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IICA

POST HARVEST HANDLING OF HOT PEPPERS
(Capsicum frutescens)

PROCEEDINGS OF A SEMINAR ON POST HARVEST HANDLING OF HOT PEPPERS

Held At

THE FARMERS' TRAINING CENTRE

MINISTRY OF FOOD PRODUCTION, MARINE EXPLOITATION, FORESTRY AND THE ENVIRONMENT

December 14, 1988

Edited by

Raphael E. Salazar and Majeed Mohammed

OFFICE IN TRINIDAD AND TOBAGO

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RAFAEL E SALAZAR AND MAJEED MOHAMMED

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WHAT IS IICA?

The Inter-American Institute for Cooperation on Agriculture (IICA) is the specialized agency for agriculture of the Inter-American system. The Institute was founded on October 7, 1942 when the Council of directors of the Pan American Union approved the creation of the Inter-American Institute of Agricultural Sciences.

IICA was founded as an institution for agricultural research and graduate training in tropical agriculture. In response to changing needs in the hemisphere, the Institute gradually evolved into an agency for technical cooperation and institutional strengthening in the field of agriculture. These changes were officially recognized through the ratification of a new convention on December 8, 1980. The Institute's purposes under the new convention are to encourage, facilitate and support cooperation among the 31 Member States, so as to better promote agricultural development and rural well-being.

With its broader and more flexible mandate and a new structure to facilitate direct participation by the Member States in activities of the Inter-American Board of Agriculture and the Executive Committee, the Institute now has a geographic reach that allows it to respond to needs for technical cooperation in all of its Member States.

The contributions provided by the Member States and the ties IICA maintains with its twelve Permanent Observer Countries and numerous international organizations provide the Institute with channels to direct its human and financial resources in support of agricultural development throughout the Americas.

The 1987-1991 Medium Term Plan, the policy document that sets IICA's priorities, stresses the reactivation of the agricultural sector as the key to economic growth. In support of this policy, the Institute is placing special emphasis on the support and promotion of actions to modernize agricultural technology and strengthen the processes of regional and subregional integration.

In order to attain these goals, the Institute is concentrating its actions on the following five programs: Agricultural Policy Analysis and Planning; Technology Generation and Transfer; Organization and Management for Rural Development; Marketing and Agroindustry; and Animal Health and Plant Protection.

These fields of action reflect the needs and priorities established by the Member States and delimit the areas in which IICA concentrates its efforts and technical capacity. They are the focus of IICA's human and financial resource allocations and shape its relationship with other international organizations.

The Member States of IICA are: Antigua and Barbuda, Argentina, Barbados, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Dominica, the Dominican Republic, Ecuador, El Salvador, Granada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, the United States of America, Uruguay and Venezuela.

The Permanent Observer Countries of IICA are: Arab Republic of Egypt, Austria, Belgium, Federal Republic of Germany, France, Israel, Italy, Japan, Netherlands, Portugal, Republic of Korea and Spain.

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PAPERS, RESULTS AND RECOMMENDATIONS
FROM TECHNICAL EVENTS SERIES
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RAFAEL E. SALAZAR AND MAJEED MOHAMMED

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"The responsibility for the opinions expressed in this publication rests solely with the authors".

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A Seminar on "Post Harvest Handling of Hot Peppers", under the auspices of the Marketing and Agroindustry Programme of the Inter-American Institute for Cooperation on Agriculture (IICA) in collaboration with the Post Harvest Unit of the Ministry of Food Production, Marine Exploitation, Forestry and the Environment was held on the 14th December, 1988 at the Farmers' Training Center, Centeno, Trinidad and Tobago.

The Seminar was designed to discuss the pre- and post-harvest handling of the hot pepper. The objective of the seminar was to train and update the participants in the most suitable pre and post harvest handling practices for hot peppers with the aim of improving the quality of the produce to become more competitive for the local as well as the export market.

This document contains the edited versions of the proceedings of this seminar.

