thrives on poor soils in dry tropical areas. Plants are of value for soil erosion control and as green manure. Not in high regard as human food.	No information

Glycine max	Soybean	South and east Asia, particularly China and Japan (but not India) and U. S. A. In other parts of the world usually cultivated on a limited often experimental scale.	Annual. Maturing period 5 months Best suited to warm but not tropical climates. A valuable source of oil and livestock feed. Regularly eaten (in traditionally processed forms) in south and east Asia, but not in other regions. Extensively grown in U. S. A. as a source of oil, processed food materials, livestock feed and industrial nonfood products.	1000-2000
Lablab niger	Hyacinth bean	Dry tropical areas in Asia, Africa, West Indies and Central America.	Annual. Maturing period 6-8 months. Also occurs as biennial and perennial. Moderately resistant to drought. Susceptible to disease in humid conditions. Includes garden "climbing" varieties grown to produce green beans.	500-1500
Lathyrus sativus	Lathyrus pea Khesari dhal	Mainly India.	Annual. Maturing period 5-6 months. Hardy, drought resistant and grows on poor soils. Because of its resistance to drought has been an important "famine crop" in India, surviving, or cultivated, after cereals have failed. Eaten in large amounts in such circumstances it may produce the disease lathyrism.	No information
Lens esculenta	Lentil Split pea	Near East, north Africa, India, Burma central and southern Europe	Annual. Maturing period 5-6 months. Resistant to drought, and high temperatures. Includes orange-red and green varieties.	600-1200

Parkia biglobosa (Synonym Parkia africana)	African locust bean	West Africa	A leguminous tree with pods maturing annually. The seeds are fermented and used as a condiment throughout west Africa. The pods contain a sweet yellow pulp used for making "sweets" or drinks.	No information
Phaseolus lunatus	Lima bean Butter bean	Tropical America, West Indies, tropical Africa, Madagascar, New Guinea, and north Australia	Usually annual but may be perennial Maturing period 4-6 months. Needs warm, humid climate.	400-1500
Phaseolus aureus	Golden gram Green gram	South and east Asia, particularly India, and Africa.	Annual. Maturing period 2-4 months. Moderately resistant to drought and high temperatures. The sprouted seed is a popular vegetable in China. In India the green pods are eaten and the dry grams are often pounded into flour.	300-600
Phaseolus mungo	Black gram Mung bean	India, Africa, and West Indies.	Annual. Maturing period $2\frac{1}{2}$-5 months. Rather susceptible to drought. Like Phaseolus aureus is highly valued in India. Eaten by Indian immigrants in Africa, the West Indies, etc.	200-700
Phaseolus vulgaris	Navy bean Kidney bean French bean Haricot bean	Grown throughout the world, but particularly in the Americas.	Annual. Maturing period 2-5 months. Susceptible to high temperatures, frost and drought. Includes many varieties, varying in color and size. More productive in cool climates where plant matures slowly.	400-1500

Pisum sativum	Pea Garden pea	Throughout the temperate zone. Grown in warm countries as a cold weather crop or at high altitudes.	Annual. Maturing period 3-5 months. Susceptible to high temperatures and drought. Eaten in fresh or dry form. A popular small garden product in temperate countries. Now also cultivated on a commercial scale and widely consumed in canned and frozen form.	500-1500
Pisum arvense	Field pea	Similar to those of Pisum sativum but is grown much less extensively	Annual. Maturing period 4-5 months. Moderately resistant to high temperatures, frost, and drought. Might perhaps be described as a poor but hardy relation of the garden pea. Often used for green manure.	400-1200
Vicia faba	Broad bean Horse bean	Temperature zone, particularly Mediterranean region, highlands in Asia, Africa, and Central and South America.	Annual, sometimes biennial. Maturing period 3-7 months. Moderately resistant to high temperatures and drought. Includes many varieties.	500-2300
Vigna unguiculata	Cowpea	Tropical Asia and Africa, West Indies southern Europe, and the Americas	Annual. Maturing period 3-4 months. Resistant to high temperatures and drought, and to plant pests and diseases. Includes numerous varieties. Vigna sinensis, also called cowpea, has somewhat similar distribution and properties. The pods of the Vigna sp. are eaten as a vegetable in China and India.	300-1000

Table 3 -- Proximate composition of different varieties of navy beans (expressed in gm. /100 gm. bean flour)

Variety of beans	Moisture	Ash	Crude fiber	Ether extract	Nitrogen free extract	Protein	Calcium	Phosphorus
Gratiot	7.42	3.80	4.05	1.35	53.75	29.63	.154	.560
Michelite	7.43	3.96	4.37	1.68	58.25	24.31	.166	.553
Saginaw	7.52	3.96	4.53	1.53	59.40	23.06	.159	.493
Sanilac	7.41	3.72	4.24	1.59	56.73	26.31	.167	.533
Seaway	7.32	3.71	4.08	1.66	56.67	26.56	.150	.580

Table 4 -- Amino acid composition of different varieties of navy bean (gm. amino acid per 16 gm. nitrogen)

Amino acid	Gratiot	Michelite	Saginaw	Sanilac	Seaway
Lysine	6.10	6.32	6.41	5.68	6.68
Histidine	2.39	2.53	2.63	2.48	2.75
Ammonia	1.97	1.97	1.98	2.05	1.96
Arginine	7.40	5.37	5.35	6.09	6.63
Aspartic acid	11.52	11.63	11.90	10.90	12.20
Threonine	3.65	3.73	3.64	3.60	4.19
Serine	4.45	4.49	4.35	3.81	5.17
Glutamic acid	13.52	14.48	14.80	12.42	16.61
Proline	3.25	3.50	3.42	3.57	3.58
Glycine	3.39	3.67	3.51	3.00	3.80
Alanine	4.05	4.14	4.06	4.33	4.21
Valine	4.84	4.97	4.94	4.94	5.12
Methionine	0.95	1.00	1.01	1.04	0.93
Isoleucine	4.25	4.36	4.43	4.33	4.52
Leucine	7.59	7.63	7.49	7.56	7.97
Tyrosine	2.12	2.21	2.11	2.34	2.17
Phenylalanine	4.97	5.08	5.04	5.02	5.43

Table 5 -- Effect of feeding different varieties of autoclaved(a) navy beans on the growth of rats

Group Number	Protein source	Change in weight (b)	Food intake (b)	Protein efficiency ratio (per) (b)
1	Gratiot	40.5	310	1.46
2	Michelite	40.4	310	1.47
3	Saginaw	39.0	310	1.36
4	Sanilac	39.5	300	1.44
5	Seaway	36.0	290	1.26

Table 6. Amino Acids in bean varieties calculated to 16% N.

Amino Acid	Sanilac Beans 1965	Sanilac 1963	Kidney	Blackeyed Cowpea	Michelite Navy	Mung USA	Mung (Thialand)	Mung (Thialand)
Aspartic Acid	12.52	12.28	13.14	12.29	13.46	13.90	13.02	11.81
Threonine	4.08	5.07	4.22	3.66	4.71	3.37	3.36	3.09
Serine	4.97	6.49	5.68	4.79	6.71	6.09	5.17	3.27
Glutamic Acid	16.74	18.10	17.14	18.04	15.33	16.62	15.48	14.48
Proline	3.56	4.71	4.86	5.00	3.96	4.98	4.92	4.95
Glycine	3.68	3.84	3.93	3.80	3.83	3.74	3.88	2.96
Alanine	3.99	4.00	4.31	4.17	4.00	4.07	4.44	4.57
Valine	5.16	4.71	5.12	4.78	4.25	5.10	5.26	4.87
Methionine	6.34	1.27	0.94	0.96	1.17	1.07	1.64	2.03
Isoleucine	4.38	4.32	4.18	4.03	4.50	4.56	4.14	4.11
Leucine	8.17	7.48	8.06	7.61	7.71	7.20	8.36	7.74
Tyrosine	1.99	2.06	2.26	1.92	3.00	1.69	2.11	2.16
Phenylalanine	5.55	4.99	5.33	5.27	5.12	5.92	5.56	5.12
Lysine	6.53	5.70	6.66	6.83	6.50	7.32	8.02	6.69
Histidine	2.66	1.98	2.56	2.93	2.12	2.14	2.76	2.92

continúa

Table 6. Amino Acids in bean varieties calculated to 16% N. (continuación)

Amino Acid	Sanilac Beans 1965	Sanilac 1963	Kidney	Blackeyed Cowpea	Michelite Navy	Mung USA	Mung (Thialand)	Mung (Thialand)
Arginine	6.02	5.07	5.12	6.42	5.62	6.70	6.55	6.69
Ammonia	0.81	1.35	1.62	1.97	2.12	1.97	1.90	1.99
Tryptophan	1.08	1.76	1.51	1.40	-	-	1.89	1.47
Cystine	1.60	0.73	1.00	1.04	1.12	0.62	0.77	1.01
Total	99.83	95.91	97.64	96.91	94.44	97.07	99.23	91.93
% Nitrogen	4.09	4.04	3.75	3.49	3.84	3.87	3.71	3.78
S-Methyl Cysteine	1.10	-	-	-	-	-	-	-

Table 7. Amino Acids in bean varieties calculated to 16% nitrogen

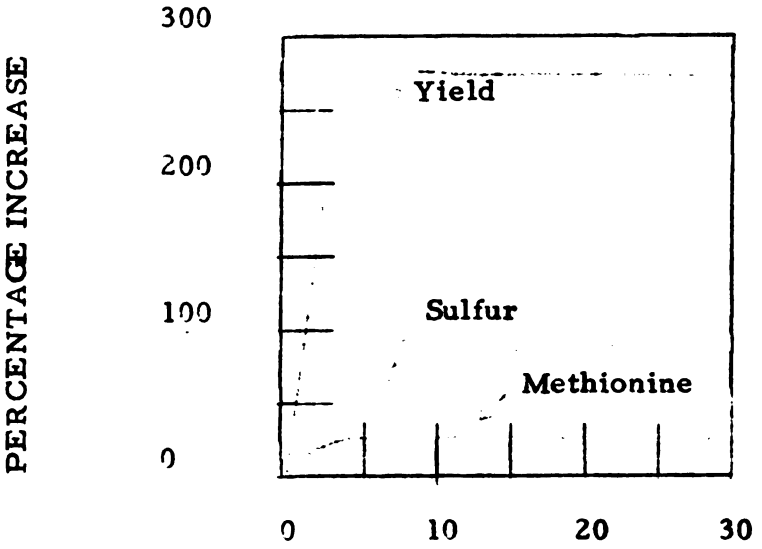
Amino Acid	Breat Northern	Pinto	Cal. Red Kidney	Trag. 279-1 81665	Algarrobo	Idaho Yelloweye	Calif. Cranberry	Marrowfat
Aspartic Acid	13.06	13.07	13.02	13.14	12.36	12.65	12.48	12,33
Threonine	4.06	4.04	4.35	4.32	4.23	4.44	4.21	4.33
Serine	6.18	6.17	6.28	6.42	5.90	6.51	6.24	5.99
Glutamic Acid	17.83	19.77	18.31	18.79	17.17	18.31	19.30	17.92
Proline	4.32	4.11	4.62	4.12	4.19	4.25	4,09	4.28
Glycine	3.97	3.96	4.08	3.89	3.68	3.87	3.82	3.76
Alanine	4.06	4.00	4.26	4.20	4.10	4.15	4.13	4.02
Valine	5.30	5.03	5.48	5.35	5.32	5.47	5.44	5.29
Methionine	1.54	1.33	1.88	1.30	1.84	1.98	1.67	1.57
Isoleucine	4.59	4.61	4.67	4.58	4.40	4.44	4.53	4.37
Leucine	8.56	8.50	8.26	8.59	7.87	8.12	8.35	8.04
Tyrosine	2.25	2.36	2.15	2.44	2.18	2.08	2.15	2.10
Phenylalanine	5.56	5.71	5.56	5.77	5.44	5.47	5.68	5.42
Lysine	7.19	7.20	6.82	6.99	6.58	6.75	6.84	6.56
Histidine	3.09	3.05	2.92	2.86	2.72	2.83	2.82	2.67
Arginine	6.97	7.54	5.61	6.64	5.95	5.57	5.88	5.64

Table 7. Amino Acids in bean varieties calculated to 16% nitrogen.

Amino Acid	Great Northern	Pinto	Cal. Red Kidney	Trag. 81665	279-1	Algarrobo	Idaho Yelloweye	Calif. Cranberry	Marrowfat
Ammonia	1.72	1.75	1.80	1.76	1.84		1.65	1.75	1.70
Tryptophan	1.49	1.30	1.66	1.51	1.58		1.56	1.44	1.67
Cystine	0.76	0.72	1.05	0.72	0.86		0.9	0.77	0.82
% Nitrogen	3.625	4.20	3.565	4.225	3.82		3.39	4.025	3.66
S-Methylcysteine	1.06	0.84	1.26	1.10	1.17		1.13	1.03	1.18

Table 8 . Amino acids in bean varieties based on 16% N.

Amino Acid	Sanilac San-Zn #1	Saginaw Sag-Zn #2	Sanilac San+Zn #3	Saginaw Sag + Zn #4
Aspartic Acid	12. 83	9. 01	10. 20	9. 37
Threonine	3. 05	3. 77	3. 70	4. 39
Serine	3. 29	3. 65	3. 56	4. 11
Glutamic Acid	7. 84	9. 49	9. 08	10. 24
Proline	3. 44	2. 94	3. 84	4. 07
Glycine	3. 44	3. 97	3. 88	4. 39
Alanine	3. 76	5. 76	4. 26	4. 71
Valine	3. 92	4. 68	4. 54	4. 94
Methionine	0. 87	0. 95	0. 80	1. 55
Isoleucine	3. 21	3. 77	3. 56	3. 88
Leucine	5. 62	6. 87	6. 88	7. 31
Tyrosine	1. 82	2. 30	2. 06	2. 38
Phenylalanine	3. 48	4. 25	4. 07	4. 39
Lysine	4. 28	4. 92	4. 21	4. 94
Histidine	1. 54	1. 79	1. 82	1. 92
Arginine	7. 05	4. 37	6. 78	4. 48
Ammonia	4. 32	2. 42	3. 56	3. 34
Total	73. 76	74. 91	76. 80	80. 41
% Nitrogen	4. 04	4. 03	3. 42	3. 50
Tryptophan	1. 11	1. 21	1. 41	1. 18



HORTALIZAS

Dr. E. H. Casseres

These remarks will be made in English in the hope of stirring up some discussion. Vegetables and fruits are as basic a food crop in Central America as anywhere else, but unfortunately most of the volume produced is destined to market. In too few cases are vegetables eaten in sufficient quantity by the rural families of the growers. As is well known, vitamins, minerals, and carbohydrates are obtained from vegetables, fruits, roots and tubers, and as the economy of these countries improves, there is an increase taking place in the amount of these foods purchased, especially in the growing urban centers. While at present it may appear that there is an adequate supply of fruits and vegetables, the data presented by Ingeniero Ramírez and the forecast of the needs of the area for the next eight years up through 1975, leads us to believe that serious shortages will occur unless something is done soon about stimulating production. Similar studies made in Mexico point to this same situation. With regard to the present and future availability of certain major fruits, such as citrus, it is estimated by many that we shall have overproduction within a few years. Large plantings, such as those at Concepcion, Panama, destined only for export, are the only new significant development. But in the long range, there is a place for citrus and other local fruits in the national markets, as yet undeveloped.

Improvement of local markets should have a salutatory effect on human nutrition in the area. Even though the large commercial developments with fruits are relaying heavily on processing in order to export a concentrated product, in general, there will be more fruit available locally and the knowledge on growing these fruits will gradually be better known. Other fruits with a promising future are the avocado, the pineapple, the mango and the papaya.

With regard to vegetables, emphasis should be placed on local vegetables in nutrition programs and home gardens meaning by that, those crops which are native to the american tropic and which are readily adapted. For example, the tomato, the peppers, and the "ayote" or native pumpking (Cucurbita sp.); the potato in the highlands; the sweet potato and the cassava in the lowland and many other simple vegetables and herbs.

The most important limiting factors to a better supply of these foods are: low yields, short seasons of production which could be extended, and applications of certain technological advances in crop production. The improvement in quality of local vegetables is something that also offers important possibilities for the enhancement of nutrient content, for example, in crops like the sweet potato and cassava which are staple food items of people's of the lowlands. Practically nothing has been done on storage or preservation of these tropical roots. The use of sturdy containers and of refrigeration is still largely to be applied to the packing and preserving highland vegetables for intercountry shipment.

Referring briefly to ornamentals, there is already a beginning in the production of cut flowers for export from certain Central American countries, and while this is not a direct contribution to nutrition as such, this horticultural development does help the rural economy by providing additional income, and promotes the well-being of peoples and their enjoyment of life.

My following comments in Spanish will attempt to summarize and to add to the main points brought out so far: El mejoramiento del valor nutritivo de hortalizas y frutales, de raíces y tubérculos, puede lograrse a través de programas de fitomejoramiento. No hemos dado suficiente atención a la simple selección de clones y variedades de mayor rendimiento y valor nutritivo. Debiéramos dar más atención a cultivos de subsistencia comunes en el área México-Centroamérica. Entre las variantes genéticas que podríamos aprovechar están, por ejemplo, las diferencias en contenido de vitamina C en tomate, en el alto valor de provitamina A en algunas hortalizas verdes, y en los carotenos en ciertas líneas de ayotes.

La introducción de nuevas especies y de nuevas modalidades de utilización de plantas ya conocidas puede tener un gran valor en la nutrición; por ejemplo, en el Africa y en partes de Brasil la hoja de la yuca se consume como verdura cocida y es relativamente alta en proteína. En las Filipinas las puntas de los bejucos de camote tienen utilización como hortaliza. Una coordinación entre genetistas, horticultores, nutricionistas y otros especialistas, podría tener un efecto benéfico en la calidad de los productos que se están seleccionando y creando -- hay muy poca labor de equipo en nuestra área y una mayor coordinación e intercambio de ideas que contribuyan a un mismo fin sería deseable. Hay también una gran descontinuidad en los servicios de extensión y el nexo entre la investigación y la aplicación está muy flojo.

Ante esta situación se debe notar que hay un aumento considerable en los últimos años en el asesoramiento particular que dan compañías comerciales a los agricultores y frecuentemente a horticultores especializados. Notemos que en los servicios de extensión nuestros hay casi completa falta de especialistas de extensión de horticultura. En México tienen el primero, y es una especialidad que hace mucha falta en América Central.

Para una disponibilidad de cantidades adecuadas de frutas y hortalizas se piensa siempre en las atenciones clásicas que necesitan los cultivos hortícolas; tales como buena semilla, cuidados al trasplante y combate de plagas y enfermedades. Pero producir en sí no es suficiente. La adecuada comercialización de estos productos es un factor limitante al cual tenemos que ponerle más atención, ya que una proporción elevada del producto se pierde debido a fallas en el empacado y por la mala clasificación en supuestas calidades. Ya el Instituto Interamericano de Ciencias Agrícolas celebró en noviembre pasado (1965) una reunión técnica con expertos de Estados Unidos, México, Centroamérica y Perú, de la cual se han elaborado unas normas mínimas que definen el grado de calidad que deben poseer las hortalizas principales, a fin de que puedan salir a los mercados de Centroamérica. Estas normas van a ser estudiadas y aplicadas en vías de estudio para que cuando estén listas sean sometidas a ratificación de los gobiernos, por intermedio del ICAITI.

Producir clasificar y empacar no es suficiente. El Dr. Schaefer decía que se perdía el 25% de los productos agrícolas desde la planta hasta la mesa del consumidor. Yo creo que en productos hortícolas la pérdida es hasta de un 33%, pero que esta pérdida se puede reducir a la mitad mediante la utilización de buenas prácticas y métodos y mediante el estímulo que deben significar los precios de garantía, como pedía el Ex-Presidente Figueres. La promoción de cultivos hortícolas se debe hacer únicamente cuando se cuenta con mercados locales o de exportación.

Finalmente, necesitamos entrenar más gente en horticultura, pero a plazo corto. En los últimos 15 años el IICA ha celebrado 10 reuniones técnicas y cursos internacionales en los cuales han participado unos 220 técnicos. Sin embargo, el número de personal joven capacitado que esté trabajando en nuestros países a tiempo completo en producción, extensión e investigación es muy bajo. Actualmente conozco a siete personas en Centroamérica dedicadas a la investigación, pero considero que deben haber unos tres por país, o sea unos veintiuno. Tendríamos que triplicar nuestro esfuerzo educativo a corto plazo

para llenar esta necesidad. La tendencia que debemos estimular es la de considerar a todo el Istmo Centroamericano como una entidad, produciendo cada hortaliza o fruta en donde mejor se dé, para comercio de exportación con normas aceptadas y para mejorar el comercio regional.

DISCUSION

Dr. Pinchinat: We are considering two general areas in these meetings. First, what we should learn and know about food yield and quality improvement and second, what can or should we do to increase food production and improve the quality of food products.

There is a lot of areas that need to be investigated in relation to Dr. Adams' topic, and I would like to cite:

1. Studies on the most important protein components in beans, (like methionine, lysine and tryptophan). I feel we should know more about the interactions between variety, location, soil fertility , genotype and protein quantity and quality. Also, we should make provisions to systematically analyze all accessible bean varieties and species, as to their protein status. The more desirable lines could be used either directly or indirectly in breeding programs to improve the quality of the protein of edible beans. This sounds simple, but getting quick and satisfactory results might be quite difficult. We have been very pleased about the discovery of two genes in corn, namely opaque-2 and floury-2.

2. These genes seem to be of the qualitative type, genetically speaking.

In beans, the amino acids we want to work with might be of a quantitative nature. Experience has shown that metric characters are hard to study and hard to transfer from one line to another. It was mentioned that some microelements might be used to modify the protein composition of the bean.

If we look at macro elements, we know that in Latin America people are not using fertilizers the way they should or are not using them at all. If so, it might be difficult to make them use the minor elements, or even if these are used, they may be inefficient in the absence of the major elements.

The main idea of this Panel is not only to improve our scientific knowledge. We have to process and convert such knowledge into food. Yesterday, Mr. Figueres touched a basic point, that is, education in all its forms. Suppose that we succeed in increasing the food production of the underdeveloped countries, what do we do if the people still ignore what a balanced diet is? The problem of malnutrition thus would not be solved. I am really sorry that in the meetings that we have had we don't have somebody directly engaged in the field of education. Our findings and recommendations should reach the people, so that the time spent in our discussions be fruitful in the full meaning of the word.

Ing. Jalil: I have been very much impressed with Dr. Adams lecture. I believe that what Dr. Adams has said could contribute to the improvement of production in the region, but we have to move a little farther. We have to improve production in the shortest time and as we already know, and I am sure Dr. Gutierrez will support me when I say that in Central America we already have good yielding bean varieties that can be immediately distributed to the farmer for improving production. There are several points which I think are very important, very substantial.

1. A program of seed production that starts from the production of seeds to the distribution to the farmers, should be carried out in the region. This is one of the most important factors which I consider should be mentioned. There is no research that has really reached success if there is no good seed production and distribution scheme.

2. Another factor which I consider important is fertilizers. We know there is a lot of work in fertilizers in Central America. Here we have a FAO program on fertilizer use under Freedom From Hunger Campaign Scheme. However, that is just a drop of water in the sea. What we need here is to prepare ways and means of giving credit facilities to the farmers to have the opportunity to use more and more fertilizer, and also to teach them the best way to use it.

3. I consider also of interest what Dr. Casseres talk about the training of personnel. We, in international organizations have been training personnel for many years, probably back 15 or 20 years. However, in spite of this, we find few working in the area. Sometimes there are no attractive possibilities for those people, or the programs of the countries do not fit with the training of them.

Now, regarding the comments on the paper presented by Dr. Casseres I fully agree with his ideas, but I would like just to touch a little bit the field of fruit.

In Central America, mainly in Guatemala, we have a diversity of climates. In three hours we can go from the lowlands, where you can see pineapples, bananas and all those fruits growing perfectly well, up to the highland of Quezaltenango, where you would have an opportunity to see peaches, plums and apples, but, if we start doing a survey on fruit production or in fruit growing, we will be very disappointed to know that most of 90% of the orchard is planted with seedling, with erratic production.

A program of fruit trees propagation with varieties already existing in the area could be easily carried out so as to ensure better production and available to the population. In this field, also the training of personnel is very important. Besides, listening to the discussion yesterday, I was even more impressed about what Lic. Ponce and Lic. Ramirez said regarding the economy side of the production. In this part I ask you to forgive me for giving my explanation in Spanish so that I might coordinate much easier my ideas with my words.

En esta parte quiero primero indicar lo que ayer dijo el Lic. Ponce: que la producción de ciertos cultivos comerciales se llevaba a cabo porque se trataba de agricultores capaces. Quisiera indicar que ningún progreso o ningún desarrollo en agricultura se puede llevar a cabo si no hay un incentivo económico para el agricultor. Cualesquiera que sean los ángulos que se ataquen. Por ejemplo: tenemos que recordar que el maíz y la papa llegaron a Europa después de que Cristóbal Colón hizo su primer viaje y sin embargo, estos dos cultivos tuvieron un enorme desarrollo en Europa a pesar de que en ese tiempo se trataba de agricultores que eran, en su mayoría, analfabetos; pero había un incentivo económico. Pongamos el caso del maní en muchos países del Africa y América Latina. Puedo indicar que en el Africa usan métodos más avanzados para producirlo. Ellos hacen uso de buenos insecticidas, de programas de fertilización y maquinaria agrícola, porque saben que van a vender su producto. Un agricultor no va a desperdiciar sus esfuerzos de trabajo si sabe que no va a recibir recompensa económica. Tenemos el caso muy corriente del café en nuestros países, que fué un cultivo introducido, así como también el caso del algodón, en donde simples agricultores usan buenas técnicas debido a que estos cultivos dan al agricultor la satisfacción de que puede ganar algo. Estoy casi seguro de que un agricultor, si resuelve el problema de vender su producto, mejoraría sus ingresos, mejoraría su dieta e inclusive podría hasta cambiar sus hábitos alimenticios y sociales.