PROGRAMME

WEDNESDAY 14TH DECEMBER, 1988

8:00 - 8:30 am. **REGISTRATION**

8:30 - 9:15 am. **OPENING CEREMONY**

CHAIRMAN:

Dr. Reginald Griffith,
Ag. Director of Research,
Ministry of Food Production, Marine Exploitation, Forestry and the Environment

Introductory Remarks:

Dr. Chelston Brathwaite,
IICA Representative in Trinidad and Tobago

Opening Address:

Dr. Earl Timothy,
Ag. Chief Technical Officer,
Ministry of Food Production, Marine Exploitation, Forestry and the Environment

9:15 - 9:30 am. **COFFEE BREAK**

9:30 - 10:00 am. **Influence of Agronomic Factors on Quality of Hot Peppers**

Mr. Roy Griffith and Mr. Musa Mohammed,
Ministry of Food Production, Marine Exploitation, Forestry and the Environment

10:00 - 10:30 am. **Pre-Harvest Diseases of Hot Peppers**

Mr. Anthony St. Hill and Mr. Garth Rajnauth,
Ministry of Food Production, Marine Exploitation, Forestry and the Environment

WEDNESDAY 14TH DECEMBER, 1988 (cont'd)

10:30 - 10:50 am. **Pre-Harvest Pests of Hot Peppers**

Ms. Mona Jones, Ministry of Food Production, Marine Exploitation, Forestry and the Environment

10:50 - 11:50 am. **Standards, Grades and Quality of Hot Peppers**

Dr Rafael E. Salazar, IICA - Trinidad and Tobago and Ms. Joanne Samuel, Ministry of Food Production, Marine Exploitation, Forestry and the Environment

11:50 - 12:30 pm. **DISCUSSION**

12:30 - 1:30 pm. **LUNCH**

1:30 - 2:15 pm. **Post-Harvest Handling, Packaging, Storage and Transportation of Hot Peppers**

Mr. Majeed Mohammed, Ministry of Food Production, Marine Exploitation, Forestry and the Environment

2:15 - 2:45 pm. **Marketing and Processing Potential of Hot Peppers**

Dr. Lennox Sealy, Central Marketing Agency

2:45 - 3:00 pm. **COFFEE BREAK**

3:00 - 3:30 pm. **Export Potential of Hot Peppers**

Mr. Vassel Steward, Caribbean Agricultural Trade Corporation (CATCO)

3:30 - 4:00 pm. **DISCUSSION**

4:00 - 4:15 pm. **Evaluation of the Seminar**

4:15 - 4:30 pm. **CLOSING SESSION**

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OPENING SESSION

Welcome Address

by

Reginald Griffith D.Sc.

Ladies and Gentlemen, I want to welcome you to participate in today's exercise in Post Harvest Technology. First, however, allow me to introduce the participants at our lead table who will be addressing you shortly. Dr. Earl Timothy is the Chief Technical Officer in the Ministry of Food Production, Marine Exploitation, Forestry and the Environment and Dr. Chelston Brathwaite is the Head of the IICA Office in Trinidad. Accompanying is Dr. Salazar, also from the IICA, who is the consultant in this programme and joint organizer with Mr. Majeed Mohammed, of the Post Harvest Unit of the Ministry.

It must now be clear to us all that today is a special day in the development of our local agriculture. Your presence here today in such large numbers suggests this. For it is not always that this lecture room is so filled with people in such anticipation and excitement. Post Harvest technology is not foreign concept to Trinidad and Tobago, nor is the hot pepper a new plant. It must therefore be the thrust of exporting hot peppers which is causing this alarming interest. In such a case then, understanding the post harvest requirements is a necessary condition for successful export business.

Frankly, there is no question about this for the exporter only experiences the pinch of rejection of his products at the foreign market when they do not attain the accepted standards determined by the foreign consumers. This pinch is translated in financial terms as loss. And who is to blame really? Is it the exporter? The importer? Or the original farmer? Simply, one may attempt to apportion blame with an inference that the whole mismanagement process began at the level of the farmer, even before the crop

reached the farm-gate.

I am sure that today you'll be discussing these aspects, with some happy resolutions, I know. But also importantly, you will be discussing the measures to prevent such loss. I do not need to give you an average figure now for such losses, because this will be mentioned incessantly by the various competent lecturers, but I need to remind you that profit should always be your business so long as you are in agriculture. Thus, the measures you would be asked to adopt would have been tried and tested as economically viable practices which are tailored to suit.

With these elementary thoughts then, I want to pause and introduce the next speaker, Dr. Chelston Brathwaite of the IICA, whose Institute is the joint sponsor of today's exercise along with our Ministry of Food Production. Since our thrust in post harvest technology began in the Ministry when we established our Post Harvest Unit here at Centeno, the IICA has always cooperated with these activities. Today's participation by the IICA represents the normal example set.

Thank you Ladies and Gentlemen, I would now like to introduce Dr. Brathwaite.