Dr. Gutiérrez: We are open for discussion.

Lic. Ponce: I would like to make some comments on what Dr. Casseres explained on production of horticultural products. He mentioned that it takes place through better research, better application of this research, marketing and training of personnel, but I wonder if it is not through better consumption of vegetables. People do not consume vegetables in Central America and as long as they don't consume this vegetables, I don't see how can we expect the production to be effective. For instance, we have the highlands of Guatemala. They produce vegetables and fruits; however, the consensus seems to be that this people do not consume these vegetables and fruits, they produce them for sale. Dr. Young also mentioned this in Venezuela, where they produce cabagges for export and yet they prefer to consume yuca. Why? Why don't this people consume the vegetables that they have?

I would like to ask the nutritionists here, specially people from INCAP, to tell us what is being done in the area to increase the consumption of vegetables - if something is being done. Because as long as consumption is low, there is no use trying to put better marketing methods or trying to use quality standards, as we don't have a market for this product. We should keep in mind that Central America is mostly rural. There is about 50% of rural population and they live in small concentrated populations, so we should not think in terms of producing only for human consumption; after all, it's only 40% of our people who live in cities, or maybe less, so we will try to make this people to produce and consume their own food. In the case of vegetables, they can produce and consume them in the same place. Perhaps that way they don't have to be very elaborate on marketing methods, considering that the important thing is to get this people to have a balanced diet.

One possibility that might help to improve consumption of fruits and vegetables is to produce for export, and once we have an external market, then we can have enough supplies of this product so that people can get used to eat and consume the products in the internal market. For example: the case of banana production in Central America, which was developed as an export product. We had bananas that were being exported and now we have a very important product for internal consumption. The same could be done with fruits and vegetables that have a demand in the external market, but of course his would call for another type of production.

Dr. Behar: Before answering the question that Lic. Ponce made, I want to start confessing that I was very much disturbed by the comment of Dr. Leon in regard to the nutritive value of roots. I think this is a very dangerous concept. It is true that roots contain a large amount of calories which are also important and that have some other advantages from the agronomic point of view, but unfortunatelly those are the types of calories which we call empty calories. They come from practically pure starch and we cannot conceive a diet that will be adequate based on rooots as the main source of calories. He has indicated some areas in Africa and some in America populated by casaba eaters and we know, the nutritionists, that those are the areas in the world in which we have the biggest nutritional problems, those are really the areas where kwashiorkor and serious vitamin deffi-ciencies are highly prevalent, much more than in the cereal eating areas. It's true that these populations have survived but they have survived at the expense of infant mortality rates as high as 300-400 per thousand, of course, they have survived because a tremendous natural selection, because the requirements of the adults are not the ones of the infant and because later in life they supplement their diet with other food items. So roots are all right as a source of calories but that's all and we cannot depend on roots as a source of any other nutrient in scientific terms. He mentioned that other parts of the plants can be utilized and he specifically mentioned the leaves. Well, it's true that the protein of the leaves in most cases is an excellent protein in terms of the amino-acid composition, but again, the problem here is concentration, about 2 to 7% and then availability because of digestibility which is very low. And even if we do not take into account digestibility and we assume that those proteins are digestible, we would need to feed an infant, say two years old, in order to provide him with enough protein from leaves, about 500 grams of leaves and I can assure you that this is a lot.

I don't deny the value of those roots if we recognize their limitations. Roots can be used as an adequate source of calories if the diet also contains adequate sources of protein. He mentioned, for instance, that in the Amazonas valleys they have a lot of fish, if they consume a lot of fish then roots are all right. Roots with fish can be all right because then vou might have a well balanced diet.

We would be very strongly in opposition to the introduction of roots as a main crop for Guatemala, if it is done for nutritional purposes. It can be done for industrial purposes or for other reasons but for nutritional purposes, it could be disastrous.. If the people will

start to use roots instead of cereals, we will have a terrible deterioration of the present situation that is already so bad. I am very emphatetic about this because I feel very strongly about it. Of course, he mentioned, and I think the purpose of his presentation was to talk about what he calls the forbidden or neglected foods and this is all right. He mentioned quinna, which is an excellent product. I don't know what the agronomic limitations are for its greater utilization, I'm not familiar with it. I know that nutritionally it's a very good product. I wish it could be produced more and utilized more; I don't know why it is not. It seems to me there are some ecological and other problems; but I agree with him that we should look for other foods, that we should not keep our minds closed to the conventional or classical foods that we are accustomed to, We know that in the tropical regions there are many plants which could be excellent source of nutrients and we know little about them, and from that point of view I agree very much with these comments.

Now, coming to the question of Lic. Ponce, he mentioned that the consumption of vegetables in the Central American countries in general is very low. This is true, and I think I mentioned yesterday that one of the big problems we have in the area is Vitamin A defficiency and this is primarily the effect of a low consumption of the sources of Vitamin A, carotene sources. What we have done at INCAP as an advisory organization is to emphasize very much, in our recommendations for nutritional education, the green and yellow vegetables and this is one of our key points of our educational recommendations. Unfortunatelly, we are dealing here with the problem of changing food habits which is not very easy. We recognize that the problem is greater in the cities and in the more or less urbanized areas and particularly in Guatemala, for instance, in the ladino group than in the indian group. The indian will consume not the classical vegetables, but do consume a lot of local leaves in significant amounts; the consumption of green leaves is greater in the pure indian population but not by the ladino population and much less in the urban areas.

Lic. Ramírez: Just a few comments about the position that Lic. Ponce takes in relation to agriculture. I think the same kind of reasoning could be applied to the production of vegetables and fruits. Actually this people, as Dr. Behar says, are consuming the local products and they are producing over and above, these vegetables and fruits that they are exporting - in a sense - outside of the community. We had an experience here in 1951 and 1952 during the application of agrarian reform, about some small orchards around

the Motagua river. We found that rather than increasing the production of vegetables, there was scarcity of vegetables because those people were consuming their own products. They were not getting enough income from the production of these orchards to assure them of the other products plus their own production. This problem of vegetables is the same in relation to other products which are considered cash crops. We would like them to eat the eggs but they prefer to sell them, because that means more income to buy some other products that they cannot produce. The experience in India has been also that as the people are given more occupation and there are more possibilities of gaining income, the production of food for the market has grown more scarce than it was before, due to the fact that the people consume their own production rather than takes it to the market. So, we have to consider the economic factors too.

Dr. Schaeffer: The question I wanted to address the group was that regarding what is known about soil analysis. I want to bring this up because I think that there is an example of one key country that has perhaps made more progress than anyone that I know during the last ten years. This is Taiwan. In 1947 they had to import almost everything: they imported rice, all their food stables, fertilizers. In 1964 they became a net dollar foreign exchange country. At that time all foreign aid stopped for Taiwan. They now export pineapples, more pineapples than Hawaii; they are the greatest exporters of mushrooms, they export rice and fertilizers. Now, basically, they started on two premises. One, a very intensive soil survey and training technicians and the last reform whether we like it or not was based on taking land from the large land owners but in turn giving them bonds and stocks and in turn they had a choice of four industries, all agricultural: fertilizing industry, the pineapple business, the rice industry and I have forgotten the other one, there were four basic ones. There was a lot of what we call yelling and gnashing of teeth and it happens that now the land owners are the primary owners of the large industries. But again they have utilized land, foot by foot virtually, and based on a good basic study of what fertilizers were needed to grow pineapples, coffee, tea, rice, or their vegetable crops. They were also a country where vegetable consumption was at an extremely low ebb. If I remember my figures right, this has increased 70% in the past 12 years, and the total grams of vegetables consumed per capita had increased 70% during this period of time. I gave you this example but I want to know what progress has been made on a detailed soil survey through the Central American countries.

Dr. Gutierrez: I wonder if Dr. Braham will answer the question raised by Dr. Schaeffer regarding soil surveys.

Dr. Braham: There is not much I can tell you, except that it is very limited in Central America. We have a general map of Guatemala which is about 10 or 15 years old. It is a reconnaissance survey and not really good for detail work in production planning on farms, etc. El Salvador is completing a soil survey map, semi-detailed, which has been done with the assistance of AID. It is a very good job but it is not more detailed than the Guatemalan one. Honduras will finish a reconnaissance map within the next two or three years, but it is also on a large scale. Nicaragua has only a few patches of survey done and Costa Rica and Panama have also very scattered efforts and there is no general plan for this except that the Central American Development Bank has been trying to push a general scheme for doing soil maps all through the area, which has not been approved or is not in execution yet. As far as the use of these maps is concerned, they are used on a very general level and I think they have limited value in the national planning.

Dr. Echandi: I would like to make a few comments in relation to what Dr. Adams mentioned about the importance of ecology in relation to beans. We know that we have a tremendous variation of climates in this part of the world and that beans do grow well in the climates in which we have a rather defined dry season and low rainfall. Consequently, I think that we should emphasize in directing our efforts to planting bean and doing our research, our experimental work in these areas. I would also say that the concept of the ecological goes also for other crops. This is something that, as I said before, has been neglected in many cases. Plans have been tried or tested in places where there are not adaptable. They should not have been tested because they are not the proper climates to grow.

The other thing that was mentioned was about varieties. We know from our work on beans, that there are certain varieties quite good that are being used in this countries for several years. The production is good; they have resistance to diseases, yet they are not used practically. We have not been able to find what is lacking there. Is it that information in relation to this material is not properly distributed? Is it the lack of coordination between research and extension people? Do the agencies that are supposed to use this material know of the existence of it? In many cases we

talk about the lack of varieties and the lack of good material, but at least in the case of beans, we have been able to notice that for many years we have had this material and we have not used it. In addition to that, we have known the techniques of proper cultivation of beans and yet we go out to Central America and we find that few people, practically no one, use these. Practically no farmer uses good seeds or treats seeds of beans. There are several concepts of this nature that have to be taken care of, that have been known for many years, that are all around us know, and yet they are not transferred to the farmer or the farmer does not use them. This is all I want to say.

Dr. Pearson: I wanted to make sure that our friend, the Irish potato, does not get classified as tuber such as the casaba. The Irish potato supported the population of Ireland very adequately until 1847, when they had a tremendous famine and most of the Irish came to the United States in droves through the years. I have been impressed with the Irish potato as a non utilized material in many countries where it would probably grow very well. I wonder what is the potato situation in these areas. Does it grow well? Are they being pushed so to speak. I am very fond of potatos. The other thing is that from 100 grams of Irish potato, if I remember correctly, you can get 30 miligrams of ascorbic acid, which is equivalent to the Vitamin C you can get in a glass of orange juice or in 100 grams of broath beef liver, which is also unrecognized source of Vitamin C. No more comments.

Dr. Casseres: There was an interesting question by Dr. Pearson concerning the varieties of potatos in Central America and Mexico. Potatos are grown every year in every country. They are a standard staple food one would say but are still considered in the category of a high price food. The limited factor for a more abundant crop of potatoes is usually diseases. Proper clasification, storage and distribution are the other limiting factors, because while there are good crops, sometimes they fail to get into the other cities which are not located in the highlands, so they get down to the lower coast with less frequency and higher cost. However, there are new varieties of potatos especially produced by the Rockefeller Foundation. with international potato programs and these varieties are resistant to diseases and are being used to a great extent in Mexico and Central America.

Dr. Gutierrez: I wonder if Dr. Leon would like to comment on the production of South America.

Dr. Leon: The situation in South America is much the same as Dr. Casseres has just described for Central America and Mexico. In other words, potatos are used daily in large quantities but they are very expensive.

Some efforts have been done recently; they have obtained germoplasm from hybrids that will grow at rather low elevations and at heavy rainfall. These potatos have been cultivated in small quantities at altitudes between 600 meters and 800 meters, and of course at right soil conditions. This germoplasm was obtained from white potatos that produce more tubers.

I would like to refer to casava. I was interested in pointing out the fact that although it is a very poor root, as its maximum percentage of protein recorded was 1-2% in a variety in Viet Nam, the roots are an excellent source of protein.

Dr. Adams: With respect most of all to the leaf proteins, I appreciated the comments in this regard. I brought with me some reprint of a recent work upon which I would like to quote:

> "The estimated biological values of leaf proteins were in general lower than values for egg and egg-white, but higher than beef, casein, soybean, yeast, wheat flour, and gelatine. The values for leaf proteins were about the same as those of whole milk, which is a good recommendation for leaf proteins."

These were processed leaf proteins. I should also point out that these are not particularly cheap, but also not particularly complicated in terms of the process. Recent works on engineering systems, make it seems absurdy simple to isolate leaf proteins from a great variety of things. Another thing that was interesting to me was that no matter what leaf protein you pick up, the composition of the protein was very, very much the same.

I would like to point out something about seed production and distribution. We are not unaware of this as plant breeders, but I suppose that we often do take it for granted. It is fundamental to any plant breeder that he knows that the improved variety must be made available. We are not unaware of the importance of this thing, but, Eddie (Echandi), a question occurred to me as you were speaking earlier, and I would like to ask a question to which you may answer or not. Do farmers buy their seed from outside sources? dealers? etc.? Do they in many cases use their own

seed? And if they use their own seed, what is the extent of the problem of disease transmitted in their seed?

With respect to beans and many of the other cereals, a pattern has developed in the United States to produce seed in one location and utilize it in another. And this is because of the problem of seed born viruses, seed-born fungi, seed-born bacteria. I wonder wheter or not you may find an equal situation here, where you can produce seed that is disease-free even though the plant variety was not particularly and primarily adapted to the seed producing region. We will grow breeders' seed, for example, in California, but we dont' produce the bean itself for commercial purposes in California. We import the seed from California.

I would turn to Dr. Schaeffer's comments about Taiwan, which is indeed a model of a change and the characteristic that impresses me associated with this change is the fact that the Chinese who had immigrated to Taiwan from the mainland loves education. He respects education, he tries to get all of as much as he can, he tries to apply it. And what we have seen in Taiwan is a build-up of a fine research group, with many of them trained in various parts of the world and many of them trained in the United States. But no place in the world will find as many people interested in research as you do in Taiwan. I wonder if there is some relationship between these two facts. Thank you.

Dr. Gutierrez: I would like to add my comments about the subject of Taiwan. I think that development is a more conditioned process and Taiwan has been one of the few cases where attention has been paid to all the processes that go into development.

Ing. Jalil: Well, I am just over the same question of Dr. Schaeffer. It is not only that they have solved the problem with soil analysis, and we know what problems they have and the wonderful work they have done in mapping and surveying. But also we have to keep in mind that in Taiwan, as Dr. Gutierrez said, they have one of the most excellent seed laws and regulations that can exist in the Far East. They can use the potential of the soil to increase the production. Thank you.

Lic. Ponce: I would like to add a little more on Taiwan. Perhaps we have forgotten the political circumstances of Taiwan. They were those circumstances that made the United States put a lot of money and effort to change the situation. This is to clarify the impression or to have an idea that it was due to one or two circumstances.

Dr. Echandi: I'll just take a few minutes to answer Dr. Adams' questions. I would say that most of the bean seed that is used in Central America is bought in the markets or in the stores. Very little clean seed is used in these countries. Costa Rica, for instance, uses about 3,000 to 5,000 pounds. Honduras is probably the one that uses more and it is just a little beyond that figure. There are several diseases that are seed-transmitted over here and they are rather important. The matter of seed is handled rather poorly over here and we try to do as much as possible to improve this situation.

There is another point here, that is the places to grow seed, to produce seed. We have already located in Costa Rica an area in which we can produce seed and I am sure that in all these Central American countries we could find places where seed could be grown, free from diseases, and this is being emphasized now.

LA NECESIDAD DE EFECTUAR LA DIVERSIFICACION DE LOS CULTIVOS ALIMENTICIOS

Roberto Egli

First of all I would like to thank all of you for giving me the opportunity to speak on the United Nations Special Fund, Diversification Project, of which I am a member. This Project was initiated and its object is to bring the monoculture of coffee into polyculture. It means that we should produce crops or exportations that could replace or supplement coffee. You will see that probably the activities of our project are a little outside of the terms of reference of this Panel. But maybe it is anyway of interest that you know about it, for many other countries are faced with the same problem that they want to bring monoculture, the coffee, the cacao, etc., into polyculture. There is one program in the planning stage in El Salvador and another in Costa Rica.

The Diversification Project has five foreign technicians. The Project Manager; an Agriculture Economist, an Horticulturist, a Livestock Technician, and an Agronomist. The work is more or less divided between these fields. In the planning of the work of the program, as I told you before, no consideration has been given to human nutrition. The only thing that has been taken into consideration in introducing new crops or cattle enterprises are economic considerations. I will give you a short outline of the work we have been doing up to now.

The bulk of the project is limited to the coffee grown areas. Because of the topography of the coffee growing areas, which are mostly broken areas, none of the basic food crops has been taken into consideration for diversification. The tropical crops with which we are working are the oil crops. We are giving much consideration to the oil palm. This, in our opinion, would be a good crop in the lowland coffee areas and also in some parts of the Polochic Valley. Probably not all the problems have been solved to decide whether large commercial plantations of oil palm should be established or not. But it is likely that if we decide to implement such a project we will combine oil palm production with pasture. These would be quite helpful in the initial stage when there is a low production of palm oil and the branches could be used as cattle food and when the palms come into food production, then it would be probably economic to set processing plants.

Two crops which are of minor importance but which are considered are ricinus and tung. Ricinus, according to the trials we are making now should grow very well in the lowland coffee growing areas. However, this is a crop that has to be highly mechanized and therefore it is doubtful if this would be a good crop for coffee farms and if this is a good crop substitute or to be grown together with coffee. A further oil crop is tung. Tung should grow well here and we may plant it mainly on the very steep lands where no other use can be made of the land for other crops.

Another group of crops with which we are dealing is spices. The conditions in general for spice growing are extremely favorable here in Guatemala. To what we are paying most attention is vanilla. Of course it is a question whether you want to call vanilla a spice, but we have included it in this group. The rather astonishing thing to me when I came here was that Guatemala has never grown commercially vanilla. Then I went and had a look at the vanilla growing areas in Mexico and came to the conclusion that vanilla should grow very well in here. Then, with the help of the technicians of our counterpart agency, which is the Asociacion Nacional del Cafe, we started looking after vanilla; we went rather far inland in the growing areas of Alta Verapaz and there we found good vanilla growing on the wild stage. We are establishing vanilla plantations here on the Pacific Coast. We have now about 50,000 plants and I hope that in less than a years time about 100,000 plants will be planted and then we have to start to give consideration to rather delicate phases of processing the vanilla. This is already under study.

Other spice crop with which we are dealing here is all-spice. All-spice grows wild here, and you can find it especially in Alta Verapaz and in Peten. But it has never been grown as a plantation crop, so mostly by trying the initiative of the farmers they have now started themselves to establish all-spice plantations and the help we are giving is to develop agricultural methods in fertilizing and we would like to develop a good improving system which would force production and facilitate harvest. We are given consideration to black pepper, but only in establishing demostration plantations and cardamome, which is a crop which has already been grown for many years here in Guatemala. We are just giving help trying to intensify cultivation.

In the other field, with which we are dealing is Horticulture. Horticulture expert, Mr. Maranca, who is present here, after studying very well coffee growing zones has come to the conclusion that the

coffee growing areas are not suitable for vegetables. They are areas of very high rainfall and there is no tradition in vegetable growing in these areas and the topography in general is not suitable. Guatemala has areas outside the coffee growing areas which are better suited for horticulture products, therefore, he decided to concentrate his efforts on citrus, mango and aguacate. He has already developed a small citrus project which in its initial stage would improve the supply of citrus fruits here in the local market, which is not satisfactory at present. Citrus fruits are quite expensive here in Guatemala. In addition, he has introduced several other tropical fruits, but these are only introductions which may be developed later for local consumption such as Eugenia uniflora, Eugenia dombeyi, Myrciaria cauliflora, Garcinia mangostana, and certain nuts.

The third subdivision of our project is livestock. There we have already developed two rather ambitious projects. I think that this is the part of the project that may have by far the largest influence on human nutrition in the country. One is a project for milk production and establishing a plant for processing the milk that will be produced. The scope is to help through credit and technical advice about 120 coffee farmers in establishing a dairy entreprise and this milk could then be processed in their plant. The site where this plant should stand has almost been decided, it would be Retalhuleu. It is a small town on the Pacific Coast. Their main ambition is to produce their specially fluid milk and cheese, and if possible to market both of these in the area itself. This area is rather populous.

Another project that we have is to improve and increase bean production. This project will be located rather in the Eastern part of the country. This is rather drier than the Western part, which we had selected for milk production and the scope also is to finance large number of farmers for the improvement or establishment of beef industry and the establishment of other products which have been produced for local consumption as well as for exports.

These are in a very short way the main activities that our project has been carrying out. We have also already prepared a project for pea production in the Alta Verapaz area. We hope that we can start the subprojects, at least during the life of this project, and to put them on their way so that they can be carried on by the counterpart agency which is Asociacion Nacional del Cafe.

That is all I have to say. Thank you.

Documento presentado por el Ing. Roberto Egli

Número 1

ACTIVIDADES DEL PROYECTO FAO/ANACAFE DE DIVERSIFICACION DE CULTIVOS

a) Introducción

El presente informe resume en una forma muy breve las actividades del Proyecto de Diversificación. Su objetivo es el de dar una idea de la labor cumplida y de los proyectos para el futuro.

b) Actividades del Proyecto

El Proyecto se inició en octubre de 1964, pero fue en abril de 1965 que todos los expertos extranjeros se encontraron en el país y que el Proyecto empezó a funcionar plenamente.

El Proyecto consta de los siguientes técnicos extranjeros y guatemaltecos:

Sección	Experto Extranjero	Experto Guatemalteco
Director	Dr. D. L. Downie	
Co-Director		Dr. C. E. Fernández
Cultivos Tropicales	Sr. R. Egli	Ing. E. González
Horticultura	Dr. G. Maranca	Agr. M. Arana
Ganadería	Sr. R. Hewson	Lic. C. Rodríguez O. Cordón
Agronomía Agrícola	Dr. K. W. Berg	Ing. R. Osorio

Además, en los últimos meses fueron nombrados Asistentes de Campo para las siguientes secciones:

P. A. Marco A. Monterroso-Sr. R. Hewson - Pastos y Forrajes
Sr. César Reyna -Sr. R. Hewson - Pastos y Forrajes
P. A. Marco Antonio González - Dr. G. Maranca - Horticultura

Según esta distribución de especialistas, las actividades del Proyecto se pueden dividir en las siguientes tres ramas:

a) Cultivos Tropicales
b) Horticultura y Fruticultura
c) Ganadería

El Economista Agrícola se ocupa de los problemas económicos de todas estas ramas:

1. Cultivos Tropicales

a) Plantas estimulantes

i) Té: en abril de 1965 se establecieron dos viveros con semilla introducida de Malawi, Africa.

Las plantas han crecido muy bien y durante el mes pasado se establecieron, con plantas seleccionadas de estos viveros, huertos de té para producción de semilla, que producirán la semilla necesaria para establecer en el futuro una industria de té en Guatemala. Se ha elaborado un Proyecto Piloto para el establecimiento de una industria de té con planta procesadora en la región de Cobán, Alta Verapaz. Una pronta realización de este Proyecto exigiría la importación de grandes cantidades de semilla de Africa.

b) Plantas Oleaginosas

i) Se ha prestado mayor atención a la palma Africana. En marzo de 1965, se importó semilla de Nigeria, Africa, la cual ha sido sembrada y germinado aquí. Actualmente hay tres viveros de palma Africana cuyas plantas se trasplantarán en mayo-junio 1967, al campo.

Estos viveros comprenden plantas para plantaciones comerciales y material genético para una futura producción de semillas en el país.

Actualmente se están proyectando las posibilidades de importar grandes cantidades de semilla para establecer plantaciones comerciales sin tener que esperar la producción local de semilla.

ii) Higuerillo: se han introducido 14 variedades de semilla que se están propagando. La segunda generación se plantará este mes.

iii) Tung: Existen tres viveros de Aleurites fordii y A. montana. Estas plantas se plantarán en el lugar definitivo dentro de unos 8 meses.

c) Especies

i) Se está dando mayor atención a la Vainilla. Se han traído grandes cantidades de material vegetativo de vainilla de Alta Verapaz, que han sido plantadas en la Costa del Pacífico en las regiones de San Antonio Suchitepéquez y el Tumbador, San Marcos. Actualmente se está dando asistencia técnica a los cultivadores de vainilla y se están estudiando los problemas de establecer en estas regiones los beneficios necesarios para elaborar el producto.

ii) El Proyecto se está ocupando en menor escala también de las siguientes especies: pimienta (Piper nigrum), pimienta gorda, nuez moscada, cardamomo y jengibre.

d) Plantas Medicinales

i) Quina: Este cultivo ya tiene una cierta tradición en el país. El método empleado de injertar Cinchona ledgeriana sobre C. succirubra, no parece económicamente sostenible. Por esta razón se ha importado de la República del Congo, Africa, semilla de C. ledgeriana y se han establecido dos viveros. Se espera obtener de éstos, unas 100,000 plantas que servirán para plantaciones de demostración y para producción de semilla.

ii) Papaya: se han establecido con semilla local y semilla importada de Kenya, Africa, dos plantaciones de papaya que se espera explotar para la producción de papaina.

c) Plantas Productoras de Tanino

Se ha importado semilla de acacia negra (Acacia decurrens). Este árbol cuya corteza tiene un alto tenor de tanino se está propagando en semilleros situados en varios sitios de las zonas cafetaleras.

2. Fruticultura

El experto ha hecho estudios en todas las regiones cafetaleras con vista a establecer prioridades entre los frutales que merecen mayor atención. Se llegó a la conclusión que la citricultura es el ramo más prometedor al que debería dársele prioridad absoluta; en segundo lugar siguiendo el mango y en tercero el aguacate y frutas tropicales menores.

a) Cítricos

Como principal centro para el desarrollo de la citricultura, especialmente el naranjo y en escala menor las limeras y limoneros, se ha escogido la región entre Pajapita y Mazatenango con centro en Coatepeque.

En vista del peligro que representa la posible introducción de la "tristeza", se ha importado de Brasil y Estados Unidos, semilla de patrones tolerantes a esta enfermedad. Con esta semilla se han establecido viveros en las siguientes regiones: Coatepeque, Los Brillantes, Bárcena, Chiquimulilla, San Miguel Dueñas y Seamay.

Como material de injerto se han importado varias especies y variedades cítricas de la Escuela Agrícola Panamericana, Zamorano, Honduras.

Actualmente se dispone de 15,000 patrones de varias edades que van injertándose y de 20,000 patrones recién germinados.

Se van a establecer próximamente huertos de demostración de cultivos cítricos en San Miguel Dueñas y Coatepeque.

b) Mangos

Como centros de producción se han elegido las regiones de Chiquimulilla y la de Colomba. En estas dos regiones se dispone de 6,000 plantas injertadas con material vegetativo introducido del Zamorano, Honduras. Además, 3,000 plantas serán injertadas próximamente y unos 10,000 patrones están recién sembrados.

En la región de Colomba se ha establecido un huerto de demostración con plantas injertadas introducidas de Honduras y el Brasil.

c) Aguacate

Este cultivo es más bien indicado para las zonas más altas. Se han establecido semilleros con semillas de producción local y semillas importadas.

Alrededor de 2,000 plantas ya están injertadas con material importado de Honduras. Además, hay un semillero de más de 2,000 plantas recientemente establecido. En Nuevo San Carlos se está estableciendo un huerto de demostración con plantas importadas de Honduras y Brasil.

d) Frutas Tropicales menores

Viveros de varios otros frutales tropicales de menor importancia se han hecho en la región occidental de la costa del Pacífico y en la de Chiquimulilla. Estos frutales (Eugenia, Hyrciaria, etc.), se destinarán a la distribución para consumo local.

3. Ganadería

En las zonas cafetaleras de Guatemala existe un buen número de explotaciones ganaderas y ya se cuenta con una cierta experiencia en el ramo, tanto para la producción de carne como de leche. Es por esta razón que el Proyecto, después de investigaciones adecuadas en las zonas cafetaleras, está concentrando sus esfuerzos en organizar y ampliar este ramo a través de proyectos de desarrollo.

Están en una fase avanzada de preparación un proyecto para promover la producción de leche, principalmente en la zona occidental del Pacífico, y uno para la producción de carne, principalmente en la zona oriental del Pacífico.

En estos días se espera un Experto en Industria Láctea,

Para obtener algunos datos técnicos necesarios a la implementación de estos proyectos, se han establecido unos veinte ensayos de campo sobre rendimiento de especies o variedades de pastos y leguminosas y la respuesta de algunas de estas especies a la fertilización. Estos comprenden:

a) Ensayos de Adaptabilidad

Ensayos de adaptabilidad con Pangola (Digitaria decumbens, Signal (Bracharia brizanta), Estrella Africana (Cynodon plectostachyus), Angleton (Adropogon nodosus) y dos sorgos híbridos en las fincas: Santa Rosa Sumatan, Yepocapa; San Julián, Patulul; La Victoria, Cuyotenango; Cafetal Hamburgo, San Felipe Retalhuleu; Monte Grande, Coatepeque; y el Tránsito Bolívar, Colomba.

b) Ensayos de Fertilización

Efectuados con pangola usando cuatro niveles diferentes de nitrógeno en las fincas: Variedades, Santa Bárbara; El Carmen, Colomba; Monte Grande, Coatepeque; y Moca, Santa Bárbara.

c) Ensayos con sorgos forrajeros

Se están evaluando 5 híbridos de sorgo x sudan en las siguientes fincas: El Paraíso, Barberena; El Zapote, Barberena; La Pastoría, Barberena; y El Prado, Pueblo Nuevo Viñas.

d) Ensayos de adaptabilidad de las siguientes leguminosas tropicales; Centrosema pubescens, Calopogonium mucunoides, Pueraria phaseoloides, Glycine javanica, Stylosanthes gracilis, Leucena glauca y Stylosanthes humilis, se están llevando a cabo en las fincas: Variedades, Santa Bárbara; Monte Grande, Coatepeque; Panamá, Santa Bárbara; San Sebastian, San Miguel Dueñas; El Estor, Izabal.

4. Actividades del Economista Agrícola

a) El primer trabajo emprendido fue un estudio detallado de 95 fincas en la región de Retalhuleu. El objetivo de esta encuesta fue establecer los factores que determinan la marginalidad económica de ciertas fincas cafetaleras. Se encontró que el factor manejo es el mas importante, siendo más decisivo aún que la altitud para la economía de la finca.

b) Varios estudios generales se llevaron a cabo sobre los aspectos económicos del cultivo del Té, Cacao, Ricino, Tanino, Papaya, Cardamomo y Hule.

c) Varios análisis se realizaron sobre los aspectos económicos de la producción de lechones hasta 50 lbs. en la Finca Esmeralda.

d) Otro estudio llevado a cabo trata de los costos de establecimiento e ingreso aproximado de una plantación de naranjas en el área de Coatepeque.

e) Durante la primera mitad del año 1960, el trabajo se concentró sobre estudios de las posibilidades económicas del Proyecto Lechero.

Los siguientes informes se terminaron:

i) Estructura Agrícola de Guatemala con referencia especial al área del Proyecto Lechero. Este informe contiene datos sobre:

La extensión de tierra plantada con diferentes cultivos, su producción e importancia relativa en las diferentes áreas del país. La población rural y mano de obra en las diferentes áreas. Capital agrícola y sus distribuciones según los diferentes cultivos, así como según las diferentes áreas. Uso standard de maquinaria agrícola para diferentes cultivos. Sistemas de tenencia en Guatemala incluyendo distribución de los ingresos de acuerdo con la extensión de las fincas. El desarrollo de la producción de productos para consumo local y exportación entre 1950 y 1962.

Diferentes tipos de manejo de fincas.

ii) Programa Nacional de Crédito Agrícola incluyendo los requisitos de los Bancos para financiar las operaciones de los finqueros y cantidad del crédito otorgado según las diferentes operaciones agrícolas entre 1961-1964 y su relativa importancia.

iii) Condiciones generales del sistema de la comercialización de la leche y derivados, incluyendo la estructura de precios.

iv) Estudios de "input-output" a nivel de finca en la Hacienda Monte Grande sobre las operaciones de caña de azúcar y ganado.

v) Costos aproximados para el establecimiento de pastos. Los costos fueron calculados para tierra plantada de café, monte secundario, monte y además para los casos en que la limpia es efectuada por el finquero o la tierra es dada en arrendamiento a los obreros.

vi) Estudios sobre el Proyecto Lechero que comprenden:

* Gastos de Inversiones e interés aproximados según diferentes niveles de interés y tamaño de la explotación.

** Costos aproximados de mano de obra según el tamaño de la explotación.

*** Costos aproximados de las raciones de concentrado.

5. Becas

Una de las funciones importantes de cualquier proyecto del Fondo Especial de las Naciones Unidas es la de formar personal técnico capaz de llevar a cabo las labores iniciadas por los Proyectos.

En el Proyecto de Diversificación cada Experto trabaja con un técnico Guatemalteco y el Experto en ganadería tiene dos contrapartes. El Proyecto prevee la otorgación de becas a estos técnicos para perfeccionarse en el ramo respectivo. Al momento, la situación a este respecto es la siguiente:

1) El Lic. Oscar Cordón, Técnico en Producción Animal está actualmente estudiando, desde el mes de enero de este año, en Texas, U. S. A. Se espera su regreso para enero de 1967.

2) El Lic. Carlos Rodríguez, Técnico en Manejo de Pastos, iniciará estudios en Puerto Rico y después en Jamaica durante el mes de octubre próximo.

3) El Agr. Mario Arana, Técnico en Horticultura, iniciará estudios de Fruticultura en Florida, en el mes de septiembre del corriente año.

4) El Ing. Roberto Osorio, Economista Agrícola, partirá en octubre de este año para el Reino Unido, para especializarse en mercadeo y comercialización de productos agrícolas tropicales.

5) El Ing. Esteban González, se va a especializar en cultivos oleaginosos. El irá en enero de 1967 por un período de 6 meses a Paris a estudiar en el Institut de Recherche pour les Huiles et Oleagineux y luego visitará la República de la Costa de Marfil.

Guatemala, agosto 8 de 1966.

PROYECTO DE DIVERSIFICACION DE LOS CULTIVOS EN GUATEMALA

El objetivo del Proyecto del Fondo Especial de las Naciones Unidas para la diversificación de los cultivos en las áreas marginales de cultivo del café es el de introducir nuevos cultivos y explotación ganadera que puedan reemplazar o complementar el cultivo del café.

Este Proyecto se inició en el mes de octubre de 1965 pero solamente se empezó a trabajar efectivamente en el mes de marzo/abril de 1966.

En la planificación del trabajo del Proyecto, no se ha dado ninguna consideración a aspectos de nutrición humana, sino que se han tomado en consideración solamente factores económicos para elegir cultivos susceptibles a dar buenos resultados en las diferentes zonas cafetaleras. Sin embargo, varios cultivos que se están tomando en cuenta tendrán sin duda alguna influencia marcada sobre la alimentación de la población de ciertas regiones de Guatemala. Por el hecho que las actividades del Proyecto están limitadas a las zonas cafetaleras del país, que en su mayoría tienen una topografía quebrada, no se ha podido tomar en cuenta el cultivo de plantas anuales para evitar los efectos nocivos de la erosión y por consecuencia el plan de trabajo del Proyecto no incluye ningún cultivo de alimentos básicos.

Las actividades del Proyecto se pueden resumir de la siguiente manera, considerando los efectos que podría tener sobre la alimentación humana.

1. CULTIVOS TROPICALES

a) Oleaginosas

Se está trabajando con los siguientes cultivos:

Palmera Africana (Elaeis quinensis)

Higuerillo (Ricinus communis)

Tung (Aleutites montana, A. fordii)

Entre estos cultivos la palmera africana podría en un futuro constituir un importante aporte a la nutrición humana del

país. Esta planta produce buen aceite comestible con considerable contenido de carotenoides que constituiría un valioso suplemento a la fuente de aceites vegetales del país que consisten casi únicamente en aceite de algodón.

b) Plantas estimulantes

Los estudios para implementar una industria de té en el país están en una fase avanzada. El producto de este cultivo será destinado en su mayoría a la exportación pero no está excluido el que la disponibilidad del té a buen precio aumente el consumo interno.

c) Especies

Se está contemplando el cultivo en mayor escala de las siguientes especies y condimentos:

Vainilla
Pimienta negra
Pimienta gorda
Cardamomo

El fomento de estos cultivos tiene como objeto la exportación. Se ignora hasta que punto la disponibilidad de estos productos pueda influir sobre la alimentación humana.

2. FRUTICULTURA

En esta rama se ha decidido concentrar los mayores esfuerzos en los siguientes cultivos:

Cítricos
Mango
Aguacate

El objetivo inmediato de los proyectos en ejecución es el de crear centros de producción con el fin de abastecer mejor y además a precios favorables la demanda del mercado local. Los objetivos futuros tienden a la exportación ya sea de fruta fresca o productos industrializados.

Además, se están introduciendo otras frutas tropicales tales como Eugenia uniflora, E. dombeyi, Myrciaria cauliflora, Garcinia mangostana y ciertas nueces destinadas para consumo local.

3. GANADERIA

Esta es seguramente la rama del Proyecto que podrá tener la mayor influencia sobre la alimentación humana en el país.

Se encuentra ya en una fase adelantada de preparación un proyecto para promover la producción de leche y otro para la producción de carne.

a) Proyecto de productos lácteos

Este proyecto se localizará en la zona occidental del Pacífico. La meta es promover la producción de leche en esta región por medio de créditos a los finqueros interesados y asistencia técnica que incluye la introducción y propagación de plantas forrajeras adecuadas para esta zona. La leche será elaborada en una planta a construirse en Retalhuleu. Se preve principalmente la producción de leche fresca, ya sea pasteurizada o esterilizada y quesos. Se espera que la mayor parte de la producción se podrá vender en la zona del Proyecto que ya tiene varios centros urbanos de cierta importancia y de esta manera mejorar sobre todo la nutrición infantil en esa región de la República.

b) Proyecto de producción de carne

Los esfuerzos para mejorar la producción de carne se localizan sobre todo en la zona cafetalera oriental de la costa del Pacífico. La meta de este Proyecto es de mejorar la producción de carne por medio de crédito y asistencia técnica además de la instalación de mataderos en puntos estratégicos que garantizan una distribución de carne higiénica para el mercado local y facilitarán la exportación de carne de buena calidad.

DISCUSION

Dr. Behar: In the English version of the abstract, in the last paragraph, you asked to what extent the availability of this crop can influence human nutrition. I think that this can be extended to the afore presentation by saying that I think they do influence very directly on the economical point of view. It whould not be neglected. And influencing the income of the population will very much influence human nutrition even though the credits may not be directly related to human nutrition. From the economical point of view, I think that would be extremely helpful. Now let me ask another question that I would like to put together. On the oil seeds we know that they say that shortage of oil seeds is becoming more severe as the cotton prices are going down and the cotton cultivation is being reduced and there is even a greater shortage of oil seeds. And I would like to ask you why soybean was not considered among the oil seeds that are listed here. And this I am asking because I am particularly interested in the advantages of soybean because in addition to the oil you can of course utilize the cake as an excellent source of protein, as a protein concentrate. You say here that the African palm could interest human nutritionists by the high content of carotene in the oil. This is true, but unfortunately, we know that at least in this area people will not consume non-refined oil. The oil, if it is going to be consumed, has to be refined and then without any carotene. And the last question is on the milk production. You say here that technical assistance would or will include the introduction and propagation of forrage plants adequate for this zone. I wonder why you emphasize the introduction when there are, I think, a lot of forrage plants locally available, which are just not known. Shouldn't we include the study of forrages which are locally available? In the limited experience that we have in analyzing them, some are much better than the ones being introduced as forrages, and they have just not been studied. And the emphasis is always made on bringing from the outside forrages instead of trying to see what we have locally that could be better utilized.

Dr. Egli: The first question about soybeans is purely technical. This means that in the coffee growing areas we practically can not have other crops while we have to plow, because of the erosions. You see, if you go through the crops that I have mentioned here, you will see that consideration has practically been given only to annual crops, for the erosion in the coffee areas, we work only in the coffee areas. And the second question. I had prepared my

short abstract in Spanish, maybe I was not too exact in that. We are already given consideration to the crops existing here.

Ing. Aguirre: My question is regarding your project with new production. I wanted to ask you if you had already decided as, you probably have, since the project seems to be fairly advanced, on what breeds of cattle you will be utilizing in that particular area. I would like to give this suggestion that probably has already been considered. One of the very definite advantages that we know in livestock industry today concerns to the use of artificial insemination, and I would certainly hope that you would have already considered the possibility of using this type of facility, since you seem to be considering a localized area. Perhaps this would offer an extremely good opportunity of giving a show of what artificial insemination can do on milking breeds of cattle. Therefore, I would appreciate if you had more comments on this line. I know that Dr. Peterson and Dr. Dracy will agree with me on this problem that you would be facing there as far as deciding upon the right size for commercial operation, as far as dairy cattle is concerned. And probably the problem you would face is on transporting and distributing this milk, but since a plant is going to be established in Retalhuleu, this probably will not be too much of a problem. But as far as livestock for meat production, the area is well suited for it. It is one of the main producing areas in Guatemala and I am sure you won't have as many problems in that line. However, I am hesitating and I would like to question you concerning your breeds for dairy cattle.

Ing. Fonseca: I would like to add a little about this dairy project which seems to me very interesting due to the account of being in the lowlands. I think that more of a definite project should be taken in order to have success with a dairy project in the lowlands. We have the experience that the lowlands are usually due to the high temperatures, high moisture, not adaptable to the specialized European breeds of dairy cattle. This was shown not very long ago in the area of Costa Rica, when the volcanic ashes from the Irazú moved most of the dairy herds up from the mountains into the lowlands. Most of these herds were Holsteins and Jersey breeds. Of course, they had a lot of problems in adaptation, and there were many deaths due to different diseases such as piroplasmosis, anaplasmosis, and especially they were highly attacked by "tórsalo". In some ways, management was one of the counterparts to these problems and there are some herds which are right now producing and I would say they are performing quite well. However, as we

know, we can not just expect to produce milk from just plain forages. We need to supplement the dairy cow with concentrates. And these areas are not concentrate producing areas. In other words, they are not grain producing areas. So the feed has to be carried from very far away, many miles away from these areas and this implicates a raise in the cost of milk production. I would like to know what have you taken into account in order to overcome all these problems which I have just pointed out in respect to adaptation, control of diseases, parasites, and specially to nutrition of this cattle. We know that dairy cattle are more susceptible to a lack of malnutrition than beef cattle which can graze although it takes quite a while for them to grow, but they can still very well hold on for a longer period of time, rather than the dairy cattle which are more critical in their nutrition if you want a good production from them.

Dr. Shaw: Have you made a study of the potentiality in terms of sales for fluid milk taking into consideration the home refrigeration situation in the area and at what price?

Lic. Ramírez: I think about the program and I saw the resistance to change of some of these producers. How are you coping with the situation to substitute the present cultivations? I noticed that most of them are long term investments, and also the solution of the liquidity problems of this kind or producers. Are they small producers and large scale producers?

Lic. Ponce: You have mentioned in the list that you intend to produce higuerilla and I wonder where do you intend to sell this higuerilla. What amount do you intend to produce? Where is the main market? In previous experience we had in Central America the request for higuerilla was so high that it was just impossible to produce them in a short space of time. I am just curious how are you going to cope with this problem, if you had it anyway.

Dr. Egli: I would like to ask Mister Klaus Berg to come here. He is the Economist of our Project and might be helpful in answering some questions. The first question was about the breeds. We have considered it according to altitudes. The Holstein in the higher altitudes, Brown Swiss in the middle, and in the lowlands Brahman. The area that we have chosen in Retalhuleu is ecologic exceptional. There we have areas with up to 5 000 mm of rain with an extremely good distribution. All year round there are areas which have only 2, 3 or 4 months of dry season, so that there the question of

reaching the dry season with concentrates is a minor problem compared to other areas, However, we have found that we have to use concentrates to have a reasonable milk production, and the situation is being studied and the main components would of course be cotton, cake, sugar molasses and maize, for the concentrates. This is under study.

Now the questions of marketing aspects and refrigeration. In this project we will have only relatively large producers. We intend that no unit of milk production should be less than a caballería, which is about 45 hectares. And under these circumstances refrigeration would be possible and as the road system is not very satisfactory, we can deal only with large producers and we will not be able to deal with people who produce 10, 20, or 30 liters of milk, The smallest unity of production should be 300 liters a day. This is a big problem and probably a limiting one. We are giving serious consideration to the buying capacity of the population of this area and if not all the milk can be consumed in that area, we still can try to sell part of it in the market in the city. But the primary objective would be to increase milk consumption in that particular area. We are fully aware that this is one of the most important problems. This consumption study is being carried out now for our Project by the Universidad de San Carlos and we hope to have the results in about two months time. This, of course, will be the basis for the projection of the plant and also of the whole milk scheme.

I want to refer to the question of the resistance to change habits. In general, for the project as a whole, we can say that we do not expect that the coffee farmer will pull out much coffee and plant other crops. Our workers in the project area, there are all large fincas and most of them have some portions, and other fincas have large areas of land that are not in use and that can be used for pasture. In our project we don't hope that we will replace much coffee, we can only hope that through the introduction of new activities, onee coffee prices really get bad, they will have in these additional activities an economic basis.

In reference to the higuerilla and the ricinus, we have made a market study and consumption is rather high because ricinus has now many industrial uses. France has become a very large consumer, for they use it for synthetic fibers. There is a small local market interest and we will have to compete withe the world market. Therefore, I said that ricinus is a crop that can have

a future here only if it is established in a way that it can be highly mechanized. I would say fully mechanized. Then, that means low production costs. We can say that this will be a good crop for Guatemala in the future. Now we are still in the trial stage.

Dr. Chichester: I am still a little concerned with Mr. Shaw question about the distribution of the milk. Did you say that this was going to be pasteurized milk?

Dr. Egli: This is now under study. Pasteurized or sterilized. Dr. Meharry can help me, he knows about it.

Dr. Meharry: Yes, with modern technology we are thinking in terms of sterilizing the milk. This of course makes the milk a little bit more expensive, but it will mean a delivery once every week or even more. This will depend on the results of Dr. Bressani's studies.

Dr. Gutiérrez: We'll adjourn until tomorrow morning and I want to thank you for your participation.

SEXTO TEMA

TECNOLOGIA DE LOS ALIMENTOS

Moderador: Dr. R. Bressani

CONTRIBUCION DE LA TECNOLOGIA DE LOS ALIMENTOS AL MEJORAMIENTO DE LAS FUENTES DE PRODUCTOS ALIMENTICIOS

Dr. C. O. Chichester

Dr. Bressani: May we have your attention please. Dr. Chichester will begin the discussion of this morning with the role of Technology in Increasing both the quantity and the quality of food for the Central American population.

Dr. Chichester: Thank you. I thought that perhaps I might be fairly general this morning. I will try to place food technology, as I see it, in the context of supplying nutrients to a population, so as to extend as far as possible the available supply. Actually food technology has existed almost as long as man. Early man was tied to his food supply since he had to eat at fairly regular intervals. As a hunter, if he could not consume his catch before it spoiled, the remainder was lost to him. Sometimes I wonder if we are far from this at present. Man was and still is confined to areas that will yield his food supply to him on a continuous basis throughout the year or else he had to move with his food from area to area. Formerly populations were small, and other than an occasional famine, forest fire, or what have you, there was a relative abundance of food.

Perhaps the earliest technology that man developed was that of drying. Grains, fruits and other vegetation can be dried rather easily with sun. Within limits this reconstitutes easily to an edible product and has a relatively long keeping life. This technology was carried on without the intervention of man for many years and probably supplied a reservoir of food, to carry groups of people across the earth. At some point in time it was discovered that flesh foods could also be dried, and these could be kept for a

moderate period of time. It is also likely that under suitable climatic conditions freezing, as a method of food preservation, was discovered. In these primitive processes the food supply available to an individual or group was increased, since it meant the utilization of the available food was increased and effectively the waste of nutrients was decreased. The development of other operations such as smoking, which is a modification of drying, was probably another discovery that early man made. The process of smoking is a combination of chemicals with a low moisture environment that decreases the susceptibility of materials to microbiological spoilage. This represented the first use of chemical preservatives in food preservation.

Natural fermentation, allowing a microbiological agent to invade the food, is another method of preservation. In this case the microbiological organisms consume a part of the carbohydrates and some of the proteins that exist in the food. Nevertheless, the overall object is to preserve a food supply. Thus, we have a series of practices for stretching the food supply of an individual or group. This in effect makes man more competitive with his environment. It was only in the 1890's that large scale thermal processing of food was developed, and only within the last twenty years that the process of radiation has come upon the scene.

Food technology or food science in a broad sense then concerns the handling of food materials from the point of production to their ultimate consumption. Its concern is the transportation, processing, packaging, and marketing of food as unit operation. I stress particularly marketing here because I believe that within fairly broad limits food technology is concerned with the delivery of food to the consumer, since if one does not deliver to the market or there is no one willing to buy, there is no reason to consider producing or preserving food.

It is interesting to note that in Central America as well as the rest of Latin America, approximately 30% of the food materials which are produced or grown are lost. In these countries approximately 20% is lost to the consumer before it leaves the point of production. The other 10% is lost through poor or inadequate marketing. Yet if one looks at the more sophisticated countries one finds that almost the same amount is lost. The losses in production and marketing are smaller, but a higher percentage of loss is found in the non-utilization of products, due to selection,

both at the manufacturing level and at the consumer level. In effect, this loss is transferred from the farm to the consumer who then makes up his mind whether or not he will eat something. At least in this case the food material is available to the consumer. In the latter case the food is lost before it gets to the consumer, it is a loss without retrieve and no choice is left to the consumer. In the area of preventing wastage on the farm, the food technogist while he can ake some contribution, is not in a position to do a great deal. The agriculturalist, the agronomist, the horticulturist, works in this area. They make use of pesticides, develop local storage, and promote better transportation, which contribute to the prevention of wastage in the farm unit. All of the developments for the prevention of wastage are available but their application, as we have heard several times, requires a significant change in both political and economic planning.