Introductory Address

by

Dr. Chelston W.D. Brathwaite,
IICA Representative in Trinidad and Tobago

Mr. Chairman, Acting Chief Technical Officer, distinguished guests, ladies and gentlemen.

On behalf of IICA, I am very pleased to welcome all of you here, this morning to this Seminar on Post Harvest Handling of Hot Peppers, which is being sponsored by the Ministry of Food Production, Marine Exploitation, etc. and ourselves.

Our Institute is acutely aware of the need for the effective application of postharvest technology in food marketing and has set out as one of its five programmes in the current medium term plan, a programme in agricultural marketing and agroindustry.

This programme recognises that the inadequate infrastructure for the handling, storage, preservation and agroindustrial processing of foodstuffs and raw materials have a negative impact on food security and on providing producers with a margin of profit and consumers with acceptable quantity and price levels.

Improvement in food self-sufficiency and food security in Trinidad and Tobago will depend to some extent on improvements in the marketing system for food crops. In 1985, the Government of Trinidad and Tobago requested IICA's assistance in preparation of projects proposals for establishment of an improved marketing system for food crops.

A mission visited Trinidad and Tobago from August 25 to 31, 1985, and prepared "Proposals for the Improvement of Domestic Marketing of Fruits and Vegetables in Trinidad and Tobago".

The mission noted in Recommendation 6 (Research and Training) that "While the curriculum of the national institutions of technical and higher learning, specifically ECIAF and the Faculty of Agriculture, UWI does provide for some courses in agricultural marketing and post-harvest technology, these programmes should be reviewed with a view to giving greater emphasis and specialised training in these fields, as well as undertaking and supporting the relevant research. A national course in post-harvest technology and marketing seems necessary".

We are pleased that our current initiative seeks to give effect to some of the recommendations of the study particularly the establishment of a market information system, and training in marketing and post-harvest technology. In addition, we are currently preparing a series of standards for tomato, okra, melongene, cabbage, banana, cucumber, sweet pepper, hot pepper.

We are pleased that our Institute has found it possible to provide the services of Dr. Rafael Salazar, for a two-year period in the first instance to assist the Government of Trinidad and Tobago in this important area of work.

I am pleased, Mr. Chief Technical Officer, to present to you a copy of this Manual entitled "A Farmer's Manual on Post Harvest Handling of Perishables".

The presentation of the Manual to you, sir, and by extension to your Ministry represents our continuing commitment to producing in Trinidad and Tobago, a cadre of farmers who are not only businessmen but who are capable of utilising the latest in technology to the benefit of themselves and ultimately agricultural development in Trinidad and Tobago.

In this regard, therefore, Mr. Chairman, I hope that the Manual will be widely distributed and will serve as the basis for an improved post harvest treatment of crops in this country.

May I then, Mr. Chairman, express our sincere gratitude to your Ministry, particularly your Post Harvest Unit in general and Mr. Majeed Mohammed, in particular, for the support and collaboration which we have received in this and several other activities.

Our Institute is pleased to be associated with this initiative and on behalf of IICA, I pledge our continued and unswerving support to any future effort designed to improve the food marketing systems in Trinidad and Tobago.

Opening Address

by

Dr. Earl Timothy,
Ag. Chief Technical Officer
Ministry of Food Production, Marine Exploitation
Forestry and the Environment

The topic of today's seminar, "The Post Harvest Handling of Hot Peppers", is essentially a marketing topic, even if we must assume a certain optimum production condition that precedes consideration of proper marketing procedures. I note this at the very beginning because there appears to be a general tendency to perceive agricultural change and development disproportionately in terms of PRODUCTION; the parameters are largely production-based. But PRODUCTION and MARKETING are inseperable elements of the food supply whole.

All the focus on indices of production over time tend to support the notion that there has been neglect, however benign, of the potential for gain or for loss in what proceeds with the commodity beyond the point of maturation. We compress a great deal of thought and energy into strategies calculated to produce more of a commodity per unit of input, and we describe positive changes in the indices as DEVELOPMENT. What the figures do not usually indicate, however, is the proportion of this increased production that does not get into the food supply or that does so in an unmarketable condition or with a reduced nutritive value.

Agricultural development, to the extent that is measurable, cannot be assessed strictly on the basis of increased productivity and production of commodities: A farmer or a Ministry of a Government is hardly interested in statistics for the sake of statistics. What are essentially of concern are:

i. increased incomes to farmers
ii. a reliable supply of quality items to consumers at affordable prices and
iii. the improved food security position of the country.