One of the areas that I think should be stressed here, which is close to food technology, is the effective use of extension service people. If one is to produce food and then process it, it is extremely important that the food materials that are delivered to market or to the processor be of a quality and of a quantity that can be effectively utilized. Although many processors, when they are large, conduct their own extension work, in the genesis of the food industry, governmental or agricultural units must take this responsibility. I cannot stress enough, at least from my own experience, the value of extension people in preventing wastage on the farm, and aiding the delivery of raw materials to the processor of a quality required for processing. Without an effective extension service it becomes very difficult to deal with the small producer.

The problems of marketing are also in the province of food technology, and are the subdivision of unit operations in technology. I think that perhaps the example which is often cited, but is a valid one, is the marketing of meat products. The small abattoir is an extremely wasteful unit. The yield on a per carcass basis of edible material or perhaps the utilization of potentially saleable material is much less than 50%. By increasing the size of the unit operation, the slaughtering house, vast economies by reclamation can be achieved. It becomes economical to recover by-products such as blood, bone meal, fat, etc. but even here the ultimate in economical and non wasteful operations has not been achieved. In Europe and the United States we still distribute large sections of meat to the local market which require final

local reduction to a consumer unit. This entails a certain amount of waste for which the consumer has already paid a high price in the conversion efficiency of plant protein to animal protein. If one calculates the efficiency of converting leaf proteins to animal proteins, not from the standpoint of animal weight but rather from the conversion of plant protein to that used by the consumer, a figure of 15 to 20% is not unusual and in many cases is considerably less. In effect, we have cut the availability of the food by subdividing the operation so far that in every subdivision a loss is taken on the food that is available to the ultimate consumer. Thus, in this area food technology can make a contribution to increasing the availability of food or food materials by merely reducing the wastage that already exists.

Another important area of concern to food technology, I believe, is the manipulation of available resources so that maximum benefit to man is realized. The combination of plant protein sources to more effectively utilize the proteins that are present is well known -- Incaparina is one of the products that has been extremely successful. Although great strides have been made in this area, I think that a great deal of work still remains to be done. I personally do not believe that we have a combination food material today which makes the ultimate use of the plant materials available and simultaneously is a really satisfactory food, from an organoleptic viewpoint. The field can be extended considerably in this area.

The technique for producing texturized products from plant protein isolates has just been evolved. As technology in this area develops, the cost of producing isolated protein should decrease. Products derived from the isolated protein rather than the mixture of plant proteins have some very desirable characteristics. Consider, if you will, a synthetic meat material which has the texture, the flavor, the color and the cooking qualities of meat. Vegetable proteins by proper use of technology are susceptible to being presented to the consumer in a most appetizing and esthetically pleasing form.

One other area that I think food technologists should look at is the possibility of the development of new sources of plant protein. As was cited yesterday by Dr. Leon, Quinoa is an example of one, since it is a cereal grain that has a high biological value in its protein and has not been used extensively. I think, though, that there is considerable work to be done in investigation before this

type of material can be utilized effectively. For example, Quinoa has some of the disadvantages found in similar plant materials. It possesses saponins in its outer seed coat which are very bitter and unless these can be removed effectively, the products made from Quinoa are not very tasteful.

Another area in which food technology can make a very great contribution is in the better utilization of marine protein sources. Fish farms have been in existence for many years, and it's probable that some expansion of these can take place in Central America. A number of agencies have developed methods of producing fish protein concentrate from fresh fish which offers the possibility of an excellent protein source at moderately low cost. However, there is a great deal more technological research that must be performed in developing the most effective method of utilizing these proteins in food materials which the consumer will eat. I am sorry that the paper which was supposed to be given yesterday on sea resources was not presented. I hope you'll pardon me if I cover a little bit of that area.

In many areas, and particularly in Central America, there isn't enough thought given to the source of protein or food from the sea. In 1954 the harvest from the world oceans was approximately 25 million tons. In 1964, it was approximately 45 million tons. But in the intervening ten years research indicated that the resources of the sea of the same type that were being harvested either at 25 or 45 millions tons per year, was approximately 2 billion tons. Thus, even in 1964 we were taking from the sea only 4% of the production that it is capable of sustaining. The utilization of the increased yield available is of course, I think, well within the province of the food technologist. The world population consumes about 20 million tons of fish protein. The world consumption of protein at the present time is around 160 million tons. Obviously, the sea alone could well supply all the proteins needed for humans for the next 20 to 40 years, without utilizing any animal protein at all. The speed with which a sea resource can develop is almost without parallel. Probably the best example is Peru, which was almost a non-fishing country in 19 4 and by 1964 was the largest fish producer in the world, accounting for 20% of the total production of the world oceans. The development of a fishing industry depends largely upon the fishery resources available to the area, and Central America has a very interesting resource in Costa Rica and the Dome Honduras shelf which are highly fertile and have very large marine resources.

Another area that I would like to cover is the one in which one might expend the availability of protein of various food materials by the direct incorporation of the missing amino acids. The enrichment of cereal grains with vitamins is a long-accomplished fact. The enrichment with amino acids should be no more difficult to work out, although the feasibility of using this of enrichment is dependent upon a central marketing system or method of distribution. The magnitude of the effect of adding amino acids to our presently available grains has been commented on by many people. If one fortified wheat with 2/10 of 1% of lycine, the protein quality would be increased by 50%. If one calculates this on the basis of 10 million tons of wheat, the effect would be equivalent to adding 500,000 tons of protein to the supply, a truly significant increase.

In the same light, all materials which are traditionally eaten and are in short supply can be stretched. For instance, in Central America there is predicted a shortage of milk. It is a technological possibility to extend this milk supply. The question then is whether one develops a synthetic product to compete directly with milk or, with government's blessings, stretch the available supply of milk by the addition of proteins of similar biological quality and the addition of vegetable fat. If we have only 75% of the supply of milk we require, we can add material to the milk -- proteins and fats -- which will not materially change the flavor of the milk and will stretch the supply to cover the other 25%. This is not done at present in most countries since the dairy groups object to the utilization of non-dairy products in milk. The same technique can be applied to many other products. For instance, it is possible to apply the stretching technique to meat products such as sausage or ham.

There are the more exotic changes which may be made by applying advanced technology to the food supply. The conversion of other materials to food, such as hydrocarbon or the synthesis of amino acid, represents a technological conversion of simple nitrogen sources to utilizable amino acid compounds and the incorporation of a supporting carbonatious skeleton. When one envisions the production of protein from crude oil, one does not simply convert the crude oil to protein, but rather utilizes an organism which can use a simple nitrogen source such as ammonium sulfate, to build protein with basic carbon skeleton of the hydrocarbon. One does not produce protein from petroleum, one uses the petroleum only to produce the carbon skeleton and a simple nitrogen source to make the amino acids. This concept can be extended. It might

be possible to adapt rumine microorganisms to protein production, using as an energy source cellulose, outside of the rumminant. Lignin could also be chemically modified so that they could be used by microorganisms. In any of these processes, the microorganisms must be tailored to produce a protein which then can be ultimately consumed by animals or man. But I would stress this, the mere production of a protein product such as fish protein concentrate or proteins derived from hydrocarbons does not in any case mean that a food material has been produced. The food technologist must be concerned in this case, not only with producing the raw materials but in the conversion of essentially a non-edible raw material to an acceptable and asthetically pleasing food.

In short, the food technologist can very effectively contribute to the solution of food problems in a number of ways. The further development of preservation processes in order to spread the available food over a time span thus avoiding gluts of food at one time and shortages at another. This would include the developing of marketing facilities which would make the food more available to the consumer. It would also, in my opinion, consider the interchange of food materials between countries and the problem of developing an export market. Secondly, development of food materials or mixtures which are palatable, acceptable and yet combined show synergistic effect of their nutrients. Thirdly, the development of a technique which would make the maximum use of the resources we have available. That is, the better development of technological processing units which economically recover by-products normally lost to the consumer. The development of new processes for the production of protein or energy from materials which are not yet utilized or utilized to their fullest extent such as the sources of the sea. Fourthly, the further development of biological processes for the conversion of carbon chains and simple nitrogen compounds to proteins, amino acids, carbohydrates and lipids, which would ultimately be converted to a food material. Fifthly, the development of processes of producing food materials without the intervention of direct biological processes, for example the synthesis of amino acids or carbohydrates by chemical means.

Dr. Bressani: Thank you very much Dr. Chichester, we will wait for the questions.

DISCUSION

Lic. Aguirre: Thank you very much Dr. Bressani, I think we are impressed with the very enlightened presentation that Dr. Chichester has just made and all that I will attempt to do here is to refer to what is the food industry in Central America, its potentialities and the possibilities which are being explored for its expansion.

The food industry in Central America is very important, one doesn't realize the size and volume that it had reached during the last few years. Many of you will be surprised to learn that the food industry in Central America is putting out a production, the gross value of which is pretty close to ½ billion dollars per year. In fact, I wouldn't be surprised if it has already passed that mark in 1965. The added value of this production is about half of it, so you may realize the importance of the food industry in the development of Central America. Obviously, this has been the result of the integration program and the common market. The intercommerce of industrialized food products in the common market has grown from about 14 million dollars per year to about 39 million dollars in 1962 and in 1966. I wouldn't be surprised if we are approaching 50 million dollars. I must admit that the food industry is losing its share. It was about 40% of the intercommerce in Central America and it has come down to 29%, obviously because the industrialization process in Central America has taken impetus and a great number of other commodities are being produced. Nevertheless, the food industry, as in any other country, will have to continue to develop in Central America and this is precisely the point which I want to touch this morning.

We have to admit that practically all the food industry that we have in Central America is based on foreign technology that we have imported and usually is being applied to raw materials that are common here and in the countries in which they were developed. When I am talking about foreign technology I am not trying to bring out a nationalistic point that there should be a Central American technology; I don't want to mean that. I just want to refer to the fact that the variety and abundance of raw materials which are not known elsewhere should be taken into consideration because that is the basis of our growth in food technology. We have to rememeber that Central America is located in the tropical zone and further, that the mountains that come from the Northern

Hemisphere, in going through the isthmus to South America they have to squeeze in the narrow portion of land that compose Central America and in doing so, they provide us with a great variety of climates. Therefore, being in the tropical zone we have a tremendous potentiality of materials that can be grown or are already grown, and yet we have to learn how to utilize. It's a great advantage to all that being in the tropical zone we don't have to live the long winter periods and we have chlorophyllic function, 365 days a year. That was the reason that prompted the famous ecologist, Dr. Hallbridge, to refer to Central America as "the largest carbohydrate factory of the world". Obviously, our chlorophyllic function goes on all year round. Now, Dr. Chichester mentioned something that is very important and he said that the mere fact that we have a technology at our disposal doesn't mean that we have produced a food product. The food product in order to fully qualify as such, has to be a product that is really consumed by the population. In economic terms it is very important the potentiality of the consumer to obtain this product, but let's forget for the time being about this factor. This is obviously important and we don't have to elaborate further on this.

The other important fact is, that when a product is being developed for a definite market, one has to be very careful that the presentation of the final product is in such a way that the population accepts it. That is why I want to refer to a specific case that probably illustrates this point. For a long time we all have heard about the process of dehydration, and in many countries it is being utilized, even in our country it is being utilized for many food products. One can easily imagine the possibilities that we could have in Central America if we could learn how to process our own natural fruits. It could have many advantages. For the farmer, it could be the possibility of extending his cultivations that today are being restricted, because there is no way of preserving the fruits and then when he is harvesting, everybody is harvesting and the price goes down. For the Central American population it would have the advantage of presenting the possibility of consumption of these fruits throughout the year and not on a seasonal basis, as it is being done now. And then, for the region in general, it could be very important because we could go to the foreign markets with exotic flavors and not trying to compete with the same products that they themselves can grow and produce. We would arrive in these markets with flavors that are completely different and since we will be dealing with highly sophisticated societies in which there is a great desire to introduce into

their menus these exotic flavors, the potentiality of Central America for processing their own tipical foods would be tremendous. When I say so I want only to give you some examples. Hamburg in Germany, which is so far from Central America, is flying fresh fruits from this area to that market. Granted, of course, that this is only for a very restricted market and I don't think that there is any possibility of a large trade in this respect. Nevertheless, it shows an example, the eagerness that we have in international markets for new flavors.

Now, here is a point that Dr. Chichester mentioned. We can try to apply the simple technology of dehydration, and I am talking about dehidration because that offers the possibility of preserving the fruits without having to rely upon refrigeration, thus making it easier for transport because of loss of weight and because of facility of preserving. Now, if we try to apply the usual techniques for the dehydration of our own tropical fruits, we might end up with a product that might be healthy from the sanitary point of view, maybe even attractive from the outside, but it has lost its flavor. The flavor and aroma of tropical fruit is very volatile, I don't want to say volatile in the clinical sense, but very hard to keep with dehydration. Then, it is important that we in Central America learn how to process our own tropical fruits. We can not expect any of the developed countries to be interested in this kind of problem, because even though it could be from an academic point of view a challenge for a research investigator in some of the universities, we canot expect the countries themselves to be interested in this kind of technology. That is up to the Central Americans and we have to learn how to do it. The initial steps have been taken already along these lines with fruit drying and gamma radiation. I must differentiate here that I was talking about dehydration and, of course, freeze drying is the one that we look as most promising. We have already tested the several ways of dehydration, we even went through the process of encapsulating the flavor for a process of spray drying but unfortunately it doesn't work as we would have hoped. We went, of course, to the obvious possibility of recovering the flavor and aroma after we had lost it in the dehydration chamber or whatever it was used. Well, we were partially successful but it is an expensive process to be applied, so at the present time we are hopping that with the freeze drying process we can obtain some of this. Now, what I mentioned about the gamma radiation was not for the possibility of dehydrating but we are also trying to see, if through this process we can extend the ripening period of some of our tropical fruits, because that way we could extend the area

of our market for these fruits, not with the degree that we could do it with dehydration, of course, but still within the Central American region.

There are some more aspects that we could talk about the possibilities and potentialities of the food industry, but I hope that Ing. Rolz will do it, because I have taken already more time than I should. I would like to finish my discussion by remarking that the main point I wanted to bring accross here is that in Central America we have to dedicate a great deal of effort in order to learn how to process the raw materials that nature has given us and that unfortunatelly, not in all cases, we can apply the regular technology without modification. In other words, applied research is needed in our area in order that we can learn how to utilize and process our own products.

Dr. Bressani: Thank you very much Mr. Aguirre, now we will hear Dr. Bates.

Dr. Bates: We are concerned, one way or another, with protein. This is probably the main theme and one aspect of the talk here during the last few days. We are concerned with the consumption of protein. There is a level at which protein supply is adequate. Here again is an average so there is a problem of biological variation. But it exists and it's adequate, there is a FAO standard on it. I might mention that the aminoacid is not only what exists but what is available to the organism. For instance, many cereal grains have high specific aminoacid. Onee they get into the gut, they are not available. This is something that should be emphasized.

I think in one way or another we are all concerned with doubling up supplies of proteins. I am sure that you all know that while we are trying to do this, this is not staying level, it's going down. More people to feed and various parts of the world on famine. I think we found to our great consternation, during the last few years, that the rates are going down, so when we evaluate processes, methods, programs, the direction is up. For some of us who are on an immediate basis, it's very practical, but not a help. There are other processes but they take longer time. For instance, education. We all agred that this is one of the primary, but it is not easily made. Probably the most expensive commodity is time. The price is going to be very expensive, not only in

monetary units, in manpower. I am not so much concerned about the people as I am about the development of the protein, because we have had examples of what people educated, trained, and other people can do. But they are not available. We are working against time. So, in the ultimate in food technology, when I value any process, any potential process, I fall down generally on schemes such as this. How far up do we go? Now, I don't think that with anyone of them, let's say that with the exception of general education and general enlightment, we could have a great effort. But add them altogether and maybe we could get up there. Now, take something approaching this dimension, today attracting a very interesting possibility. This decade I don't think it would even show up here. Maybe next decade it will be a very significant factor. Maybe in some countries not at all necessary. Perhaps exportation of fishing resources would show up in some countries. In other countries fishing might not be the answer. I think one of our main jobs here is to define where our efforts can best be directed. Also keep in mind that the solutions for today are not necessarily the solutions for tomorrow. We are quite concerned apparently with the cotton seed protein. It is useful. It has been tested. It can contribute in various forms, with proper utilization of research. That is the answer right now in Central America, probably for the next few years. It may not be the answer ten years from now. Perhaps animal production can come up, all production has its feasibilities. I don't know. Corn and beans if they are done properly, if the proper varieties are introduced, might again bring it up here. But I'd like to just present this as a very crude problem and when we talk about it in terms of grams of protein per person per day, I can't think of a more crude phenomena. But this is a crude method of keeping before us at all times what our objectives are through technology and whenever I think of a process, be it the introduction or the enhancement of a food industry, it somehow brings this level up. For instance, the great pineapple industry in Taiwan has not significantly directly influence the nutritional protein intake of the population; however, I am sure that the enhanced income which this pineapple industry provides, or which a processing industry could provide to Central America, enhances the well-being of the populace and does give them greater disposable income so they might buy, let's say, instead of living of beans they might buy a little bit of milk or meat and somehow bring this level up.

Dr. Bressani: Thank you very much Dr. Bates; now is the turn of Ing. Rolz.

Ing. Rolz: Thank you Dr. Bressani. First of all I would like to make some short remarks on food technology and then I would like to mention two specific examples of applied technology that have been worked here in Central America. First of all, food technology as such, implies applying technology to food production processes already in existence and covers also, basic research on the exploitation of the potential "new" food resources. Central America, as Lic. Aguirre pointed out, has imported technology developed elsewhere and has adapted it to its own pertaining conditions. However, I would like to mention that, in a very modest way, the creation of the Central American technology has started. Most of this work has been done in the food industry area due mainly to the well known fact that food and agriculture prevails in the region. Along this I would like to mention first, the utilization of agricultural carbohydrate-rich by-products, mainly those found in the coffee and sugar industries. They are a potential raw material for producing raw protein, and I would like to stress the word raw protein because I am not a nutritionist.

Some work has been done on the production of yeast from sugar cane molasses. In Central America, black strap molasses are a cheap source of carbohydrates. The cost of a gallon of black strap molasses is about 3-5 cents. This means roughly about $\frac{1}{2}$ cents a pound. In 1962 the production of black strap molasses was about 25 million gallons. The amount "lost" was 11.5 million gallons, meaning by "lost" either dumped in rivers or land. Preliminary economic analysis indicates that the cost of dry yeast should be around 5-10 cents a pound. The second point that I want to bring to this discussion is the work that has been started in the sterilization by gamma irradiation of canned fruits. The effects of gamma irradiation on canned pineapple at ambient and low temperatures (by low temperatures I mean near zero degrees centigrade), have been evaluated. The time history of the carbohydrates and ascorbic acid with respect to storage time and temperature, and the bacteriological contamination with respect to dosis used, were correlated. Thank you very much.

Dr. Bressani: I'd like to thank all speakers for their interesting presentation. Dr. Chichester has given us a general outline of food technology, what it can do for the nutrition of people, what are the requirements and the possibilities of preserving food and new problems that are being developed in many other countries in the world. Lic. Aguirre spoke his mind in the need of processing materials that we have available during 365 days a year and I think that for the over-all development of the Central American area

this is a very interesting program and should serve all the efforts that are being given and probably many more. Then Dr. Bates indicated the whole process of agriculture through technology and what is the objective in all activities in agriculture and animal production and good technology, except that in using the perameter of grams of protein per man per day, it would have been best to use, as far as I am concerned, a good diet per kilo per day or per person per day or better life per person per day.

Finally, Ing. Rolz talked about something that has been of very much interest to INCAP and our group. It is the utilization of agricultural by products that are being thrown away or are not being utilized to the fullest extent. I want to tell you in this respect that for example, we in Central America process a tremendous amount of wheat and all the by products of wheat are being utilized for animal production purposes, but here we have raw materials that contain calories in the fat or oil of the germ of the wheat and then we have products containing protein as high as 18% and this is what we call the granillo or wheat short, materials of high nutritive value, digestibility and good flavor. and it's just a matter of doing some utilization type of research and be able to utilize them for human consumption. Of course, the problem of utilization coffee as a raw material for the production of bacterial protein is very important and it would help the coffee industry of the area.

Yesterday we heard Dr. Alvarez saying that a tremendous losses of mollasses took place in Central America because they are not utilized. We can go on like this to indicate large number of raw material that we have, that we could utilize to produce food for both the animal population and the human population. Now, we could have questions and comments from the floor. Dr. Vasconcelos please.

Dr. Vasconcelos: We shall learn this afternoon the possibilities of increasing fishery production so I won't mention this now, but I would like to illustrate a particular point made by Dr. Chichester and let me refer to the present spoilage of fresh fish in Central America, including Panama. Fresh fish, the so-called fresh fish, is fish caught in shrimp nets. Initially I would like to say, that no country has solved this problem efficiently, but just to illustrate and to have in mind the possibilities that we should study in this area, I would like to say that at the present moment we can estimate roughly, perhaps my figures are wrong,

but please accept them as a gross estimation, that some 100-120 million pounds of fish have been caught in those nets by the shrimp boats. I mean fish, of course, not shrimp. And of these, perhaps some 60 million may be used for direct human consumption. But I don't think much more than 20 million, the quantity that is being used at the present moment is used for human consumption. This leaves some 40 million tons free for other uses and if you add the other 40 million roughly, that is not good for direct human consumption, but which can have other utilization, we reach a gross figure of 80 million pounds of fish spoiled in this area, at the present level of production. Of course, this is not a simple problem, and I think that unless these countries that catch fish concentrated on some particular plan to allow for a certain high scale of production, it would certainly be useless to talk of good utilization prospects. In Panama and El Salvador where there are rather efficient shrimp plants, where the production is concentrated (in El Salvador for instance) in one plant, fishing is done from 45 to 60 boats. Only one plant, so you see there is a concentration. In those places perhaps we may achieve more easily good results in a better utilization of this presently spoiled fish resource. In those two countries, there could be some 55 million tons of fish that maybe is escaping our attention. In this project of mine, we are looking to study very carefully this problem with the cooperation of ICAITI, and as soon as possible.

Dr. Lombardo: I would like to comment on the material presented by Dr. Chichester and the other speakers. Although the further development of food technology is very feasible, I feel that there are still at the present time some very strong limitations to this further development. And they all have to deal with economic, social, and institutional factors. I would like to mention, for instance, that it is a well-accepted fact that in less developed countries, habits, ways of doing things, customs, are very difficult to change. We know for instance that the people of less developed countires have a strong liking for fresh food. They are still not used to consuming or tasting processed foods, and this is a limitation which we have to conte d with in trying to develop further processed foods for the people in less developed countries. Another limitation, which I feel is the major limitation, is the income level of the people of less developed countries. If we take, as a frame of reference the Central American countries that form the common market, we see that, roughly, two-thirds of the population is rural. Now, I associate a rural population with very very low levels of income. Mr.

Aguirre has pointed out a very interesting fact. That the output of the processed foods has increased tremendously in the last several years. Now, my educated guess on this factor is that the common market, or at least the food processing industry of the common market, is only tapping the high income level groups that instead of being concentrated in one single country, now has extended to five countries. In other words, unless we know some more about this, my guess is that we are not really touching this two-thirds population which because of its very low income limitations cannot consume the food that is processed. We all know that food that is processed has a tendency to be of higher price. So, with a low level of income, the people cannot afford to buy these products. Another limitation in regards to development of food technology is that to develop new ways of preserving foods, we need research, and research takes a lot of investment. And as Mr. Aguirre pointed out, we need to know how to develop technology for the food and the condition and environment of Central America, which he mentioned specifically. I think that these aspects are also very important in considering this whole problem of food processing and food technology.

Dr. Chichester: I must say that I disagree with you, that the Latin Americans don't like processed foods, since they eat processed food all the time. As an example, any of the dried beans are dried foods, as are crackers, soft drinks, beer, ice-cream, bread, sausage, and meat. I was hoping to leave the impression, but perhaps I didn't make it explicit enough that there are very different levels in food technology, or food processing, ranging from the very simplest level which man has used as far back as we can look in history, to the very new developments. When you say that people don't like the processed food or are not accustomed to processed food, such as canned vegetables of purés for children, you are perfectly right. It is very difficult to change food habits. I was trying to say which I still think it's valid was that it depends on the level at what you talk about processing. Dehydration under the sun of such things as raisins or fruits where the material is laid on the ground, is processing food. You eat materials such as toasted wheat, this is a processed food.

If you intend to supplement food, there is no question that you must take into the account the economic circumstances of the people who are purchasing the food. Therefore, you must develop your technology (which has been done in many places), at a level which will allow low income people to purchase the food.

This means you cannot go into, if you are going to satisfy this segment of the population, sophisticated processing. There is a great deal yet to be done, in simple processing foods. Particularly, if one looks at the fish which are essentially free that the only cost (but this can fool one economically very badly) is processing which should enable you within some limitations to produce a saleable product. You must adapt your technology to the foods that people are accustomed to eating. If you do this, there is really no limit to what technology can contribute or at what level it can contribute. I think it is a very bad mistake to envision the preservation or the technology of food only at the very sophisticated and high cost that exists in highly developed areas.

Lic. Aguirre: I'll try to answer to Dr. Lombardo. In the first place, he referred to the processed foods. Our population is consuming more "cuquitos" than soft drinks. Well, to those of you who don't know what "cuquito" is, it's a simple refreshment packed in polyethilene bag. It's a refreshment. Now, let's talk about children. The volume of "cuquitos" that are being sold is tremendously overtaking the volume of the soft drinks. Of course it is a very crude way of presenting it. I don't want to make a point of this. I only want to show that the mere fact that this industry is taking on, is because it has been designed, consciously or unconsciously, to really appeal to the psychology of the population. Now, you may say, well, you cannot call it a processed food. Well, first of all it's not a food, it is only a refreshment. Yet, the child would have the possibility of drinking some more refreshments that he could get in a natural form. Yet he prefers these because the people who are making the recipes are people who know more or less instinctively what the consumers want. So what I want to make a point is that they even though are not used to processed foods, that doesn't mean that because they don't consume Corn Flakes if they are within their purchasing capacity. They can if you present the food in such a way that it has some appeal to them.

Now the second point that you mentioned is that this production of the food industry in Central America is reaching usually only the stratus of the population that can afford it, obviously. Any production will reach the status of the population that can afford its cost. I know that. But let's not forget that the raw material for the food industry comes from agriculture. And that therefore, any improvement or enlargement that we have in the food

industry will always benefit agriculture. We can of course argue a great deal whether the result of agriculture is being well distributed or not well distributed. But this is not the point of the discussion here. The food industry has the tremendous advantage for the Central Americans that the raw materials come from its own land. Therefore we are, by that way, improving the production of the country. And further than that, through industry, that production is being saved from decay and is being offered to the whole region. So I think those two points should be taken into consideration.

Dr. Bressani: Thank you very much Lic. Aguirre. We are running a little bit short of time, you know. We are supposed to hear Dr. Tepley, and we were supposed to break this at 10 o'clock. Now, we can hear from Licenciado Ramirez, and then from Ingeniero Jalil, and if we have time, from Dr. Bates.

Lic. Ramírez: Thank you. Food technology is a part of agricultural development and we cannot separate them. Of course, that in a more advanced country, the present food technology with all the sophisticated methods of food preservations and transportation hardly has agricultural relation to agriculture and livestock production. We have to remember that the applied technology corresponds with agricultural development. A subsistence economy, like ours, will continue with the traditional methods of preservation and marketing, and will apply tecknology only in response to the size of the market, the money market. The more complicated methods of preserving, storing and transportation are a development of agriculture. And not just the opposite. Dr. Bates' comments on the matter are very enlighting regarding the pulling of agricultural resources together with applications of technology. And applications of technology with existing materials and income levels. Thank you.

Ing. Jalil: I have a question to Licenciado Aguirre, and I have been very much concerned about what he said regarding the enlarging of the ripe period of tropical fruit through gamma radiation. I think that this is a pretty difficult subject, and I believe that this is a type of advance technique to be applied in our countries for many years to come. Probably I missed your explanation, but in our opinion, and regarding to Central America, where as you already said there are so many climates for

tropical fruits to grow, widening and enlarging the production, and of course the ripening of tropical fruit, I would say that it is one of the most feasible thing to do in Central America up to now. What we have to use here in our countries, and which is already as there are tremendous resources of early, median, and late varieties, already existent in Central America. However, to reach continuous production, we have to run away from orchards depending only from seedlings propagated by seed by the farmers. And to try to produce those fruit trees by better methods of propagation, as we already know: budding, etc., and then to teach the farmer a better way of orchard management. At least, this is one of the policies which are followed in many countries, and this is possible done here even in Guatemala.

Dr. Bates: The point of soft drinks was brought up. I think one way to call them is antinutrients. We find these in Indian villages. You can not get so far away from civilization that you don't run into bottles of soft drinks. Here is a little bit of a challenge and almost a failure of food technology. Why are the soft drinks out there? First of all, they are stable, they are easily transported; secondly, they are reasonably good tasting; and thirdly, and probably most important, the companies that pushed soft drinks have an excellent merchandizing program. Now, I submit that there is a great need of food technology to develop products that are not antinutrients, that are competitive with these antinutrients in price, in quality, and in storage characteristics. For instance, get in a bottle or a can or maybe even a plastic bag foods that have appeal to the youngest children, that have to be reasonably sweet, that have both the advantages of the soft drinks with none of the disadvantages. I think that we could probably do a lot better than that in Central America.

Lic. Aguirre: I think it's very interesting what Dr. Bates just mentioned. And Dr. Bressani, you have a new challenge now since you developed Incaparina. Probably you can develop now cuquitarina, so that you can sell a nutrient through cuquitos that are so well aceepted. Now, going back to what Mr. Jalil just mentioned, the fact that I tried to get across was not that one substitutes the other. Obviously the agricultural aspect is very important. The only thing that I was trying to mention is that one of the possibilities of extending the marketability of

these products, that we are exploring because of the success India has had already with mangos; and we are also studying the possibilities of applying these techniques to our own products. We are in the initial steps and I don't want to imply that one substitutes the other. It's just one way of implementing the efforts at the agricultural level, because you will have to admit that if you extend the ripening period, then you are extending the market area that you can cover with your products.

DESARROLLO DE SUSTITUTOS DE ALTO CONTENIDO PROTEICO

Dr. L. J. Tepley

Dr. Tepley: I am glad to note from discussion so far that this panel is interested in protein foods! Since around 1950 when the special importance of protein in the prevention and cure of Kwashiorkor became well recognized, and at the same time some far-sighted individuals saw the day coming when we would not have vast amounts of skim milk powder available for donation programs. There has been a very considerable effort to develop alternative sources of supplementary foods which could be as effective as skim milk powder. This work has been carried out by United Nations agencies, governments, private organizations, and commercial firms. INCAP, here in Guatemala city, has probably been the main pioneer in this development program. I personally have been involved in this field of activity since 1960 as a staff member of UNICEF and through connection with the work of the Protein Advisory Group (PAG) of WHO/FAO/UNICEF. It is my feeling that in the last 2 or 3 years we have come "over the hump" with respect to the use of unconventional commercial sources of protein for human feeding. As I see it, it is now only a question of how fast we move in this direction. Actually, however, we have very few examples to point of marketing of supplementary foods including these unconventional protein sources which have reached the point of extensive marketing. There is the Pro-Nutro operation in South Africa, which has been a long term development and it is now becoming quite successful; however, the experience learned there is probably only applicable in part to many other countries around the world because of the different conditions. But aside from that, we really have only the Incaparina operations to point to as merketing developments that have at least gone that far. At the same time, as I will point out in a few minutes, there are in a number of countries around the world, mixtures of this general type already developed. Some are about to go on the market, some already have gone on the market. And I see this coming in more and more countries.

Of course, besides the special types of supplementary foods suitable for feeding young children, there is the more general application in enriching the staple food products, simulated meat products, etc. for the general food supply. Some of these have already been touched on.

I would like to make one additional introductory remark which I make routinely in talking on this subject. And in so doing I will extend my tribute to INCAP for their basic studies on the nutritional value of the ordinary foods as the mother usually has them in the home for the infant and young child, i.e. cereals, beans, and so on. INCAP has also done outstanding work in education of the mothers to use these foods beginning in the early months of the infant's life to provide a balanced diet particularly as the breast milk supply decreases. For every 100 questions I get regarding a special protein food, I am lucky to get one question on this kind of operation: teaching mothers how to feed their infants better with what they already have in the home. It is just a matter of human nature; these new protein sources are much more interesting to most people. But the other side is probably far more important.

As I see it, there are four main approaches to providing an adequate food supply for a country. One is general agricultural production, marketing and distribution of the normal processed and unprocessed foods in a country. This is obviously of basic importance and the more that can be done to get these food materials of good nutritional value into the home at a reasonable price, the better. Second, we have local food production and consumption for people who live in a subsistence economy. They can be helped to grow and consume a better balanced food supply. Third, we have the special products which are unconventional protein sources. Fourth, there are imported foods, but I won't go into that in this presentation. As to the first three, I would only point out that as far as I know, it is not an easy matter to achieve success in any of these areas. So it is worth considering the unconventional proteins even though a considerable effort may be required to use them. If you consider not only having an adequate per capita food supply of the proper composition, but also aiming toward eliminating malnutrition, and getting the foods distributed to those who really need them, including the lower income groups and the younger children, then it definitely is not easy, no matter how you go about it. Some of these special protein food mixtures may offer some advantages in regard to these more specific aims.

With respect to the protein concentrates available and becoming available, as to the more important ones in terms of available raw material supplies (cotton-seed, soy, peanut, fish, etc.), we now have available technology to make suitable protein concentrates which can be used to feed young children. At the same time, there is room for further technological research. For example, cottonseed protein concentrates are now being used and they seem to be quite acceptable. They do carry some color, and in some cases there is a little loss of lysine for the binding of gossypol. There is room for possible improvement, maybe by using glandless cottonseeds eventually, or by special solvent extraction. As to soya, we have soy protein concentrates of good nutritional value available. But there are other possibilities which are being worked on, which I will take the time to discuss here. Technology for peanut flour production is fairly straight foward. Now, in addition to these main raw materials, we have other possibilities. A firm in Morocco is developing a process for sun flower seed protein concentrate. This could also be useful in Chile and in Turkey. Sesame may also be useful in some countries. Sunflower and sesame are good sources of methionine. In Mexico, Dr. DeChamps at the Institute of Technology has developed what appears to be a good process for protein concentrates from sesame. Coconut protein is in high nutritional value. There are some other possible sources that have already been mentioned by others I was interested to hear Dr. Bressani mention remilled wheat fractions. The US Department of Agriculture laboratory at Albany, California, is making some very nice preparations with about 25% protein and low fiber and nutriotionally the protein is a better quality than that of whole wheat. This is done just by a simple remilling of shorts, reddog and germ fractions, which ordinarily go into animal feeds, where they are useful, but we may have to draw on some of these into direct human feeding. Along this line I will just mention urea for cattle feeding and I think that's a possibility for some countries that wish to build up their milk and animal production. This could take the pressure of oilseed proteins or these wheat fractions for animal feeding so that you could use them for direct human feeding. There is also the possibility of using not only purified amino acids, but non-protein, non-amino acid nitrogen for humans, for example, in the form of ammonium citrate added to the diet at low levels. Dr. Scrimshaw is working on this at the Massachusetts Institute of Technology. As to microbial proteins it's becoming quite clear that proteins from petroleum will present as many problems as food yeasts from molasses, plus some additional ones.

That doesn't mean that it won't be important at some future day. I would suggest that any country that has molasses going into rivers or some other source of raw material at essentially no cost, might well look at the possibilities of food and feed yeast.

There may be considerable to be gained in some countries at least, applying the use of enzyme treatments, especial flavorings, etc., for some of these mixtures using unconventional proteins.

If anyone would like information about some of the mixtures being introduced in various countries, using peanut flour in Nigeria, Senegal, and India, soy flours in Taiwan, etc., I would be glad to discuss these with individuals later if there is no time in this panel sesion. There are also programs coming along in Algeria. Incaparina I will leave to the INCAP people for discussion. I want to mention Peru where the Peruvita product has gone on the market; I wish to mention particularly the encouragement provided by the government in the form of a decree which gives income tax and import duty relief for companies that go into this kind of an operation and manufacture or distribute an approved supplementary food. There is no doubt that this is a difficult area and it's generally agreed that cooperation is needed from many quarters, including governments, foundations, and commercial firms. It is also pretty agreed that for any real impact in most countries commercial firms must get into the manufacturing and marketing operation. There is probably a lot more to be learned about marketing of special mixtures. I think we should apply all the know-how possible to that area. At the same time, we would hope to find in at least some commercial firms a special spirit about trying to make a success of this kind of operation which can provide real nutritional benefits to the people. I believe that it is in the interest of these commercial firms, including their financial interest (their long term interest at least) to help out and to go into this kind of business. We must recognize however, that in many situations it appears to companies that there are easier ways to make money, at least in the short term. We might hope to find in at least some of these companies, some of the spirit that the recently retired President of the United Airlines had. He saw this large company grow up from nothing to a vast operation. I was interested in his statement at the time he retired. He said "I have great respect for marketing and research and for cost accountants, but I'm glad they were not around when we started. They would have recommended that we didn't start this business."

And now I will close by referring to a situation in Europe about 150 years ago, when they had a series of wet harvest seasons, and the governments had some very serious food supply problems. They knew that their moldy grain wasn't fit for either farm animals or humans. They set up a special commission to look for supplementary sources of food. They looked into the possibility of using what they called "gelatin", actually a much cruder material than purified gelatine, but they made studies in animals, etc., and after some years issued a report which said that it was perfectly all right to use this gelatin, even for child feeding. And then about 20 years later, it was found in Germany that dogs wouldn't survive on bread and gelatin (a purified form). This caused considerable consternation and it took many years to explain this apparent discrepancy. By now, we have accumulated a tremendous amount of basic nutritional knowledge, food technology, food processing know-how, which can and should be applied now to make use of some of these newer sources of protein in order to help solve our nutrition problems.

Dr. Bressani: Thank you very much Dr. Tepley for limiting your presentation to a very short time. I am sure that you had many more things to say.

DISCUSION

Dr. Behar: I also will be very, very short because of the time, but there are two points that I would like to emphasize very much. The reason for it is because a little over a month ago, we attebded tended in Hamburg a very large international meeting on nutrition and a special session was devoted to the discussion of this topic of vegetable mixtures or new unconventional sources of protein. It was evident that the useful role and the limitations of these mixtures was not clear in the minds of most of the people who are working in this field all around the world; and most of them were nutrition experts; In the first place I would like to emphasize what Dr. Tepley stated very well: these are supplementary foods, and I want to make this very clear. It was obvious in the discussions there that the people were hoping that children will live with these types of foods alone. And people have tested these types of foods by giving them to children for months and with I would say, some inadequate results; but they were small things that they were finding in those children. Yet, for that reason, they would say-well these are not good foods. I think it was very

clearly stated yesterday by Dr. Leon that no food item (except for expensive infant food formulations), is expected to be adequate as the only source of nutrients for any human being, and so these products we are discussing are not designed as a complete food but as a supplementary food which will add to the usual diet of the population those nutrients which are in deficit. And this means that the formulas have to be adapted to the particular dietary habits and practices of the population not only in terms of the organoleptic characteristics, but in terms of the nutrient content, because they should supplement what people are already getting in the usual diet. This is the first point I would like to emphasize, to have this clearly in mind because this is also important in deciding how these foods should be tested, etc. The second point I would like to emphasize because, as was mentioned by Dr. Tepley, we were one of the first groups that started to work on these lines and we don't want to be thought that we are considering these special mixtures as the solution for protein malnutrition. This I think is very important to emphasize; this is just a small contribution to a very large program. This is a question of utilizing better what resources we have, but it is not going to be the solution. And we have seen groups devoting too much attention to this particular part of their work and neglecting what we consider even much more important in the long range and the long term. And this is what has been discussed here in previous meetings, the increase of production and consumption of all the other adequate sources of food, including the conventional ones and probably new unconventional ones that may come in the future, but we should not close our eyes and say "Well, this is it - the problem is solved".

Dr. Shaw: I would first like to take your attention back to Miss MacKinnon's remark about the typical kitchen that had a radio in it. I think the radio should not be discarded. In the promotion of Incaparina it is no coincidence that the largest share of the promotion budget goes into radio. We have in radio, thanks to the transistors, a tremendous medium for education. And it is being used. Somebody counted up the radio stations in Guatemala City and the total came to 27. That is more than New York City has. Now, the other point that I like to address myself to is this matter of how fast are we going. I think that if we look at the record on this (and I'm not doing this to brag) with Incaparina within the first three years in one country, the producer reached the break even point. This is without any subsidies whatsoever

and without any large government purchases. In the second country where it is now in national production and distribution, we have hopes that he is approaching the break-even point. And when I say break-even I mean a reasonable profit, not only to the producer but to the distributors, wholesalers, and retailers. This doesn't look too bad when you realize, as I saw in a Wall Street general article not too long ago, the average lead time of the introduction of a new product in the United States from laboratory to national distribution is normally about seven years. Another thing that we have learned in the last 5 years of working with the product is the importance of consumer research. This was done literally by INCAP in 1958 and 1959 before the product was even considered for commercial production. We insist now that this be done by any company that is interested in handling Incaparina in any other market. This has to be done at the company's expense, and it is a very expensive proposition. But we find that to reach success you must have a lot of knowledge about how people would use a product of this type, what the packaging should look like, what the optimum price will be, etc. This is consumer research. This has to be followed then by market research. As to whether there is a potential, what size of the potential is. To adjust the product at this level, as well as at the consumers' level, you adjust packaging price as well as other factors and all this normally takes at least a year. This is one of the reasons for the lead time you have to have for a product like this. The other point, which was made the other day, was related to subsidies. I feel that there are several types of subsidies. Some of these are, I think, suitable for products like this, some of them are definitely dangerous. I'll just mention a few of them. We have a sort of a subsidy here in Guatemala. Practically all of the health centers are prescribing Incaparina in the routine prescription to mothers who have malnourished children. This can be called a subsidy. This, I think, is a very good subsidy. UNICEF purchased 128 tons of Incaparina to assist in the initial introduction in Colombia. This Incaparina was used purely for demonstration in a specific area for one month, I believe, in the health centers mothers were given "something" and told: "Here is 'something', try it". There were demostrations made with the product and the producers cooperated with distribution in the stores so it was available. This type of subsidy is good. On the other hand, I think there are subsidies that are extremely dangerous; I think I cash subsidy to a producer to go into the program has two serious dangers to it: whether it's cash or it's free materials

or what have you. The two dangers as I see it: the people getting the subsidy tend to become experts in marketing of food technology and they may not be. The other danger comes when the subsidies are withdrawn - what happens to the price to the consumer? I think we've had some demonstration on this in some of the other programs that have been attempted. We have conscientiously avoided that in the Incaparina program.

Dr. Bressani: Thank you very much, Mr. Shaw. I think we agreed to break this at 11:15 and so we have about 20 minutes for discussion, and we could have questions on the floor, then.

Dr. Tepley: I want to extend my remarks on the microbial protein, protein from petroleum, etc. I said that I thought that any country that has molasses running into rivers ought to look at the possibility of producing food yeast, a protein and vitamin source for food and animal feed additives. Probably the economics of the situation will be found to be marginal, but it still may be worth of investigation, especially if there is some problem of disposing of the raw material from plant operations. The production of the yeast from wood sulphite licquors in Wisconsin is working out quite well for example; they doubled their production last year. Someone in an Asian country called one of the Forest Products Laboratory experts from Madison, Wisconsin, to see if he could grow yeast on wood carbohydrates. This man saw the molasses running into the river and he said he had better try first to grow yeast on the molasses, it's easier and cheaper. As to protein from petroleum, one European firm has a fairly large scale production plant in operation; they are running farm animal feeding tests in Nigeria. They and others who are using crude petroleum raw material are still working on insuring that there is no carcinogen carried over in the final product, they have special flavor problems, etc.

Dr. Bressani: Thank you very much.

Dr. Schaefer: One comment- Dr. Behar stated that these foods are primarily supplementary foods. I think too often we even forget that cow's milk is just that. It's impossible to raise an infant just on cow's milk. Impossible to raise a dog just on cows' milk. So that one has to consider these in the same light. Secondly, I don't want to start an argument, but

perhaps I disagree with Dr. Shaw in my viewpoint regarding subsidies. I realize all the pitfalls, but it is evident, in my way of thinking, that the world is still subsidizing school feeding programs. And I've yet to see a place where they really subsidize feeding the pre-school child. I think this can be handled in a number of ways. And perhaps some of you people can come forth with better ideas than I have. But I do know that in any kind of production you have to reach a certain level before the price comes down. We have thought of the possibilities of assisting through subsidization so that the desired production level can be reached in six months or one year instead of five years. That will enable the price to get down the desired level, so the product can then reach not just the one fourth of the people, perhaps, in the lower income group, but perhaps half. So, again, I agree with you, I think that nothing is worse than starting a subsidy and then stopping it. Really, this is what has happened to our school lunch programs. They've been subsidized by our surplus milk. I personally think it would have been better if we hadn't had this, because the problem would have been presented to the people much sooner.

Dr. Shaw: School lunch feeding programs are not a private enterprise production operation. We would like to see all school lunch programs using Incaparina, of course. How this is done is a government responsibility. The governments themselves, I think, would like to do this. We have evidence here in Guatemala that the Guatemalan government would like to. When they can afford it and how they can do it, I don't know, but they would like to have Incaparina in the school lunch program. And this would have many favorable effects. It would be the type of product in a school lunch program which would have carry-over in the home. We don't feel that milk has this carry-over, because the families of many of the children in the schools cannot purchase milk. And Incaparina is within the purchasing power of a large sector of the population. Therefore, I am very much in favor of subsidizing school lunch programs, but not industry.

Dr. Adams: I am not any authority on subsidies or in nutrition but we have had some experience in Michigan introducing the Europeans to canned-beans. We think that canned beans are a processed food, as compared to the dried beans. The normal European hasn't been used to eating a canned bean, particularly

as canned by Heinz or canned by Campbell Soup Company. So in the last three or four years, with the cooperation of the Foreign Agriculture Service, that has a fund program, the National Dried Bean Council in the United States, working with the Michigan Bean Shipping Association, has gone into certain European food fairs and food shows to give away samples of canned-beans. These are very tasty items, to my palate at least. In these large food shows, thousands of people come and they pay for the privilege of seeing the show. Mostly it is exhibits and give-aways of small samples, taste samples if you will, but it isn't this alone. In the stores near the food fairs shows, these same foods are offered for sale, during the time of the show and afterwards. They have gone into a number of markets in Holland, in England, in Germany and France with this kind of a program. They've learned several things from this experience. One thing is that they have to repeat the show many times. There is competition for the housewives' dollar, so one effort alone isn't enough. You have to introduce this thing time after time. They are also telling us even if our food merchandises in the United States. They are talking about the children market. It's the young person who soon, very soon, will become the buyer, the housewife and the husband of tomorrow. And so they're advertising campaigns predirected at young people. Now perhaps the lesson to be suggested, if I may be so bold as to propose anything at all, is to recognize the possibility that a program might be developed involving not only school children through school lunch programs, but, as Dr. Schaefer has suggested, hopefully in so many different ocassions here, a program involving the preschool, or as I would say in the United States the nursery school child. I don't know whether nursery school is even feasible in Guatemala or in Central America or not, where these new products that some of you have developed and want to indroduce could be tried. Work on the child, that's the lesson from the most sophisticated market studies: Work on the child by introducing him at the preschool level or at the nursery school level or at the school level. Introduce the new products here and don't just stop this year, don't take a grant or an assitance program that is going to last for a year, and then see how much more healthier the youngster is set up on a long term basis. These things are not going to work out magically, they are not going to work out because of a report that is written and lodged in somebody's high office. They are going to work out because of people of dedication and of conviction and of energy, are willing to put out a great effort over

a long period of time. And this is the thing that I see not as an expert at all, but as a side-liner, at this point in the program.

Ing. Rolz: I'm greatly encouraged by Dr. Tepley's remark on the yeast production from molasses. He mentioned that in the United States yeast from sulphite licquor is a successful commercial process. I would like to add that yeast on sulphite licquor is obtained for the cost of production of about 4 to 6 cents a pound in the United States. I don't like to bring into this discussion the differences in market between the United States and this region, but I am almost sure that we can reach an economical cost of operation to produce yeast from molasses. I would like to ask Dr. Tepley if he knows of any protein rich supplementary food, as Dr. Behar mentioned, that has large percentage of yeast in its formula.

Dr. Tepley: Dr. Behar can tell us of use of yeast in the Incaparina formula. The Pro-nutro product in South Africa has yeast in it, but I can't tell you how much. There are several products being made in Europe and sold in Africa which contain a substantial percentage of yeast; how successful those are going to be I don't know. But generally, it has been considered that in dry mixtures for human, you might use 3 to 4% or something like that. But you may be able to use more.

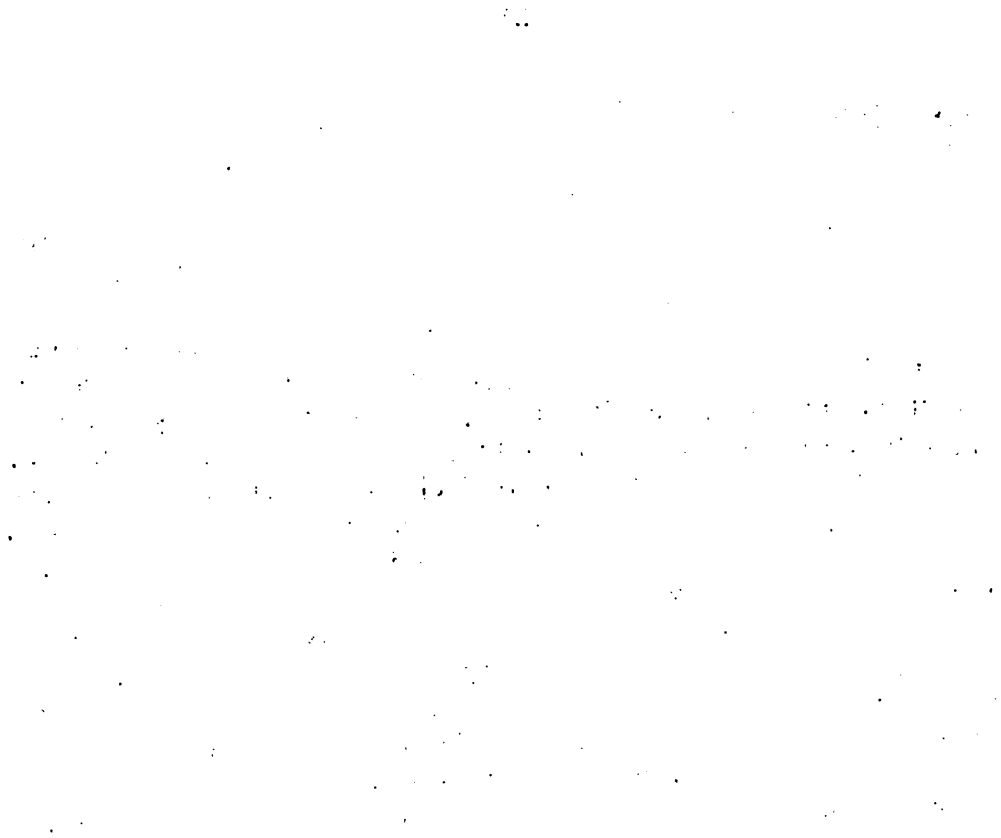
Dr. Behar: In regard to the same question, the reason we decided to put some yeast in the Incaparina formula was not primarily on basis of the protein value of yeast, but on the basis of the vitamin value of yeast. I mentioned that when we formulate formulas of this type, we should think what the diet of the population is, what the defficiencies are, and what we want to supplement. Riboflavin deficiency is very prevalent in our area. Of course, milk is an adequate source of Ribo avin. These types of formulas were to be used, not to replace milk, but to extend milk, or when milk cannot be used. We wanted to provide at least those nutrients that are needed by the population and the particular reason for adding yeast in this case was because of its very high Riboflavin content. It was on the same basis that we added calcium salts to the formula. Of course, yeast can contribute also to the protein by improving the biological value of the formula. The economic aspects should be considered. In some of the formulas that are now being commercially produced, yeast has been replaced by

synthetic vitamin mixtures because it was not available at a low price and this is allright from the nutritional point of view.