We can hardly claim to be serving the best interest of farmers when our relative neglect of their post-production and post-harvest behaviour limits their net incomes. We are not developing when the deficiency between total production and total product availability is such as to create an inconsistency of supply and/or a demand-supply situation that impacts negatively on consumer prices. This country cannot have ambitions about food security if it does not seek at every turn to maximise its supply base, to fill the gap between need and domestic supply.

All this points, inescapably, to one simple fact as we approach the 1990's and that is that the nascent thrust in the area of post-harvest handling of agricultural commodities represents a most promising element of agricultural development strategies, particularly small farmer development strategies in Trinidad and Tobago.

Produce losses after harvest may be due to a variety of factors, the importance of which vary from commodity to commodity as well as with the circumstances under which they are grown, harvested, stored, packaged, transported and marketed. Losses may be in the form of physical loss of food, reduction in quality resulting in lower commercial value, or loss in nutritive value.

The figures representing the totality of these losses are staggering, and when it is considered that the waste is most severe in the less developed areas of the world, the consequences of persistent inaction in confronting the problem should become quite clear.

An Inter-American Institute for Cooperation on Agriculture (IICA) report based on a survey carried out in 27 countries inferred that some 65 million metric tons of food, sufficient to

meet the caloric needs of more than 100 million persons were lost annually through bad post-harvest handling. Another from the National Academy of Sciences, in 1976, estimated post harvest losses in developing countries to be at least 100 million tons, worth 9.5 billion U.S. dollars. Further, the FAO has concluded that, in general, betweeen 20% and 33% of all food produced in the world is lost due to diverse causes. This would translate into annual losses of between 400 and 675 million metric tons of food. Restricting the analysis closer to home - in Latin America and the Caribbean - post harvest losses in specific crops have been estimated as follows: Tomatoes - 37-70%; Plantains - 28-65%; Cassava - 40-75%; Pineapple - 40-50%; Sweet Potatoes - 50-55%; Onions - 15-38%; and so on. In the Eastern Caribbean, the incidence of post harvest losses in fruits, root crops and vegetables is most starkly demonstrated in the inter-island trade where there is clear abuse in all the marketing services - storage, packaging, handling, grading, transporting, etc.

All this has not gone unobserved or unchallenged. During the past two (2) decades there has been a great deal of research on the problems of post harvest losses in food production systems. Internationally, the condition was brought into very specific focus at the World Food Conference held in Rome in 1974 when the precise relationship between post harvest losses and increased food availability was addressed. In 1975, the Seventh Special Session of the United Nations General Assembly passed a resolution calling for a 50% reduction of food losses by 1985. As a result of these dual initiatives, the FAO, in 1978, designated food loss prevention a priority and, as a first step, introduced programmes to reduce losses in grain crops. In 1980, the FAO and the UN Environmental Programme organized an expert consultation on the "Reduction of Food Losses in Perishables of Plant Origin" at which 'post harvest loss' was defined as that loss which 'begins at the moment of separation of the edible commodity from the plant that produced it - loss meaning any change in the availability, edibility,

wholesomeness or quality of the food that prevents it from being consumed by people'.

This Ministry has for some time been sensitized to the need to focus attention on the problem of post harvest losses as a complement to its production thrust. It has supported efforts aimed at treating with this problem through participation in consultations, by the provision of facilities for research or by collaboration with other agencies similarly motivated. Moreover, the Government has advocated the development of a post harvest capability through the work of its agencies directly or indirectly in the agricultural marketing and credit. As evidence of such support, I cite its participation in the Fruit Consultative Meeting on Post Harvest Losses held in July 1981, at the Faculty of Agriculture, UWI.

Out of the discussions at this meeting arose a number of recommendations. Through the initiative of this Ministry, a series of discussions were held between November 1982 and February 1983, aimed at implementing these recommendations. These included such organizations as UWI, CARIRI, FAC, CMA, Catelli-Primo, among others.

The ADB has continued its involvement in the funding of agro-industrial projects, which now comprise approximately 6.5% of its loan portfolio. Government funds have also been chanelled through UWI and CARDI for work in post harvest technology.

Within this Ministry itself, right here at Centeno, over $90,000 has been spent in equiping a post harvest research and development facility, which, I am advised, is second to none in the region. The unit is staffed by three (3) professionals and the research programmes undertaken during the five (5) years of its existence have been varied. They include:

i. Establishment of maturity indices for selected varieties of fruits and vegetables;
ii. Investigations into post harvest disorders and diseases;
iii. Organoleptic evaluations;

iv. Physical and chemical characteristics as they relate to quality following storage;

v. Implementation of post harvest handling techniques aimed at loss reduction.

In the conduct of its programme, the Post Harvest Unit works closely with individual farmers, agricultural cooperatives and other groups as well as with food business organizations. In so doing, it has investigated a wide range of crops including citrus, pineapple, mango, granadilla, cassava, yams, dasheen, tomatoes, cabbage, lettuce, melongene, sweet peppers and, of course, hot peppers.

The Choice of Hot Peppers.

Today's seminar focusses on the post harvest handling of one crop - hot peppers. This crop has been chosen because of its undoubted potential as an export item. But it is also a crop that poses a challenge to the post harvest physiologist, being among the more perishable of commodities. In terms, therefore, of the transfer of technological information expected to take place here today, the choice of the hot pepper is to be seen not only in terms of its present and future exportability, but also as a vehicle for teaching which is likely to facilitate the communication of ideas about the post harvest handling of other crops.

The transformation of the hot pepper trade from one geared to local markets to one incorporating marketing strategies over longer periods such as for supermarket sales and for export has made it imperative to pursue post harvest investigations aimed at deriving techniques that could prolong the shelf life of his crop. Indeed, the work undertaken with hot peppers at Centeno over the past 10-12 months has resulted in the production of a package of pre harvest and post harvest recommendations for farmers, retailers, wholesalers and exporters of this crop.

What we do here today for hot peppers we must and will do for other crops, in particular those that can be supplied to international markets. This, of course, includes the ornamentals, the production of which is being stimulated by foreign demand. This is not a simple task, since export markets are more demanding than domestic markets and the risks of spoilage can be considerably higher.

For all these crops there is one overriding concern, we have to ensure that the impact of the production effort is not lost by a failure to implement proper post harvest systems and that the income generating capacity of the agricultural export thrust is not jeopardized and whatever comparative advantage we have lost due to a failure to integrate proper post harvest techniques into our own export marketing system.

But let me return, ladies and gentlemen, to the event of the day. IICA has in the past assisted the Post Harvest Unit of the Ministry in a number of important ways, as indeed, it has provided tremendous support for our agricultural programmes generally. The Institute has been a willing partner in the publication of several of the Unit's manuals and bulletins - on mangoes, sweet peppers, melongene and cassava. Moreover, in 1987, it was involved in the training of farmers and traders at the Central Marketing Agency which set the stage for further training on improved post harvest handling techniques on a commodity basis. Today, the Unit will launch a recent publication, A Farmers' Manual on Post Harvest Handling of Perishables, for which it must again be grateful for the assistance provided by IICA.

On behalf of the Ministry of Food Production, Marine Exploitation, Forestry and the Environment, I wish to express my sincere appreciation to the Institute for all the support it has so willingly and graciously provided over time. The cooperation reflected in today's seminar is particularly valued for reasons which I have already stated. It is our hope that this spirit of

accord and collaboration will continue to exist far into the future to the mutual benefit of both sides.

To all those persons involved in the seminar - presenters, organizers and participants, I take the opportunity to wish you all success in the day's proceedings. I have looked at the outline and noted the speakers and I have no doubt that at the end of the day all concerned will be pleased with a job well done. Thank you and good luck.

TECHNICAL PAPERS

Influence Of Agronomic Factors On Quality Of Hot Peppers

by

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INTRODUCTION

Agronomy is the study of the management of the environment in relation to the scientific cultivation of a crop. The objective of the agronomist is to develop a package of practices which, when implemented results in the production of a high quality product. For hot peppers this means a fruit that is clean, mature, healthy and true to type. Any aspect of the management that is faulty will directly or indirectly hinder the successful achievement of this objective. In approaching the production of hot peppers consideration must be given to the plant genetic constituent, bio-chemical and physiological processes, the environment, agro-meteorological factors, soil, other plants, pests and diseases, and the cultural practices that are important in modifying the environment to provide the plant with conditions favourable for optimum growth and development. It is incumbent upon the farmer therefore to ensure that his knowledge of the crop is adequate that he is in possession of a suitable technological package and that he has the capability to manage the production successfully.