Coming to the point of apparent disagreement between Dr. Schaefer and Mr. Shaw, I think we should not say "subsidize the industry" but "subsidize the program". And then probably we would be in much better agreement. What Mr. Shaw doesn't like to is to subsidize the particular industry which is going to produce a product. But if you think of subsidizing the program, that's a completely different thing. And there are many useful ways of subsidizing the program, as a national program, in which many different things can be developed. There are in addition to those that Mr. Shaw mentioned, other subsidies that the programs are receiving. In Colombia, for instance, in addition to those mentioned, the Institute of Nutrition there which is in charge of the applied nutrition programs in the country is buying Incaparina in large amounts from the producers and distributing it in many of the health centers mainly as a promotional campaign. We consider this is a subsidy. In Guatemala there is a new program being developed in the recuperation centers for malnourished preschool children that Dr. Schaefer also mentioned. They are using Incaparina too, in those centers, as a promotional effort and there are many other ways in which the promotion, the advertising, the utilization of the product could be helped by investment from other sources, including governmental if we think in terms of the program and not in terms of the industry.

Dr. Bressani: Thank you very much, Dr. Behar. Going back to the yeast, about 3% yeast is used in baby foods at the present time. And in our own experience the addition of 3% of yeast, let's say, to corn flour, or rice flour, or wheat flour, will give you a significant increase in protein quality. In the case of corn it goes from a value of 1, let's say, to a value of $2\frac{1}{2}$. This is a significant increase. And there is another point, that is you can improve foods in different ways - one is to increase both protein concentration and quality, but the other one is just to increase quality and only a little bit the protein concentration. For example, you can supplement any cereal grain with 5% skim milk or 3% fish flour, or fish protein concentrate, or 8% soybean protein and you would get a food that is completely different nutritionally, than the original unsupplemented food. Time is getting very short, so I don't think we have time for just one more question or comment.

Dr. Chichester: I don't want to refer overly to yeast, but I think this illustrates a point in food technology. Obviously there are several types of yeast and there is a plant in Guatemala producing baker's yeast commercially. This is a bitter yeast and is not used extensively as a nutrient in food. Yeast however has very many interesting physical and chemical characteristics other than its nutritional qualities. Its biggest use in the United States and in many countries is as a flavor carrier. One can add flavor to yeast and then use yeast as a flavoring substance, in everything from a sausage to cheese. Secondly, it changes the physical characteristics of products, so one can use it as a modifier of texture. The use of products such as yeast illustrates the application at food technology. It can demonstrate how best to use a raw material to make a more palatable product, how to use the same raw material to make a product that has the desired physical characteristics. The application of Food Science developes the basis for a decision on what type of yeast to produce for use in a particular food product. Thus a number of technological questions must be answered before you decide to grow yeast on a large scale.



SEPTIMO TEMA

EL PLANEAMIENTO NACIONAL EN RELACION A LAS FUENTES DE PRODUCTOS ALIMENTICIOS

Moderador: Dr. H. Lombardo

Dr. Lombardo: We are moving now into the presentation of some papers that deal primarily with economic and social features, in relation with nutrition and the food supply, for the benefit of those that do not have a good command of the Spanish, I am going to ask each one of the speakers to mention briefly in their turn what they are going to talk about and then they will proceed with the presentation in Spanish. We are running a little short of time, so that I would ask the speakers to limit themselves to a maximum of 15 minutes each, then there will be about 10 to 15 minutes of questions.

Vamos a dar comienzo al aspecto de comercialización y luego seguiremos discutiendo sobre programación y algunos factores a considerar dentro de la programación del sector agrícola. Tengo el gusto de cederle la palabra al Ing. German Gerding, del Instituto Latinoamericano de Mercadeo Agrícola, con sede en Colombia, quien va a hacer la presentación sobre mercadeo o comercialización de los productos agropecuarios.

Ing. Gerding: I have to apologize to those who do not speak Spanish because I have to read the paper, but this is because one day before I came to Guatemala, Mr. Mannarelli, the author of the paper, who was supposed to be here in charge of the presentation of this report, asked me to come here and present the paper to the panel. The work is a little too long and I was not able to get a simultaneous translator to translate the paper. This is the reason why I'm going to read it. After I will try to answer your questions.

Documento presentado por el Ing. German Gerding:

LA COMERCIALIZACION Y EL ABASTECIMIENTO DE ALIMENTOS EN LATINOAMERICA

por V. B. Mannarelli

del

Instituto Latinoamericano de Mercadeo Agrícola
ILMA

En la generalidad de los países de América Latina existen serios problemas de estados crónicos de desnutrición que están afectando a una fracción preponderante de la población con niveles modestos de ingreso.

Esta situación se ha venido agudizando en los últimos decenios debido al acelerado crecimiento en el número de habitantes, que en el promedio de las naciones latinoamericanas, registra una de las tasas anuales de expansión mayores del mundo. En forma paralela a este singular aumento vegetativo de la población, se ha estado registrando un desplazamiento masivo de elemento humano desde las zonas rurales a los grandes centros urbanos, a tal punto que ya existen ciudades mayores en casi la totalidad de los países cuya población se duplica en períodos tan breves como 10 a 15 años.

Junto a este fenómeno, que está alterando a pasos agigantados y en forma irreversible el panorama demográfico de la región, se observa que la producción agropecuaria destinada al consumo interno en las naciones del continente -no sólo ha experimentado un desenvolvimiento insuficiente respecto a la expansión poblacional en aquellos artículos tradicionales considerados básicos en la alimentación- sino que, además, se aprecian en varios de estos países, disponibilidades decrecientes, en términos per capita, de algunos productos alimenticios vitales desde el punto de vista dietético.

Es así como pocos países del área escapan a tendencias desfavorables en cuanto a disponibilidades internas de alimentos en términos per capita, a una participación cada vez mayor de las importaciones de víveres, en el componente de comercio exterior, y a presiones

inflacionarias que se manifiestan, en especial, en alzas generales de los precios de esta clase de artículos, márgenes de mercadeo cada vez más amplios de los mismos, y proliferación de ciertos tipos intermediarios ineficientes e indeseables. Incluso, se llega a observar en algunos mercados, para ciertos productos, una tendencia regresiva en cuanto a las condiciones de calidad de éstos, cuando llegan a nivel del consumidor final.

Los gobiernos del área se enfrentan a menudo con un cuadro general de falta de abastecimientos, deficiencias de mercadeo y oscilaciones de precios, que desalientan la producción, frenan las posibilidades de mejoramientos cualitativos necesarios de la misma y malogran en parte, a veces considerable, los esfuerzos que se realizan a través de los diversos organismos de fomento para estimular la producción y el consumo de ciertos alimentos.

Es así como existe ya suficiente experiencia en el ámbito latinoamericano de programas tales como de crédito supervisado, colonización e iniciación de reformas agrarias, que en el momento mismo en que pueden considerarse un éxito en lo que se refiere a la producción de mayores volúmenes de artículos para el mercado, se transforman en parcial o total fracaso por el cuello de botella que implican las estructuras, métodos y sistemas de comercialización inoperantes, que gravitan en forma obstructiva en casi todos los niveles del mercado prácticamente y cuyo resultado final se traduce en precios deprimidos para el agricultor y alzas injustificadas de los mismos para el consumidor urbano. De esta manera se produce un ambiente económico desfavorable para estimular el aumento de producción necesario en forma permanente y creciente e, igualmente, se limita en forma grave el acceso al consumo por parte de la población de bajos ingresos, de ciertos elementos nutritivos de origen proteico animal y de frutas y hortalizas, por los elevados precios de éstos.

La situación descrita está demostrando la limitación de los esfuerzos hasta aquí realizados para resolver el desequilibrio que se ha estado generando entre los productos agropecuarios ofertados en los mercados nacionales y la manifiesta presión de una demanda efectiva rápidamente creciente, principalmente aglomerada en las áreas metropolitanas, y que se origina, - más que en un incremento general real de los ingresos medios- en la multiplicación del número de sus habitantes. Esto último se ha derivado, en parte, del crecimiento poblacional general aludido y, particularmente, de la migración masiva de campesinos que abandonan las actividades rurales en busca de mejores

horizontes económicos en los conglomerados urbano-industriales que, a menudo, son ilusorios. Fracción considerable de estos inmigrantes -que ya han dejado de ser elemento productor de víveres, pasando a engrosar el sector consumidor neto- no encuentra colocación en las incipientes nuevas industrias de nuestros países, -las cuales, por lo demás, tienden a ser cada vez más automatizadas- y se convierten, por la simplicidad elemental de esta actividad, en nuevos pequeñísimos intermediarios con métodos de operación primitivos en la distribución de los productos.

Analizando este hecho, que se viene repitiendo con tendencias crecientes en prácticamente todas las naciones del área, desde el punto de vista de la productividad, no puede menos que producir un sobrecogedor cuadro de ineficiencia y desperdicio general de recursos económicos y humanos, en un sector tan vital e importante de la vida económica de los países, cual es el de la producción, distribución y consumo adecuado de alimentos.

Consideradas, por otra parte, las repercusiones de las deficiencias generales que se aprecian en la comercialización de los víveres en relación a la productividad de los sectores que vincula, -pues es precisamente en esta fase intermediaria donde se establece una importante interacción entre la agricultura y las restantes actividades productoras de un país- se llega a la conclusión que su influencia se hace sentir globalmente en las economías nacionales y repercute seriamente en las posibilidades efectivas de desarrollo económico.

Muy a menudo se han malogrado importantes programas gubernamentales, a través de los cuales se ha incentivado a grandes masas de campesinos modestos a un gasto extraordinario mediante el crédito, otorgado con el sano propósito de incrementar su productividad, y que luego no han obtenido retribución económica suficiente por imperfecciones de los mecanismos de mercadeo existentes, con serio perjuicio para el productor y para las instituciones crediticias que han emprendido estos programas.

El desarrollo de cooperativas agrícolas, en donde un aspecto de fundamental interés lo constituye la posibilidad de realizar funciones de mercadeo en común y a bajo costo, también se ve seriamente afectado por la carencia de canales comerciales propios a los niveles mayoristas especialmente, en los principales centros de consumo.

Asímismo, los programas de colonización y de reforma agraria, mediante los cuales se pretende realizar un impacto importante sobre los

niveles de vida de vastos sectores del campesinado a través del acceso pleno a la propiedad de la tierra, - y que para cumplir sus finalidades económicas deben contemplar, además, la aplicación de varios instrumentos de fomento como son el crédito, asistencia técnica, organización cooperativa, etc. - también llegan a un punto en su desarrollo donde necesariamente se ven abocados a enfrentarse con los arcaicos sistemas de distribución imperantes, con toda su gama de imperfecciones operativas, colusiones de intermediarios, y falta de infraestructura comercial básica, como lo son vías de transporte expeditas, instalaciones de almacenaje, equipos de tratamiento, clasificación y empaque de productos, mercados mayoristas, frigoríficos, plantas elaboradoras, etc.

Estos problemas se hacen paulatinamente más evidentes a medida que los programas de fomento y de reforma agraria se extienden y afectan a números crecientes de campesinos y áreas de producción. Entonces es que el enorme esfuerzo realizado a través de inversiones cuantiosas y utilización de los recursos humanos que destinó el Estado para estos propósitos, se ve seriamente afectado por las fallas del sistema comercial que debe dar salida a la estimulada producción.

Desde el punto de vista de los sectores ciudadanos no vinculados a las actividades agropecuarias, y que habitan en los centros urbanos, los márgenes de comercialización crecientes de los productos agropecuarios, se traducen, igualmente, en una incidencia cada vez más elevada del gasto de alimentos en los a menudo exiguos presupuestos familiares de amplios sectores de la población. Ello no sólo conduce a reducir grandemente el remanente monetario que pudiera destinarse a la adquisición en mayor escala de bienes industriales por la población, y de esta manera asegurar la necesaria expansión del mercado en este aspecto, sino que, además, trae consigo secuelas graves en los aspectos nutricionales. Es así como se puede observar que no sólo no se corrigen las deficiencias dietéticas existentes, de por sí ya bastante pronunciadas en determinados sectores, sino que se produce una retrogradación en este sentido y estados de desnutrición que pasan a ser crónicos. Esta situación no puede menos que afectar, si se mantiene, las bases mismas de nuestras nacionalidades, cuales son la calidad física y mental del elemento humano que las constituye.

El hecho mencionado y que compromete, por desgracia, a amplios sectores de América Latina, no ha sido suficientemente enfatizado desde el punto de vista de la productividad humana en nuestro medio, ya que ha sido reiteradamente demostrado que las aptitudes para asimilar conocimientos del niño, y las del adulto, para producir y trabajar, se ven afectadas directamente por la calidad de la dieta alimenticia que consumen, calidad ésta que no puede ser adecuadamente

mejorada si los precios de los alimentos, - y en especial de aquellos dietéticamente más importantes- se elevan continuamente, sin guardar, por lo demás, relación alguna con la calidad de los productos, servicios agregados y/o con el nivel de ingresos de la población.

En resumen, entonces, es fácilmente demostrable que la repercusión de la estructura comercial existente para los alimentos, no sólo entraba y limita los esfuerzos que se realizan para mejorar la productividad y niveles de vida del sector rural, sino que también incide, mucho más de lo que se supone, sobre las perspectivas de desenvolvimiento industrial y en el uso eficaz de los recursos humanos de que disponen los países.

Considerando la proyección que tiene el sistema comercial de los productos agropecuarios respecto al resto de la economía y sobre la productividad general, es de suma importancia la corrección de sus fallas más notorias, pues ello tiene un efecto beneficioso a través de todo el medio económico. Esta es, posiblemente, una de las formas más directas, eficaces y rápidas de romper el círculo vicioso que entraba las posibilidades de un desarrollo económico integral, creciente y en forma sostenida en las naciones de la región.

Desafortunadamente, no se ha dado el énfasis necesario a la solución de estos problemas, que tienen carácter acumulativo creciente, sino hasta en fechas muy recientes por parte de las instituciones gubernamentales, universidades y entidades privadas, en nuestros países. En la actualidad, por consiguiente, la mayor parte de estas están abocadas a realizar ingentes esfuerzos para recuperar el tiempo perdido en estas materias y eliminar así uno de los frenos principales para el fomento agropecuario y del abastecimiento adecuado de alimentos para los conglomerados urbanos e industriales que están creciendo a una velocidad sin paralelo en la historia.

Una de las primeras acciones que deben ser promovidas, por ejemplo, para ir a la reorganización integral de los sistemas comerciales y de los mercados de alimentos en los países, es, a menudo, la transformación profunda de la estructura intermediaria mayorista en las grandes áreas metropolitanas.

El sector mayorista representa un punto vital en la trayectoria que siguen los víveres antes de ser consumidos finalmente, y cuya producción se caracteriza por una amplia dispersión geográfica de las unidades productivas e, igualmente, por su extraordinaria variabilidad en cuanto a variedades, calidades, volúmenes y unidades de

venta de parte de los agricultores. Esta heterogénea y, a menudo, caótica oferta de productos debe ser conjugada, por un comercio mayorista evolucionado, con los requerimientos o necesidades de la demanda nacional, expresada en función de su localización geográfica por núcleos de consumo; a las clases o calidades solicitadas por los diversos sectores de ingreso de la población y en relación, también, a la distribución en el transcurso del año de producciones que, por su configuración estacional, deben ser almacenadas y conservadas por ciertos períodos de tiempo para su ulterior consumo.

Asímismo, el desarrollo de cooperativas agrícolas, por ejemplo, en la fase inicial de los canales de mercadeo, y de las cooperativas de consumo y cadenas de supermercados particulares en el otro extremo del sistema comercial, - todos ellos instrumentos de rebaja de costos comerciales- se posibilita en escala masiva y en plazos relativamente cortos, si el sector mayorista del comercio de productos agropecuarios cuenta con la infraestructura, organización y supervisión técnica necesaria para la realización de las vitales funciones que le corresponden dentro de sistemas de mercadeo modernos, que se adapten a los requerimientos actuales y al crecimiento realmente explosivo de las áreas metropolitanas.

Sin embargo, debe ser señalado que las funciones que están llamadas a cumplir los mercados mayoristas dentro de los canales de mercadeo, como elementos de promoción racionalizadora del sistema comercial entero y de fomento a la producción, son variadas y complejas, y deben ceñirse a una política integrada nacionalmente al respecto. Del conocimiento y exacto cumplimiento de los objetivos perseguidos y de las modalidades de operación que deben establecerse en el área de estos mercados, depende en gran medida el éxito de una actividad comercial organizada.

En la casi totalidad de los países de América Latina se está generalizando por parte de los gobiernos, la estructuración y aplicación de programas de desarrollo agropecuario encaminados, entre otros aspectos, hacia el fomento de la producción para atender la ascendente demanda interna de víveres y materias primas para la industria, incrementar o diversificar exportaciones y sustituír las adquisiciones de alimentos en el extranjero.

Asímismo, se ha acentuado en época reciente el interés por resolver los problemas de orden socioeconómico que representan los sectores rurales de ingresos extremadamente bajos, que los margina en la práctica de la corriente económica de los países y limita las expectativas de un desarrollo conveniente de la industria manufacturera.

Dada la trascendencia del desenvolvimiento adecuado del sector comercial de alimentos, para la consecución de las metas de producción y consumo de víveres, que se incluyen en la mayor parte de los planes de desarrollo indicados, llama la atención que, en muchos casos, éstos carecen de planteamientos claros respecto a una política integral de desarrollo comercial para los alimentos, que garantice el normal desarrollo de los demás aspectos del programa, y una acción sostenida y coherente para asegurar el abastecimiento y consumos deseados. En la mayor parte de los casos, se ha estimado, aparentemente, que los problemas de mercadeo han quedado suficientemente tratados en los planes de desarrollo, por la simple inclusión de una lista de inversiones en determinados aspectos de infraestructura comercial, como transportes y diversas clases de instalaciones comerciales y de elaboración, los cuales, si bien importantes, no representan sino una parte de la solución del problema que implica la reorganización de los sistemas y métodos de mercadeo anticuados e inoperantes que conforman el medio comercial habitual para los productos agropecuarios en la mayor parte de Latinoamerica.

Desde el punto de vista estrictamente nutricional, es evidente que cualquier disminución de los amplios márgenes comunmente existentes en la comercialización de determinados alimentos (por lo general frutas, hortalizas, algunos granos y ciertos productos de origen animal), permitirá el mejoramiento de los niveles de precios agrícolas, y el consiguiente estímulo a la producción de los artículos alimenticios.

Ello también propende a disminuir los precios al detalle haciendo, de esta manera, más accesible su compra por parte de la población de ingresos modestos, que es donde se aprecian las mayores deficiencias en el consumo de estos productos.

La importancia de una disminución de los márgenes intermediarios -lo cual es perfectamente factible en nuestros países por lo elevado de éstos y la forma rudimentaria e ineficiente de los métodos de distribución, y las pérdidas de productos y/o de su calidad que llevan aparejadas-reside en el hecho que su efecto se hace sentir en forma relativamente rápida y masiva en todo un país y además, en forma simultánea sobre el habitante rural y urbano, aspecto este que generalmente es difícil o casi imposible de obtener en la práctica, con otra clase de programas.

Esta disminución de los costos de mercadeo y transferencia de una fracción del margen comercial, a través de adecuadas relaciones de

precios, al agricultor y al consumidor, sólo puede ser conseguida mediante un planteamiento integral de transformación de los procesos de distribución de alimentos, que incluya la aplicación de una política adecuada y coordinada en este sentido por parte de los gobiernos.

En esta forma se habrá dado un paso fundamental para propiciar los mejoramientos necesarios en los niveles dietéticos de la población, mediante la acción sobre un aspecto tan básico ligado a este problema, como es la relación entre la estructura de precios de ciertos artículos alimenticios y la capacidad adquisitiva real necesaria para que sean consumidos en cantidades suficientes por la mayor parte de la población.

DISCUSION

Dr. Lombardo: Deseo pasarle el micrófono al Ing. Berríos, quien va a hacer una presentación sobre programación del sector agrícola en Centroamérica.

Ing. Berríos: The subject was supposed to be developed by Dr. Gonzalez, one of the leading agronomists working in agricultural programs. He is working in Chile and was supposed to come for this Panel. I am not a specialist in programming but I will try to make a relation about the steps taken by the "Mision Conjunta de Programación para Centroamérica" in relation with agricultural problems. The strategy of the program has been designed and the Instituto Latinoamericano de Programación is cooperating with the Mission. The decisions as to the relation oridentification of problems and the selection of projects are being taken and the implementation of strategy is the following step in doing that. At the present time we are trying to assist the government in specific projects. I would prefer to continue in Spanish in order to cover the matter a little faster.

Casi desde el primer día hubo el consenso de que en Centroamérica se deben hacer primero estas cosas. En primer lugar hay necesidad de incrementar una selectiva gama de productos alimenticios, es decir, productos alimenticios seleccionados. En segundo lugar se debe elevar la producción y además se puede hacerlo. Esto implica que se tomen medidas necesarias de orden técnico y político. Ya ha sido señalado este grupo de medidas, tales como el uso por parte del agricultor de insumos adecuados y de la tecnificación conocida y mejorando también los sitemas de comercialización y mercadeo. La Misión

ha sido consistente con ese punto y formuló un programa regional de producción de granos básicos que incluye maíz, frijol, arroz y sorgo, para Centroamérica, durante el presente quinquenio. Este programa ha servido de orientación para la formulación de programas nacionales sobre granos. Estos programas cubren la fase de producción con todas sus implicaciones y la disponibilidad de personal entrenado para hacer servicio de extensión y enseñanza media superior, para los técnicos que ayudan en la investigación en la extensión. El programa también observa la conveniencia de formar cooperativas de producción y de mantener y acelerar los programas de producción. El crédito no es contemplado como un medio, por ser una esfera tan amplia que se requiere un estudio por separado, el cual se está llevando a cabo actualmente. La parte de comercialización que también es tenida como una de las estrictamente necesarias para poder acelerar cualquier proceso de producción de los granos, había sido desde hace unos cuantos años cubierta por CEPAL y FAO con estudios que han realizado sobre las necesidades de comercialización y necesidades de ampliación de instalaciones de almacenamiento, junto con SIECA. De hecho existe ya en Centroamérica una comisión coordinadora de mercadeo y estabilización de precios. Esta comisión funciona, celebra reuniones periódicamente y toma decisiones sobre niveles de precios que deben regir en los países a fin de que haya un criterio homogéneo. El Licenciado Ponce seguramente les va a exponer este aspecto que es bastante amplio y para lo cual es la persona más enterada. Por lo demás, sólo tendría que agregar que la Misión también está trabajando en un programa regional de producción de carne y se prepara un programa lechero para Centroamérica. A grandes rasgos, la Misión se ha concentrado en materia de programación de la producción de alimentos, en los granos básicos y en carnes.

Dr. Lombardo: Muchas gracias Ing. Berríos. Tenemos ahora la presentación del Lic. Mario Ponce de SIECA.

Lic. Ponce: To begin with, we must take into consideration that the there has been signed a treaty of economic integration that has created a common market for Central America and also is tending toward the economic integragion of the five countries. Then, we talk about regional planning, because under a common market it is no longer possible to plan nationally without taking into consideration the situation of the other countries. That is why I say that we must do regional planning at the same time with national planning. This precisely has been one of the activities of the Mission that was created about three years ago. As Ing. Berríos pointed out, there is a mission from Chile coming to assist in the preparation of long range planning.