AGRO METEOROLOGICAL FACTORS

1. Direct Effects

   Rainfall, sunlight, temperature and humidity are all factors which impose their influences on plant growth and development (Leopold 1964). The direct effects are seldom readily visible and even if they are, by the time

they are observed the damage is already inflected on the plant. These adverse effects are usually internal and are related to processes such as photosynthesis, partitioning of assimilates and rate of enzyme catalysed reactions (Leopold 1964). They are however very essential for the growth and development of the plant and affect fruit size, shape, colour, pungency and dry matter content.

Whenever night temperatures fall below 16°C, or are above 25°C flowers fall off (Splittstoesser 1978). During the day temperatures above 25°C causes stomatal closure. This results in a reduction of carbon dioxide intake, photosynthetic activity slows down, the productions of assimilates reduced and the genetic potential of the plant in terms of its yield, fruit quality, dry matter and in particular fruit size is not attained.

During the dry season, high temperatures and wind speed coupled with low relative humidity is not unusual. These factors when combined, accelerates the process of transpiration. The plant loses water faster than it can extract it from the soil and wilting occurs. The various Capsicum cultivars are particularly sensitive to this condition and the drooping of leaves on a hot dry day have been observed in hot peppers. This symptom is however, an indication that there has already been a cessation of growth processes (Wadsworth, 1960) and when it occurs in the reproductive stage of the plant yields become more diminutive and fruit quality is adversely affected (Leopold 1964).

Sun scald also occurs during periods especially when there is a severe shortage of soil moisture. It can be most commonly observed in cultivars with poor foliage cover and a distinct preference for displaying the immature fruit above the foliage. At first a yellow or white patch appears on the side of the fruit towards the sun. This spot may merely remain yellow as the fruit ripens, but frequently the tissue is more severely damaged and a blister-like area develops. In the early stages of the disorder the symptom may not be readily visible. The fruit quality is however reduced and when placed in storage the tissue in the affected areas breakdown.

Blossom-end rot is another plant disorder that is of importance in hot pepper production. Symptoms of this disease appear as a leathery scar or rot on the blossom-end of the fruit. Blossom-end rot can occur at any stage of the development of the fruit. It is usually caused by sudden changes in soil moisture. It is most serious when the crop is growing rapidly with high soil moisture and is suddenly subjected to high ambient temperatures during a dry spell. Another cause of the disease is the deficiency of calcium. Usually much of the fruits may be affected but the symptoms may not be clearly manifested before harvest. The breakdown of tissue, loss of colour and appearance reduce fruit quality.

2. <u>Indirect Effects</u>

Excessive rainfall, high temperature, high relative humidity and low light intensity, resulting from cloud cover provide conditions that are favourable for the rapid growth and expansion of pest and disease

populations. Aphids, flea beetles and leaf miner are severe problems in hot pepper production (Splittstoesser 1978). Alternaria and Anthracnose are also diseases of economic importance. These can easily spread from one location to another; facilitated by high wind speed and long spells of intense rainfall. Poor management of pests and diseases result in severe damage to the crop. The typical symptoms include loss of appearance and break down of tissue. Many of these defects can be observed before harvest but may continue insidiously throughout the post harvest phase of the crop as well.

CULTURAL PRACTICES

There are several cultural practices which can be implemented to modify the environment and improve the quality of hot peppers. These are spacing, weed control, crop rotation, drainage, irrigation and harvesting.

SPACING

The effects of spacing is primarily important in the dry season when temperature is high, sunlight intense and soil moisture low. Close spacing increases the plant population density, reducing the space alloted to each plant. The plant spreads occupying its alloted space closing the canopy almost completely, thus facilitating mutual shading. Because of this, the developing fruit is protected from the direct rays of the sunlight, there is a significant reduction in the incidence of sun scald and fruit quality is preserved.

WEED CONTROL

Weeds compete with the crop plant for sunlight, soil moisture, nutrients and space. Crops that are weedy produce poor quality peppers. Weeds can be controlled manually, mechanically, chemically or by cultural practices. In this regard close spacing

has been found to be most effective. Weeds must also be controlled because they harbour pests and diseases which can infest the crop inflicting damage which may ultimately be manifested in storage.

CROP ROTATION

Crop rotation is of sufficient importance to be considered by the farmers producing hot peppers. It ensures the effective and efficient utilization of the land and minimizes the risk of pest and disease outbreaks as well as the depletion of soil nutrients. Within this context it implies the sequential cropping of a series of selected crops, three or four, on the same plot of land, in one year. When the practice of crop rotation is adopted, pests and diseases which may cause damage to hot pepper may never pose a serious threat to the crop and may be controlled with minimum effort.

DRAINAGE

Drainage is of particular importance in the wet season. Adequate drainage removes excess water from the root zone and allows aeration of the roots. When conditions are ideal, that is, when there is a proper balance between soil water and air, uptake of nutrients is facilitated and crop growth is at an optimum. Adequate drainage is needed throughout the crop as it also reduces the incidence of soil borne diseases.

IRRIGATION

To grow hot pepper successfully in the dry season requires irrigation. But water is usually in limited supply and it is not uncommon for farmers to use the appearance of the crop to indicate when to irrigate. This method of assessing crop water needs is crude, unsatisfactory and unscientific and leads to sporadic watering. Fruit growth is therefore intermittent, size and shape are adversely affected, resulting in an increased susceptability to damage in post harvest handling.

The quality of the water used for irrigation is also important as it may pre-dispose the crop to disease pathogens.

FERTILIZATION

The practice of fertilizing hot peppers is common and essential and should be encouraged if fruits of a high quality are to be produced. Plants require thirteen elements which they combine with carbon, hydrogen and oxygen to form the building blocks for the millions of cells of which they are made, (Splittsloesser 1979, Clarkson and Hansen 1980, Mittleider and Nelson 1973). The yield and quality of hot peppers are directly related to the level of nutrients available to the crop. (Splittloesser 1974). For the optimum quality of hot peppers to be produced, not only must the individual elements be available, but they must be in quantities that favour the selective utilization by the plant. Abnormalities in fruit size, shape, colour, pungency and dry matter content can be caused by deficiency and toxicity of plant nutrient elements.

Nitrogen, a major plant nutrient is well known for its effects on plant growth. It is needed for the synthesis of the proteinaceous substance called protoplasm. Plant growth is by cell division and enlargement and protoplasm is essential in this process. As cells enlarge, however, their walls become thin and are more vulnerable to physical damage. The application of high levels of nitrogen to hot peppers lowers yields and exerts a profound effect on fruit quality. Tissues are soft and sappy and breakdown very easily under stressful conditions occurring before or after harvest. Further, the fruits are more easily attacked by pest and disease organisms, physical damage can be more easily caused in packing and transporting and severe post harvest losses are likely to occur.

Phosphorus and potassium are important in the development of a high quality pepper. Phosphorus combines with calcium to enhance the structure of the fruit. Potassium is important in the

maintenance of fruit integrity, which includes its size, shape, colour and firmness. A deficiency or excess of these elements is another cause for the loss of quality in hot peppers.

Calcium and boron are the two elements that are taken up passively by the plant. The quantities absorbed by the plant is related to the availability of water in the soil. The effects of calcium have already been mentioned. An imbalance in boron however hinders fruit development, causes paleness in colour and internal fruit damage.

HARVESTING

The major concerns in the harvesting of peppers are the stage of maturity, the care that must be taken and the container used for transporting peppers from the field. The maturity at harvest depends upon the specification of the market and the time taken from the field to the consumer. Care must be taken in the harvesting of peppers as abrasions affect the appearance and pre-disposes the fruit to disease infestation. It is important that crates be used instead of bags as it reduces the incidence of abrasions and allow for the cooling effect of the wind circulating in the crate.

CONCLUSION

The goal is to produce a pepper of high quality. This is within the reach of the farmer. The extent to which he achieves this goal will depend upon his level of pre-harvest management.

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Breeding Of Hot Pepper For Improved Post Harvest Quality

by

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INTRODUCTION

The Ministry of Food Production, Marine Exploitation, Forestry and the Environment provides farmers with subsidized seed material of two hot pepper varieties. These are the local yellow and red types.

Over the years the bulking of these two varieties have resulted in genetic deterioration. These two varieties ought to be purified through selection and isolation. However, farmers should be given the opportunity to an alternative source of hot pepper. Accordingly, the Vegetable Section at Central Experiment Station, Centeno, embarked on breeding a range of sweet and hot peppers of local adaptability.

The objective for breeding and selecting hot peppers was to incorporate a thick flesh cultivar into a chilli type (hot). This would offer a hot pepper with a thick flesh for processing pepper sauce. Another objective was to select a fruit with a uniform size (conical or bell) free from ridges with a convex shoulder and a round to tapering end. This kind of fruit would be of excellent post harvest quality, particularly at storage and transportation.