We still have not prepared a long term plan for the economic development of agriculture in Central America; we are mostly working on a short term basis. First we are considering three main aspects. One is diversification of the export products of agriculture. As you must know, we are dependent mostly on three agricultural products for our foreign exchange: cotton, coffee, bananas in some countries and sugar in others. But these three products cover about 70% of our foreign exchange. We realize that these three products are continuously subject to extreme fluctuations in price or to external conditions which are not controlled by the country and therefore it is the intention of the governments of Central America to diversify agriculture and to make it less dependent of these three products. The other aspect that is being considered on a short term basis is the extension and modernization of productive activities of grain to cover the dietary needs of the population. On this respect I already explained the situation on basic grains that are essentially the basic food of the population and are essentially the main occupation of our agricultural population. The third aspect is the development of livestock production mostly for exports and also the substitution of imports of milk by internal products. Now, regarding the diversification of products for export, it has been considered the possibility of exporting vegetables and fruits. There have been studies made by OAS as to what are the market possibilities in the United States and several of the European countries for tomatos, pineapple, citrus fruits, strawberries and some other products. Once we have developed an export market for vegetables, then we have to concentrate our efforts on the consumption of these vegetables in the internal market. Because it seems to me that changing the dietary habits of the population takes a long time and if we already have an external market we have the possibility of exporting the product, then we can divert the production towards this end. Once we have established our marketing and storage in third countries, then we have to direct our efforts for local consumption. Now, as to the basic grains, I won't go into this because we have already gone into it. I think you have some charts that were prepared, showing just what the situation is in reference to corn, beans, and rice. I would like to add that this, of course, is taking into consideration hypothetical situations as to a new diet requirement that was prepared by Lic. Ramírez, but the production figures are the actual production figures for 1965. These are the figures that we have received for the country, and the figures for 1969 refer to the projections of the country. I was pointing out that these are production projections, however, these have not been followed up by specific projects. We have general projects; we have

seed production projects, projects on fertilizer use, but we do not have an integral project as to how are we going to achieve the projections that have been pointed out by the countries. Another thing that we have to take into consideration is that we cannot longer plan for each country, and I think in some cases Dr. Echandi mentioned marketing in view of the fact that Honduras has better possibilities for bean production. It was possible that under the common market there should be an increased production in Honduras to supply the other countries. Of course, we must take into consideration the different ecological reasons if we are going to increase production taking into consideration those situations that are best adapted to the particular production of certain products. Also we can see in the chart what the situation is, as far as beans and rice are concerned. We already have enough corn for our population and even this is a hypothetical situation, taking the actual consumption of corn we do have enough. We should not discourage corn production taking into consideration that it is more important at present to produce more rice and beans than to produce corn. I won't go into details of this. We are also working on the coordination of the marketing and rationalization of the marketing of grains in Central America. These programs are not coordinated and we must make compatible the free trade with price stabilization programs. At present only Costa Rica is the country that has the most complete program; they are covering corn, beans, rice, and sugar. All the other countries are defficient as to the products they cover. Some of them, like Nicaragua, cover three products: corn, beans, and rice; some cover two and there are countries only offering price for corn. There is one country that has four products so we must have price estabilization in the other four countries for the same products. in order to avoid abnormal movements of grain due to better prices that might be offered in other countries that have prices for different types of grains than we have. So, this is one of the aims that have been in mind as to coordination programs. Also, another one is to contract enough grain storage facilities. There is a lack of storage facilities in the country, so it is our intention to construct grain storage but with a regional sense, that is, taking into consideration not national but regional movement of grain. To this effect it has already been prepared initial plans for storage centers in the area, and as I said before, taking into consideration the region as a whole. Another of our aims is to get the governments to provide enough funds for the operation of these projects and for the purchase of grain on a minimum price to the farmers. Again we have only one country and it is Costa Rica where the government is providing enough funds for this program. In other countries there are no plans and we find

sometimes situations when they cannot buy the whole amount offered by the farmers. This situation is what we may be facing in this harvest of corn. There are some countries that have grain centers already full with corn, the new crop is coming and I don't know what are they going to do. That is why I want to mention that this might go into one of those price fluctuations that retard the grain production in Central America.

Now, I am going to make some comments on milk. There was mentioned that there is not enough food production in Central America to cover the hypothetical diet that said Lic. Ramírez. You may be assured that, according to Lic. Ramírez, we would need around 968 million liters of milk on an adequate diet. The estimate production for 1959 was 950 million. So, actually we do have enogh milk produced to supply this hypothetical diet but the question is how can we get this milk to the consumer. In the first place there is a very poor social structure in Central America. There is no relation, there is no connection between production centers and consumption centers. There are difficulties in preservation and transportation of milk and on top of these things we find that most of the countries have utilized this fluid milk into by-products which are usually at low cost and which bring good prices to milk producers. I mentioned that in a country like Honduras, 77% of milk production is not brought fluid to the consumer, but has to be prepared in by-products. And these by-products usually mean a very poor quality of cheese. So we have a situation that in the rainy season we have a tremendous amount of milk production, prices go very low, people have to divert this milk to the production of poor quality cheese or feed it to the calves and then there is a scarcity during the summer time, prices go up, and the consumer is supposed to buy the milk at the prices that are offered at the market. So we must find a solution to this problem of milk supply in Central America. On the other hand, we have imports of about 6,000 tons of powdered milk from third countries and we could very well supply this imported milk with internal production if we rationalize the production and if we construct adequate centers to process this milk in those areas where it is produced. At present, there is one plant in this country that can produce powdered milk. However, they have had some difficulties in the operations but there is the possibility of increasing production of powdered milk. To this effect, the Central American Intervention Authorities have taken steps to protect the market for the producer, and they have taken two meassures. First, they have increased their tariff on imports of milk. It is a gradual increase so as to give time to the milk producers and the government to contract the necessary installations for the production of powdered milk in Central America. The second step is to establish a quota system, whereby

once the country has enough internal powdered milk production, then they can request the government to impose a quota on the milk coming from third countries. This way they are trying to guarantee a market for the producer of milk. Of course, there has to be measures to guarantee price and guarantee supply for the consumer. On this respect it is also contemplated that milk should be offered at reasonable prices and by that I mean prices that are more or less current on the market and also there would be a quota in the event that they are self-sufficient, and open quota to be brought outside to maintain a sufficient supply of milk in the market. This is the situation on milk. Unfortunately, there are no national or regional plans for production. It is projected, so we have been a little bit advanced for measures on imports, the countries have not reacted soon enough to take advantage of this situation and from what we already have seen there are protests in some countries, in Guatemala recently, and in some other countries, that have been protesting that the desire for milk has increased and that there have been no counter balancing measures tending to produce that milk.

Now, I will refer to livestock. On the last eight years there has been a tremendous increase and demand on livestock. In fact, we are exporting now 30,000 tons of beef and 8 years ago it was a little amount that we were exporting. We are not self sufficient on beef and as a result, there has been a tremendous decrease in the availability of supply per capita. We are sure that the availability of beef supply was greater about three years ago than it is now. Some countries have tried to correct the situation imposing controls on exports of meat trying to guarantee internal supplies. I don't believe this is the right apporach. We are trying to increase production, rationalizing internal market of meat or to sacrifice beef for cheaper kinds of meat that could be produced in Central America. At present, in view of the situation of the beef, most of the countries have undertaken an increased production of livestock meat. However again we have a divorce between production from the economic point of view and research on the other side, especially on forrage and feed. I don't think we have any problem to increase forrage production or to increase the animal feed, and again it is another situation where we have to establish to increase a big production but at the same time establish the means to increase forrage and feed for these animals. Otherwise, we might find ourselves with lots of animals and we don't know if we can feed them, especially during the summer time when most of the difficulties occur.

Dr. Lombardo: La mision de los programas regionales de que hablé se interesa por un programa regional de diversificación de importaciones. En esa diversificación agrícola entrarían algunas frutas, tal como indicó el Licenciado Ponce. Además, a nivel de los países, hay interes en desarrollar programas específicos de fruta.

Lic. Ramírez: If we stop to think of the relative advantage that the Central American countries have enjoyed during the past will be weighted up very soon, and that these countries will face a situation of having to turn to the production of foodstuffs and other elements which are basic for their self-sufficiency. We have to rember also that trade is conducted by individuals who look at the gains of the foreign exchange for their own enjoyment and not for the welfare of the people. Therefore, the gains of foreing exchange will be dedicated to private means rather than to financing capital formation for promoting the internal production. That is the reason why we feel very strongly about these attitudes of developing programs because we find that in the past what we had was the enjoyment and the enrichment of a few exposers at the cost of the hunger and unhappiness of the vast majority of the people.

Dr. Lombardo: Before turning over the microphone to Dr. Pinchinat, I would like to announce that we will adjourn at 12:30 and the meeting this afternoon will begin at 3 o'clock.

Dr. Pinchinat: It has been very interesting to know that it has been established regional basic food crop program for all Central America. I would like to ask Mr. Berríos at what stage of execution is this basic food program and what are the plans to include in it the orderly participation of the agricultural research people or institutions like the Inter American Institute of Agricultural Sciences of the OAS, the agricultural stations and the universities. I make a distinction between those agricultural stations and the universities because in most cases the stations are run by the Ministries of Agriculture whereas the universities do their own independent work, and on top of that both the Ministries and the Universities sometimes do not try to join hands with autonomous or independent organizations like the Inter American Institute of Agricultural Sciences that I mentioned earlier. So I would like to hear of specific plans to harmonize the work of these institutions for more collaboration between them.

Lic. Aguirre: I would like to say that I am very pleased to see the interest of Lic. Ponce on the development of forrages and feeds for the development of livestock. There is no question in my mind that

we can not have an efficient livestock industry in Central America unless we do have the concurrent program going along of producing better forrages and better utilization of them on a year round basis. I still would like to see one good program started and continued in Central America for this particular area and we have over-emphasized the need for organizations that have the possibilities of promoting this kind of program in order to have an efficient production to be economic for local consumption but also to compete in the international export market.

I have another question for Ing. Berríos and this concerns to the promotion that the governments in Central America may be doing in the aspect of agricultural cooperatives concerning not only production but also marketing. It seems to me that in many countries this has been the answer to some of the marketing problems, and we have had some examples in Central America of cooperatives that have had done very well. In Costa Rica the cooperative of milk producers in the central plateau has kept in business many milk producers that would have been out of business if it were not for this type of efforts that the cooperatives have had there. In Guatemala, for a very few years, they have had an example in the western part of the country, of wheat producers, and that has increased the yield and has solved some of the marketing problems. I would like to know how this Central American growers are considering this type of solution.

Ing. Berríos: With respect to the question of Dr. Pinchinat, I must say that this program was discussed by representatives of INCAP, FAO, ISOS, and other institutions. Besides that, in the meeting of the Ministries of Agriculture and Economy, it was taken a resolution asking IICA and the Misión to coordinate the precepts for an agricultural education program in Central America. I think that IICA has published already a document which is supposed to be the basis for the preparation of this part of the information to be used in the formulation of a program. That program is supposed to be designed in the near future and that will have to take into consideration your advise that there should be coordination not only at the level of research institutions but also in the institutions that are concerned in the development of agriculture.

Concerning the question of Dr. Aguirre, I should say that the formation of cooperatives is usually easier for the marketing aspects. It has been much more difficult to get success in the production phase here in Central America and besides it, even though it is

known that the type of associations has been very successful in other countries, and that here in some countries like in Guatemala cooperatives have been among the indians but the number of failures is probably much higher than the number of successes. The problem that has been shown in the formation of cooperatives has been balanced by the failures. The failures usually come from lack of experience in management. The classical concept of cooperatives is now being revised and adapted to the Central American conditions, giving them some help in the administration of their cooperatives to insure that they will have economic success, otherwise, the cooperatives usually fail.

Dr. Lombardo: Thank you gentlemen, we will adjourn at 2 o'clock.

EL PESCADO COMO FUENTE DE ALIMENTO

Dr. L. Vasconcelos

I would like initially to make it clear in this presentation that when I refer to Central America, Panama is included. The weights that will be mentioned, unless otherwise stated, refer to head-on fish in raw, the imported quantities converted accordingly. I would also like to state that I regard fish mainly as a commodity. In this sense, with due consideration of the nutritional needs of this region, I am as happy to see it being exported as to see it consumed locally. In some cases I am, indeed, much happier to see it exported.

Well, gentlemen, we all know that fish consumption is very low in this region. Current estimates reach the figure of roughly two kilos per capita (or about 1,500 grams of edible substance) of which a little over a third is being supplied through imports. Foreign products, therefore, still make a large contribution to internal supply. It appears actually that imports have increased in the last three years.

In general, we deal with very unreliable statistics, as far as the consumption of fishery products is concerned. But it may be fairly assumed that from 1960 to 1965 regional consumption has increased by 38 per cent; local production by 33 per cent. If we consider that in the same period there was a population growth of 18 per cent, this would mean an increase from roughly 1.8 to 2 kilos in per capita terms. One would say that the rigidity in the supply of meat products, more than anything else, was responsible for this trend. Meat production increased barely by 6 percent between 1960 and 1965, according to ECLA figures, and it seems that such a displeasant situation has stimulated the consumption of fishery products, among which fish caught by the shrimp companies was readily available in sizable quantities and did not require practically any extra investment to reach the market. Other local sources were similarly encouraged, of course. In Panama, to cite an example, a few small entrepreneurs went on to meet the new market solicitations through a better organization of their efforts and the utilization of rather modern equipment which now allows them to supply fish more efficiently than the artisanal fishermen can do. There, as elsewhere, it should be mentioned that overhead investment in roads and other basic facilities, such as power plants, has contributed indirectly to facilitate this recent increase in the supply of fish originated in the region.

With the present market situation in mind, realizing moreover that meat production cannot improve substantially in the very near future, it is only natural that the Central American Governments are eager to promote the development of the fishery industry in their countries. Therefore, a more important role is being accorded to fisheries in economic planning. To achieve a higher production and consumption of fish, however, the Governments face two major problems. The first one is that very little is known about the resources available. The second concerns the complexity of creating conditions for a decisive expansion of the internal market, this being a multifarious goal.

In relation to marine resources, an optimistic view seems to prevail. Indeed, from the information obtained so far, mainly through the shrimp industry which, incidentally, is catching fish with a most unselective net, we are able to establish the existence of several species of good commercial value and to make assumptions regarding the potentiality of these resources. Some investigation has already been carried out, particularly by American institutions, which also tend to identify encouraging prospects. The Costa Rican possibilities were mentioned here by Dr. Chichester. I would like to state that the Caratasca Bank in Northeast Honduras, the Panamanian Bight, the coast of Nicaragua, and many other parts of this region also look very promising.

In relation to market mechanisms and facilities, we face a serious handicap in Central America. First of all, the consequences of a low income level that have been cited here several times. A low income plus the demonstration effects referred to by Miss McKinnon, which in this mass consumption society of ours exerts a heavy pressure on the population to spend more and more in superfluous items with the result that consumption patterns are considerably distorted in contrast with the historical development of other countries which have already overcome poverty. These demonstration effects increase the burden, no doubt, on the presently underdeveloped countries, sometimes reducing their capability to satisfy essential needs.

Secondly, I would cite the low acceptance of fishery products in the Central American households, on account of food habits which, like in most of Latin America, do not favour fish consumption. Any housewife in such fishery minded countries as Portugal or Spain, for instance, knows how to prepare and cook scores of different species of fish, each one perhaps in four or five different ways. In Latin America, which has been a meat paradise, it is common that the housewives do not even know how to cut a fish.

A third point deserving notice would be the infrastructural facilities. They are, at present, quite deficient in this region. May I call your attention to the fact that the fishery products traditionally imported do not require any special market infrastructure. Also, the present installations for landing shrimp, plus the use of trucks, a few crude hand-carts and the very clumsy stalls one sees in the "Mercados Municipales" have been enough, up to now, to handle the fish delivered by the shrimp companies and the artisanal fishermen. But this, of course, is not sufficent to cope with a larger supply and a wider market.

One word should also be said concerning the reticence of entrepreneurship. In brief: present experience clearly demonstrates the obvious fact that it is one thing to export fishery products for a prosperous salers market, but quite another to cater for the internal market. The entrepreneurs in this area tend to prefer business which will not confront them with so many difficulties as fish production and local marketing do.

The inadequacy of the administrative set-up should not be left without mention. The present fishery administration in Central America, this including all sorts of services that the Governments may provide to the industry and the consumers in general, is rather weak, and no precise development policy has been devised for them to follow. It has not yet been possible to establish sound fishery agencies in this region. The Governments lack trained personnel and adequate means to foster fishery development. Moreover, additional basic investment needs are outstanding for the benefit of the whole sector.

The Central America Regional Fisheries Development Project which has been requested by the CCE and financed through the Special Fund and the Governments is long due to become operational. I hope it will start very soon. Next month, likely. It is a very ambitious project, aiming at an expedient assessment of marine and brackish water stocks, processing and marketing studies and demonstration, the strengthening of fishery administrations, etc. Resource investigation is planned to allow for successive feasibility studies as we go on. It is our intention besides, to carry out an immediate programme with a view to a better utilization of the presently exploited resources. We shall have, as you already know, four small boats of a multipurpose type. Other specialized equipment is also contemplated in the Plan of Operation. When fully operational, nineteen international experts and about 50 counterpart staff will be working in the Project.

I just said that one of our main goals is to contribute to the improvement of the existing industry, assisting the Governments accordingly. We will endeavour to assist in granting an adequate place for fisheries in the national and regional economic development plans. There is an urgent need to do so. We heard the representative from SIECA referring to milk and meat planning, as well as to other aspects of agricultural planning, but he could not speak about any policy for fisheries either in the short or the long run. We shall cooperate closely with that Secretaría and the National Planning Boards to fill in this blank.

Another important goal of ours will be the demonstration of processing methods and marketing, which will call for the usual educational campaigns and other measures that I will describe briefly to you in a few moments.

In the carrying out of our programmes we will seek the collaboration of the existing institutions, being very conscious that with such a scarcity of means, development efforts should not be duplicated. The Fishery Department of FAO does not think it advisable that we should start by recommending the establishment of another regional institute, a Fisheries one. I am instructed to try and coordinate the activities of this Project with those of the existing institutions which in one way or another are interested in fishery development. This not withstanding, however, that we may discuss with the Governments at a later stage the possibility of creating a Central American Fishery Institute.

What we would like to promote immediately is such collaboration as, for instance, with the ICAITI, to assist in the development of its lines of action in the best interests of the fishery industry. Our activities will have several points of contact with ICAITI.

I have been assured that with INCAP we could also discuss common programmes under a similar arrangement and I will be very happy to raise this matter on concrete terms with Dr. Behar. Collaboration with UNICEF may also present positive prospects.

With regard to bilateral aid schemes, there seems to exist several possibilities deserving consideration. Let me just mention one: Peace Corps teams that may be associated with this Project; but there are many others. The region is already benefiting from scholarships, feasibility studies, industrial cooperation and finance, etc. provided through bilateral aid.

In a word, we intend to knock at all the available doors, including the universities.

Please let me have any recommendations and comments that might occur to you on the prospects of collaboration with this Project.

Well, it seems relatively easy to assess and to program investments assuming that the basic resources are available in quantities which would allow for a clear outlining of production alternatives. But this is only one step. The Fisheries Project, besides making all possible efforts to measure investment requirements, will try and assist the Governments to promote those investments that may be considered for financing either by the Interamerican or the World Bank. This, we hope, will not fail to encourage private industry. The Governments will be constantly informed of the results of the feasibility studies carried out by the Project with a view to an integrated development. In the light of these studies they may wish to appraise the possibility of creating some sort of a regional investment fund, opened to the fishery industry within their economic integration scheme.

I would also be very happy if the Governments would agree to set forth a development policy together for meat and fishery production. Meat production is growing slowly, and an increasing amount is being exported. Exports which augment at the annual average of 15 per cent, are obviously good for the countries, since meat products reach higher prices outside. By all means, they should be pushed further on; no less than the exports of fishery products. Meat and fish production face the same market eagerly. A larger output of fish would perhaps be a great help to the meat producers because it would tend to alleviate the present pressure on the diminished supplies per capita which they make available to the mass of local consumers with the complaint that they do not receive sufficient remuneration. It is possible that meat prices will step up further. The cattle raisers are facing higher production costs. These may increase even more if a serious attempt is made to reach quickly the desired output in the near future (sellective breeding, special pastures and fodder, etc.).

We should ask the Governments to assess the social costs of a simultaneous development of meat and fish production, with wide views set both on the export and the internal markets, in order to establish complementary investment programmes and other forms of assistance which may be shared in common by these two important sectors of the regional economy.

It seems a fact that Central Americans are already consuming one kilo (if not 1½ kilos) less of meat per person/year in relation to the average of five years ago. Fisheries may contribute substantially to reduce the drastic effects of this situation on human nutrition. You see, it would be in the best interest of the cattle industry to discuss with the fishery people ways and means towards an integrated policy which would help at the same time producers and consumers. This may have manyfold aspects. I sincerely believe that if the Governments are encouraged to move along these lines, we will have achieved something of paramount importance. In this connection, I dream of having discussions with the main representatives of private enterprise in each Central American country to stimulate their interest in investment and management of new fishery ventures. I am sure that regardless of their particular fields of activity, they will realize that by so doing they will be acting against a steeper increase in the cost of the labour they hire. In El Salvador, as elsewhere in the region, I have already met entrepreneurs of a high calibre who assured me of their interest in discussing such propositions based on serious feasibility studies.

The Governments, we know, are prepared to go a long way in basic facilities. They may also participate somehow in direct investment in fisheries. In this case, I would like them to tell the representatives of private industry: Look, gentlemen, since this action is bound to reduce the cost of your labour, do not lose the opportunity of making your presence be felt from the beginning. If participation by the Governments is eventually considered possible and necessary, and if you, the private industry, for one reason or another, think that the Government may not be the best manager, the minimum you can do is to provide between yourselves and adequate management and make an offer of it...

Availability of private capital does not seem actually to be a problem. However, to spur the development of the fishery industry, a situation may arise which will make desirable that Governments buy preferential stock in new fishery enterprises for the internal market, to be sold later to private interests. For quicker results every possibility must be explored, of course, including this one, to which the preceding remarks would apply fully.

To finish this presentation - I am trying to keep myself within the 25 minutes, which seems a reasonable time - and in order to give you a rough idea, gentlemen, of the investment needs for the development of the fishery industry here, I would say that to double

the present consumption level we would probably require, in a very optimistic assumption, perhaps one dollar per capita of direct investment, something close to fifteen million dollars plus perhaps twenty or thirty million dollars in overhead and basic facilities. Central Americans are spending some eleven million dollars per year in fishery products, or less than 1 per cent of their gross expenditure in foodstuffs. One third of that, as I mentioned at the beginning, goes for imports which have lately increased. The present rigidity of the meat supply is helping fish into the market through the back door, you know, but it is also favouring the imports of fishery products (which by the way are cheaper than the imports of meat products). Regional sales of fishery products are probably close to 70 US cents per capita. If we would project the last five-year trend, we would have by 1970 a very modest increase of from 20 to 25 cents per capita. We should fight to encourage the consumers to spend more money in fish from their additional income expected from here to 1970. I assume, --I am very scared about all these figures, please accept them as but a way of reasoning and believe me that next year I shall be better prepared! --I assume that, in 1970, the average Central American citizen may have an increase in the order of 15 dollars above their present annual availabilities to buy foodstuffs. I again refer to the very interesting remark made by Miss McKinnon. On the arena of those fifteen dollars there will be a wide competition. Competition from the well known suppliers of all "modern life" pleasures, not forgetting soft drinks... I am not against soft drinks at all, of course, I enjoy them very much. My children are very fond of them. But I refer to soft drinks as an example of the impact of huge advertising machines, huge payments to those shouters over the radio that every five minutes remind us that we should buy this and that, or otherwise die.

On these 15 dollars there will be then a very stiff competition. If Miss McKinnon's remarks are right, and I think that they are right, part of it will go to all sorts of gadgets, transistor radios and sun glasses. Isn't that so? But let us assume with an optimistic view on the available marine resources that we can get hold of one dollar for fish. I frankly do not know yet what this would cost in terms of previous advertising and in investment costs, but I would like to think that such a goal can be achieved: To grab one dollar out of the 15, for fish! If this is possible, private industry would have the prospects of an increased turnover of 16.5 million dollars that even at present prices, -- which surely should come down or else these prospects may not materialize at all-- would mean the additional sale of 39,000 tons of fish. Well, Gentlemen, I think I better stop here. Your remarks and questions are most welcome. Thank you for your attention.

DISCUSION

Ing. Fonseca: I was very much concerned this morning, when Dr. Vasconcelos gave some data on the losses that the fishery industry has annually here in the Central American area, and if I am not wrong, he mentioned that annually a whole amount of eighty million pounds of fish from the shrimp fishery go to waste.

Well, I was a little concerned about this and I was not very well informed on the amount. I knew that there was some loss, but I never thought that this was so much loss going on. Because recently I had the opportunity to go in one of those shrimp boats with the Minister of Agriculture of Costa Rica who had been showing what the losses were in order for our country to sign up for this project that Dr. Vasconcelos has mentioned recently. And when the nets came up to the ship, we were told that only just about 12% of the total catch was shrimp. The rest was all waste. We saw how this shrimp was picked by hand from the deck of the ship and the rest of the fish was shown back into the sea. Of course, all these fish were already dead because they had been on the deck for a long time, while the shrimp were being picked. So what this fish was projected for was either to be decomposed in the sea, or else for some of the sea birds which follow these ships very closely; we call them "buchones" in Costa Rica, because they have a big pouch underneath their necks. That is where they feed from principally. We were very much concerned about this and we asked the fishery technicians who were aboard, what was the possibility of using all this material instead of just throwing it back into the sea. They mentioned the fact that they had a lot of trouble in refrigeration, because usually these ships go out to sea for a week or maybe a little more and they just have enough refrigeration capacity for the shrimp. They don't have any capacity for the extra fish which could be perfectly processed later on when they came back into port. Well, this intrigued me, and it worried me because right now here in Central America we are paying about ten dollars per hundred weight of fish meal in order to feed our poultry and our swine. We animal nutritionists have to deal a lot with fish meal because we have to balance the amino-acids of the diet with fish meal for either poultry or swine.

One of the technicians that was on board that day mentioned the fact that the only way to try to use this fish, this surplus fish or waste fish, was to grind it on board, and probably throw it in the sea in plastic bags so every day a boat would come up and pick it up from the sea. However, this does not seem very practical because other

fish, like sharks, might catch the plastic bags and it would be waisted again. So I would like to ask Dr. Vasconcelos if they are taking any immediate action to save this waste that is going on at the moment.

Dr. Lonnquist: I have a question. I suppose it is a little bit on the ridiculous side but I wonder if anything has ever been done about the possibilities of stocking farm type ponds throughout the countryside, where they can be constructed with good edible fish that might be utilized then by the local populace. The reason I ask this question is that I remember reading a short article in the Brazilian Genetic Society Journal, about a year ago, and they were commenting on the tremendous food production potential that existed in some of the ponds in Brazil, as compared with (this is per unit area of space), the normal food crops that were grown in this area. I suppose these fish were feeding on naturally growing plants so they requiere little extra attention and I do not know too much about it, but at least the idea sounded to me a little bit comparable to using cattle and sheep for harvesting forrage in areas in which you couldn't normally recrop the area. I just wondered if anything has been done in this area at all. At least there is a possibility.

Ing. Aguirre: My question, Dr. Vasconcelos, is in the same line as Ing. Fonseca has already indicated. I am really concerned with the possibilities for this trash fish. You mentioned this morning that no country has really solved this problem so far, and I recently had the opportunity of reading a reference concerning some work done at the University of Miami on trying to preserve this fish. I am not fully aware of the exact methods used but I wanted to ask if this promises any breakthrough on this line or perhaps the use of antibiotics or other bacteriostatic agents that might help in preventing the spoilage of these trash fish, that might make it commercially available for fish meal production or other type of products.

Dr. Rols: I would like to ask Dr. Vasconcelos if his program has a specific project to elaborate fish flour.

New speaker: I might be wrong, but it is our impression that the consumption of fish as fresh fish is going to find great obstacles in terms of food habits for the large majority of the population in Central America. I don't mean that it is impossible. I think that it could be, and should be modified. But I see it as a more long term project in terms of direct consumption of fresh fish and I think in the meantime while the industry develops, in my opinion, more attention should be given to the industrialization of the product, which can have a much more immediate market on a larger scale than the direct fresh consumption.

There have been some efforts by FAO and other groups in establishing fish ponds and the problem is that people are not accustomed to eating fresh fish. I mean the large majority of the population. The people that will consume fresh fish is a very small minority in the area. But the potentialities that we forsee for industrialized products, processed products, not only fish flour, which is usually the name given to the product that is particularly designed as a feed for animal feeding, but fish protein concentrates which are specially designed for supplementary purposes in human foods, could be extremely useful. Dr. Bressani, in our Institute, has been working for years on the possible utilization of these products and we have the basic data on how they could be utilized from the technical point of view. If the products were available at a reasonable price, of adequate quality, a lot of things could be done with them.

Dr. Vasconcelos: Replying first to Dr. Fonseca--there are no technological problems involved in the utilization of trash fish itself, except maybe that the type of boat used by the industry is probably not the most suitable for a satisfactory recovery of trash fish. This ought to be investigated. A study to assess the possibilities offered by other types of vessels, or by introducing modifications in the present ones, could perhaps be envisaged. Anyhow, the problem is essentially of an economic nature. You certainly mentioned an important aspect of it, that the fishermen cannot easily store trash fish aboard, and then also, even if fish is landed in good conditions, processing operations may not be economical depending on the possibility of an adequate scale of meal production being reached in function of the quantities landed. Several types of fishmeal are possible. The feasibility of producing the simpler ones will be studied, I hope, in cooperation with the ICAITI and other institutions. Besides, we are encouraged by the news that the European industry have recently devised rather cheap plant units for a small scale output, which are able to produce fishmeal of top quality with little investment requirements.

Please be assured that we shall pay the best of our attention to the problem, although realizing fully that several shrimp countries have already tried to solve it, so far without significant results.

In relation to ponds, kindly note that my project is devoted only to marine and brackish water resources. However, I would dare reply to Dr. Lonnquist. There appear, indeed, to exist real possibilities in the region for fish cultivation in ponds and small lakes. In Mexico they have developed with considerable success the production of carp and other pond fish. I recently saw, paying attention all the way down from Mexico City to Guatemala, quite a lot of carp being sold

in the market places, fried or fresh, with an excellent aspect. But I don't know at what price they are being raised and harvested. Of course, Dr. Behar was right in insisting that the region is not used to fish consumption in large scale. It is interesting to notice that Central America has not developed pond cultivation methods. I ignore whether the Mayas and other pre-colombine people practiced fish cultivation. Never read any reference anyway. Incidentally, this is also one of the few areas in the world where no real tradition of dried fish is known. You agree with this, would you not? There is no such tradition to an extent comparable, say, with Africa.

Some work with ponds has already been done in Central America. One question that I always put to myself, here as elsewhere, is the question of costs. Sometimes these experiments cost a fortune. And this is not noticeable in the part of the iceberg seen from the surface. Pond cultivation, where it was already an established tradition that could be relied upon, has paid excellent results in several countries. My colleagues of the FAO Fish Cultivation Section are much interested in pond fisheries. One expert has just been through this area. I shall meet him in El Salvador in a few days, and I am looking forward to getting his views on the possibilities of the processing and marketing sections of this Project being of assistance to an eventual programme of fish cultivation.

Dr. Aguirre, I have partly answered your question, I presume. Your point is very interesting. I cannot be specific, because I am not a processing technologist. But my Project shall look very carefully into the possibilities you referred.

Before replying to Dr. Rolz on fish flour, I would make some comments on food habits. This is really a very important aspect. To start with, people may be ignorant, but they are intelligent. I have studied budgets and food balance sheets and it always amazed me to realize that the population of the poorest countries do really seem to get the highest food value possible out of their low income and technological level. I doubt that anyone of us, if we were suddenly pushed on a one-hundred dollar basis would do so well, in spite of our cultivated background! Generally speaking, I dare say that Central Americans are obtaining the most they can from the little money they have. However, in a society that is becoming more and more urban, large segments of the population are increasingly facing a market economy and, there, the former intelligence may not suffice to cope with the first years of market impact. They must buy now everything they eat. And they must probably make choices against better old food habits. The diet may deteriorate considerably during those first years.

In order to facilitate the acceptance of fish, I hope that we will reach an interesting collaboration with INCAP, to accomplish a straight forward effort. Preferably paid out by the cattle raisers... I hope that we can demonstrate successfully how best and more economically fish should be consumed. Among the aspects to be considered -- and we had the opportunity to exchange some views already on the subject, I would say three or four most economical and easy ways of preparing fish ought to be determined beforehand. We should assess the costs of fish consumption, not only in terms of fish itself, but also of associated foods. When we consume fish, fried, how much goes into oil costs, salt, potatoes or rice? Is it cheaper, perhaps, in boiled preparations? What then in vegetable costs, tomatoes and so forth? How much should the housewives expect to spend for each alternative? You see what I mean. This study on associated foods which could provide us with a few reasonable alternatives to work on, would represent a great help to the demostration programmes that I expect to carry out.

It is a hard program, Dr. Behar. You know it well. Moreover, fresh fish being perishable, and the fight against the effects of a warm climate being more expensive than against the effects of a cold one, the consumption of fresh fish in large scale may be too expensive than against the effects of a cold one, the consumption of fresh fish in large scale may be too expensive for the present income levels of the mass of consumers we wish to touch. Industrialization seems indeed to be a more adequate solution. By industrialization I mean mainly dried and salted fish, that can be easily stored, easily transported and easily financed, if a price support scheme is shown to be feasible. Obviously, the Governments and the banks can more readily finance processed than fresh fish.

Other forms of industrialization are possible, no doubt. I beg you not to make me many questions about fish flour, because I still have quite a lot to learn and so far I have been frankly more discouraged than encouraged about it. There are possibilities of turning out a good product. There are never technological problems for such relatively easy processing, when mankind is already reaching the moon. An excellent flour can be made out of fish; proteins, fat contents and other elements suitably extracted and mixed. A reasonable price, is a different thing. The industry may never be able to produce here so cheaply as in countries like Peru, which have sold a mine of fish. A very rare example in the world. But from this very cheap level to something more reasonable, several alternatives can be studied. More or less moisture, more or less fat. However,

how to consume fish flour except in ready-to-serve soups and other sophisticated foods, becomes the second big question. I wish INCA will be able to make a decisive contribution to solve this question when everybody else, everywhere, seem to be concerned with it nowadays. I am afraid nobody has really given a correct answer yet. At least this is how I see it. I have known of a small experience which left me in despair. It had to do with the foolish idea- excuse my saying so- of enriching manioc flour with proteins in an underdeveloped area where this flour is produced by a multitude of small plants much scattered around. To be sure that the protein were added to the flour, the experiment was carried out at the wholesale level. And it was terrible! Several hundreds of sacks had to be opened, the flour taken out, mixed, and put back into the sacks. A very expensive experiment.

Well, when marketing is poor, when production of agricultural products is such a peacemeal business as it has always been in countries on a 200 dollar level per capita, we cannot perhaps be too ambitious in anticipating this type of solutions. But let's not give up. We should study other alternatives. Above all, we should be quite open to the possibilities that might be feasible, which is exactly why I started by saying that I do not like to be inquired yet about fish flour... Everybody knows alright that some nice fish flour can be produced, but a lot more is required to make it available to poor households. I hope, gentlemen, that I have replied satisfactorily to your questions.

Chichester: I wonder if you considered in the marketing of fish the possibility of producing fish ham and fish sausage, such as the Japanese produce. The Japanese you may know, have started the industry of producing a sausage-like product from fish, trash fish primarily, and their industry has gone in three years from a start to something over 400,000 tons a year of fish sausage, and fish ham. And interesting enough, as I think it illustrates one of the ways that technology can be applied. The better quality materials are almost undistinguishable from the ham or the frankfurt type sausage, or salami that is produced. I wonder if this might be a suggestion as something to look into, if there is no tradition for fish consumption.

Peterson: Speaking incidentally on this connection, it is very interesting to note in spite of the affluency, that children particularly will choose the hamburger or the hot-dog over the exotic types of meets. And incidentally, I have been very much intrigued by the report from Japan on this fish sausages that have good keeping qualities and that are taking the place of the meat hamburger and the so called hot-dogs.

Chichester: I just wanted to add that these are also kept without refrigeration and they have about a thirty day life at ambient temperatures as you might expect here, without refrigeration.

Pinchinat: I heard that people don't use much fish in Central America. If the information strictly concerns Central America and not Haiti and the Dominican Republic, that might be true; but in Haiti people eat a lot of fish, especially the small size species. We have many projects of fish ponds. In the Artibonite area, in the rice paddies, people raise fish along with rice. Thus, there might be hope that fish consumption can be increased in the Central American area.

Dr. Vasconcelos: First of all, I think that I lost myslef a bit a few moments ago when referring to the market possibilities. So allow me to complete my reasoning. What I aimed at was that though the people may not be used to consuming one type of food, they will certainly choose the best, and the best in a market economy is the lowest priced, the one which promises them the flavour and the nutritious value that they expect, or they assume the product have. So I think that we can always be very optimistic in regard to the introduction of new foodstuffs, within, of course, reasonable limitations. Dr. Chichester, you are touching indeed an interesting subject, pointing directly to the need of promoting consumption of fish in industrialized forms. The processing technologists and economists of this Project may be able to assess the feasibility of fish sausages and alike products. I did not stress enough as I whished, a few moments ago, that feasibility studies are one of the most important aspects of our Project, but you have certainly understood that this is a must, in a Project with these characteristics. No doubt that the possibility of sausages not requiring particular care for storage, at Guatemala City temperatures at least, presents a very important asset for the eventual development of its production.

DISCUSIONES POR GRUPOS

Group I	How to satisfy the qualitative needs for food in Central America
Group II	How to satisfy the quantitative needs for food in Central America
Group III	The proper role of agriculture, nutritional sciences and food technology in national planning.

Group I	Group II	Group III
Behar	Alvarez	Schaefer
Braham	Pearson	Bressani
	Jarquin	
Leon	Adams	Gutiérrez
Lonnquist	Echandi	Cowgill
Pinchinat	Jalil	Egli
Fiester		Cásseres
Francisco Aguirre	Tepley	Shaw
Chichester	Rolz	Bates
Lombardo	M. A. Ramírez	Ponce
Berríos	Gerding	
Fonseca	Alvaro Aguirre	Peterson
Vasconcelos	Dracy	

REPORT OF GROUP I

SATISFYING THE QUALITATIVE NEEDS FOR FOOD IN CENTRAL AMERICA

The development of regional plans for action to improve the qualitative needs for food involves general economic advances and the counsel of nutritionists and food technologists. This can be accomplished through the formation of a regional nutritional advisory committee to economic planning groups. Regional crop and livestock improvement associations must also contribute to such program planning.

Education of the populace at all levels on nutritional needs should be emphasized. Major considerations should be given to the wide use of mass media. Other programs include the special training of extension and public health personnel and the inclusion of course in nutrition and food science in the curricula for professional education. Applied nutrition projects should provide assistance to families in rural areas for the production of protective foods.

The development and enforcement of suitable sanitary standards for foods handled in market centers should be promoted.

Improvement in the food supply would result from the reduction of losses by increased efficiency in processing, distribution, conservation, and marketing of food products now being produced. This would be reflected in an increase in food production and reduction in price.

The improvement of general income levels lead to better dietary standards in a large portion of the population. Development of cash crops in some areas and industrial growth would contribute significantly to the economy.

A number of specific changes which would contribute to better nutritional balance can be presented. Some of these would be reflected in rather rapid improvement of the situation. Others even though initiated immediately, would not result in important improvements for several years because of the developmental time period required.

The suggested list of items worthy of consideration are as follows:

1. Salt iodization on a regional basis.

2. Increased use of supplemental foods, e.g. Incaparina

3. Increased production of high protein foods

   a) Beans
   b) Milk
   c) Poultry
   d) Pork
   e) Fish
   f) Other animals for rural use

   All of these can show rapid changes in qualitative aspects of the diet but the selection of those which can be developed should be done on the basis of their economic value.

4. Enrichment of foods where applicable

5. Development of new crop strains having better protein balance. (Genetic alteration and selection in indigenous crop species) Consideration could be given to maintaining a price differential for these products.

6. Investigation of indigenous plant species for possible use as food. (Vegetables, legumes, fruits, etc.)

7. Introduction and improvement of new food crops such as soyas, etc.

8. Increased meat and milk production (beef, pork, pultry, rabbits)

   a) Forage improvement and pasture management
   b) Increased production of suitable concentrates
   c) Disease control
   d) Processing

9. Development of new processes for the production of protein supplements (microbiological, chemical, etc.)

REPORT OF GROUP II

HOW TO SATISFY THE QUANTITATIVE NEEDS FOR FOOD IN CENTRAL AMERICA

It is evident that there is a great need for increasing the availability of food products in the Central American region. Some factors that make this consideration real are the present nutritional condition of the human population, the high rate of population increase, and the need for improvement of their living conditions.

I. Measures for increasing the supply of basic food crops, vegetables and fruits

There is, without doubt, definite potential in Central America for a substantial increase of basic food crops, vegetables and fruits. In order to meet the desirable levels of production there must be a departure from traditional systems of monoculture now prevailing in the area.

The main steps we envisage to carry out this goal are as follows:

Cereals and grains

Zonification: In order to ascertain the optimum production sites, agro-ecologic and socio-economic studies are necessary.

The evaluation and breeding of crop varieties adapted to given ecologic sites should be considered.

Seed production and distribution: Sites suitable for seed production must be identified. Reliable "seed" producers, appropriate organizations, and systems should be developed for multiplication, handling and distribution of seeds.

Improvement of cultural practices: The most efficient methods of planting, rotation, intercropping, fertilization, weed control, irrigation, farm machinery, etc., must be determined for each growing condition.

Pest and disease control in the field. The primary steps to be considered under this item are:

The use of recommended varieties, seed treatment, spraying programs, field sanitation, crop rotation and other cultural practices.

Fruits and Vegetables

In regard to fruits and vegetables the factors mentioned above are also applicable. However, in the case of fruits the following additional measures should be given due consideration:

Continue investigation on the existing tropical fruit species to determine the most promising varieties of crop bearing trees.

Introducing testing and propagating improved varieties and superior rootstocks suitable to local conditions.

Promote and assist actively in improving all aspects of orchard management including the control of pests and diseases.

II. Measures for increasing animal production

It has been recognized that the Central American area offers a great potential for the production of livestock and fishery products. This is true not only for pasture lands now dedicated to raising livestock, but also to many of the regions that have not been developed for agriculture.

Some of the reasons for promoting the increase of livestock production are:

1) to cover present deficiencies with high quality protein for the diet of an increasing population.

2) to transform forages and industrial by-products not suitable for direct human consumption into readily acceptable foodstuffs.

3) to have an outlet for surpluses of foodstuffs.

4) to provide for a diversification of the Central American economy and a source of foreign exchange through the export market.

However, in order to attain these goals, immediate attention should be given to the solution of some of the most pressing problems; also measures should be adopted to achieve a rapid increase in the availability of livestock and fishery products.

Some of these measures could result in rapid improvement of present conditions, while others would require long term projects directed toward the development of a sound livestock and fishery industry in Central America.

A - Production

1. Dairy and beef cattle

   a) better daily management of livestock

   b) adequate and constant feed supply

   c) reproduction at the beginning of most abundand feed supply

2. Swine and poultry

   a) commercial type production should be emphasized with sound management practices

   b) balanced and constant feed supply indispensable

3. Sheep, goats, and rabbits

   Efforts should be made to provide the marginal producer with one or more of the above mentioned species according to local environmental conditions.

4. Fish

   a) A through resource assessment

   b) Processing and eoonomic feasibility studies

B - Industrialization

Adequate practices should be encouraged for the proper preservation of livestock products. Some of these may be implemented in the rural environment like small cheese factories and small bottling plants for fluid milk. Others which require large capital investment could be developed in urban centers, like large plants for producing powdered milk and dried egg products, and packing plants for beef and pork.

Along these lines, the promotion of products like cottage cheese, other types of cheese, dry milk and butter, as well as fishery products should be undertaken to attain higher consumption levels among the entire population.

III. Factors responsible for food losses and possible solutions

There is a need to identify the factors responsible for losses of food products from the harvest to the consumer.

Once the food products are harvested, they need to be transported, graded, processed, packed, stored and retailed.

On the efficiency of these operations will depend the conservation of quality and nutritional value.

Some of the most important factors causing physical losses are:

1) Inadequate methods of harvesting

2) action of microorganisms producing spoilage

3) action of redents and insect pests

4) bad climatic conditions like high moisture and temperature

5) improper care of food in the home

Some steps which could be taken to improve present conditions on a short term and a long term basis are as follows:

1) Establishment of drying plants near the production centers

2) Establishment of adequate grain storage facilities in terminal markets

3) Planning and development of slaughter houses and packing plants in coordination with livestock production programs

4) Planning and development of processing plants for milk and dairy products

5) Organization of marketing cooperatives

6) Establishment of official quality control centers both for human foods and animal feeds

7) Establishment of official marketing research centers

8) Better methods of food storage and use in the home

IV. Economic measures

A- Application of systematic price stabilization policies

B- Production of food for exportation should not be carried out at the expense of production of food for domestic consumption.

C- National and regional development programs with the propose of raising income at the family level.

V. Current and future trends in the production and consumption of food crops and livestock products

The current status of food supply in Central America could be summarized by indicating that carbohydrate products are slightly below the level to satisfy the caloric needs of the human population, and there is not a sufficient production of protein-rich food, both in regard to quantity and quality.

With the exception of corn, which is the main component of the rural diet, cereal production is low. In reference to corn, it would be highly desirable to continue research on the introduction of high lysine-containing varieties. The importance of legumes can be stressed by stating that together with corn, or rice in certain areas, beans are the usual staples in the diet of the Central American population. At present there is a shortage of beans and the supply has been constantly declining. Governments and private organizations should exert major efforts to increase the present level of bean production. In relation to fruits and vegetables, it is apparent that the supply is not sufficient to satisfy present needs. Nevertheless, proper agricultural practices together with adequate marketing, we feel, would improve the present level of production and consumption. In regard to animal products the present level of consumption should be increased more than two fold in order to assure enough daily intake of high quality protein. Dairy and beef cattle should increase in number at about a 5 per cent annual rate. The swine industry should also be promoted whenever feasible. Sheep and goats could provide meat and milk to certain rural areas. Poultry and fish product have shown gains in recent years. The consumption of these products should be stimulated.

VI. Research and educational programs

In order to accomplish the increase in the production and consumption of livestock and food crops as they have been outlined above, we want to strongly emphasize the need for research and educational programs.

A - Research

The great need for trained technical personnel should be pointed out. Despite the training facilities provided by International Institutions, the requirements for trained personnel cannot be fulfilled at present. Governments should undertake effective measures to strengthen such program and to offer the necessary support to the personnel already trained.

B - Education

We believe that adequate education will in the long run solve most of our endemic problems. Some steps should be indicated which would tend to alleviate the situation caused by insufficient quantity of food products available to the human population.

a) Educational programs for rural youth and current extension programs should be reorganized and strenghtened.

b) Educational programs for adult farmers should be expanded.

3) Governments should carry out nutrition education programs at all population levels with the purpose of directing the population towards adequate consumption of food with special regard for the qualitative and the quantitative needs of the vulnerable groups, i. e. children, adolescents, pregnant and lactating women, the sick and the aged.

INFORME DEL GRUPO III

El grupo III reconoce que el planteamiento expuesto en estas recomendaciones es parte de un panorama más amplio en el que están ocurriendo transformaciones sociales, un alto crecimiento demográfico y una producción insuficiente de alimentos y que se requiere mayor conciencia y acción en los niveles políticos y administrativos para introducir los cambios necesarios.

Objetivos

El papel de la agricultura, las ciencias nutricionales y tecnología de alimentos en la planificación regional es lograr el máximo aprovechamiento de los recursos agrícolas y de las facilidades existentes para el mejoramiento de la salud, combatir la malnutrición y para el levantamiento del nivel económico general.

Mecanismo de acción

El proceso de integración económica de los países centroamericanos se verá fortalecido con un intercambio interdisciplinario continuo a nivel técnico, tal como el realizado en la presente reunión. En el Istmo Centroamericano actualmente operan las siguientes organizaciones que desarrollan programas regionales en el campo agrícola, nutricional, tecnología de alimentos, financiero y económico:

Instituciones	Tipo de Acción
Banco Centroamericano de Integración Económica (BCIE)	Financiamiento para el desarrollo
Comisión Económica para la América Latina (CEPAL)	Estudios económicos
Food and Agriculture Organization - Central American Integration Scheme (FAO/CAIS)	Estudios agro-económicos
Instituto Centroamericano de Investigación y Tecnología Industrial (ICAITI)	Tecnología Industrial y de alimentos
Instituto Interamericano de Ciencias Agrícolas de la OEA (IICA)	Investigación y educación agropecuaria

Instituto de Nutrición de Centroamérica y Panamá (INCAP)	Nutrición humana y animal y ciencia de alimentos
Regional Office for Central America and Panama (ROCAP de USAID)	Asistencia técnica y financiera
Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA)	Sanidad Vegetal y Animal
UNICEF	Las necesidades de madres y niños

A la vez, existen Consejos Nacionales de Planificación en cada uno de los países que están ligados a nivel regional por medio de la Misión Conjunta de Programación para Centroamérica y por la Secretaría Permanente del Tratado General de Integración Económica Centroamericana (SIECA).

Se considera indispensable que las opiniones y recomendaciones de los técnicos y científicos que laboran en las instituciones regionales antes enumeradas se incorporen en los planes nacionales y regionales de desarrollo. Para esto se propone la creación de un Comité interdisciplinario integrado con representantes de los organismos regionales citados que se reuniría periódicamente por convocación de la SIECA; para canalizar sus recomendaciones al organismo regional de planificación y promovería reuniones técnicas periódicas.

El Comité podría también verter opiniones y asesorar a las agencias internacionales que lo soliciten, sobre la importancia y méritos relativos de los programas regionales a ejecutar.

Campos de acción

Para lograr avanzar significativamente en el futuro inmediato en las ramas de agricultura, nutrición humana y tecnología de alimentos, los planes de acción regionales a desarrollar debieran incluir por lo menos:

Incremento de la industria animal

Diversificación de cultivos alimenticios y de exportación

Desarrollo de variedades de cultivos básicos con mayor valor nutritivo (maíz con endosperma opaco dos y endosperma amilaceo dos).

Fortalecimiento y coordinación de las actividades de investigación, extensión y comunicación.

Ampliación de las actividades de extensión al campo de economía del hogar.

Promoción y desarrollo de la industria pesquera.

Educación nutricional.

Establecimiento de programas de nutrición para madres y niños de edad pre-escolar.

Continuar y mejorar los programas de nutrición escolar, sustituyendo gradualmente las fuentes de provisión externa con productos locales y enfatizando la función educacional de estos programas.

Producción y conservación de alimentos de alto valor nutritivo y económico para uso interno y exportación.

Desarrollo de nuevos alimentos para seres humanos y animales y utilización de fuentes protéicas.

Utilización de subproductos y desechos industriales y agrícolas.