The making of the Hybrid:

Work on the hybrid was initiated in 1985 at Central Experiment Station, Centeno. Two parents were selected. The maternal parent (Capsicum frutescens L.) was an ornamental (dressing pepper) purple colour, Chilli type, and the paternal parent (Capsicum annuum L.) was California Wonder, a commercial sweet pepper variety popular

in Trinidad and Tobago.

The characteristics of both hot and sweet peppers (Table 1.) indicate the possibility of crossing the two species of capsicum.

The first filial generation (F_1 hybrid) was planted on 7th November, 1985 at Centeno. The plants flowered in eighty-one days after planting (DAP) and matured 24 to 30 days later. The Plant was prolific and the fruits obtained were conical in shape, Chilli with shades of purple and thick flesh.

The second generation (F_2) segregated into a range of colours and fruit shapes. The colours varied from shades of purple (Light to deep), green and yellow. The shapes were bell, elongated conical, elongated bell and conical. There were also segregation according to flavour into sweet, intermediate chilli and chilli. This kind of segregation produced a wide range of variability among the different genotypes which offered a broad genetic base for selection.

Breeding Method:

Selection at the F_2 was based on individual plant selections to establish the F_3 families. Plants were selected for disease tolerance viz:Tobacco Mosaic Virus (TMV), leaf spot, collar rot and southern blight. Selection for fruits were based on shape, unripe mature fruit colour and flavour.

Many selections were made, but the majority were thick flesh with hot seeds and varying intensity of purple colour for the unripe mature fruits.

The selections were made for Chilli pepper with green unripe colour. One selection was conical shaped and the other was bell shaped. At full maturity both selections gave a bright red coloured fruit. These two genotypes are presently undergoing further selection to stabilize the shape and the flavour.

Breeding Strategies for the future

Further investigations for agronomic and quality characters are anticipated shortly as the hybrid stabilizes - these include days from planting to maturity, number of fruits/plants, total yield, fruit size, resistant/tolerance to disease, pungency and post-harvest quality.

Preliminary storage and quality tests, indicated that the new hot pepper hybrids would have a great impact both at the local and international markets.

It should be noted that the post-harvest section at CES, Centeno is currently examining the potential of this hybrid.

TABLE 1: COMPARISON BETWEEN SWEET AND HOT PEPPER CHARACTERISTICS

SWEET PEPPER	HOT PEPPER
Capsicum annum L. 2n = 24	Capsicum frutescens L. 2n = 24
Synonyms:	Synonyms:
C. annuum var. Cerasiforme (Miller)	C. minimum Roxb.
C. annuum var. acuminatum (Fingerh)	C. baccatum
C. annuum var. Longum (DC.) Sendt	
C. annuum var. grossum (L.)	
Common Names:	**Common Names:**
Capsicum, Bell pepper, Red pepper, Sweet pepper, Chili, Chilli, Cherry pepper, Paprika, Long pepper, Cayene pepper	Hot peppers, Bird Chilli, Birdseye Pepper, Red pepper Goat pepper, Tabasco pepper Spur pepper
Cultivars:	**Cultivars:**
Many cultivars exist based on the morphology of the fruit eg. Long: 20 - 30 cm in length	Based on fruit: small, narrow, berry variable in size up to 7 - 5 cm: usually highly pungent

Sweet: Bell, large inflated
thick flesh.
Chili or Chilli: More than 9 cm,
narrow pointed

CENTRE OR ORIGIN:

Mexico, not known in a wild form derived from C. minimum. Roxb.

CENTRE OF ORIGIN:

S. America, possibly Peru, Mexico second centre of origin

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Pre-Harvest Diseases Of Hot Pepper In Trinidad and Tobago

by

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The hot pepper has a tremendous potential as a crop for both the local and the export market. In recent years, farmers in Trinidad and Tobago have expanded cultivation of hot pepper to satisfy both the local and export demand. This recent expansion in cultivation has been accompanied by an increase in disease problems associated with this crop.

Disease problems are serious constraints to successful production and marketing of hot pepper. Pre-harvest disease problems over the years have contributed to the lack of adequate and regular supply and increased prices on the local market. It is, therefore, of crucial importance that farmers be aware of the major disease problems that affect hot pepper production, what are the causes of these diseases, what are their symptoms, and how they are spread, in order that these diseases be properly managed and controlled.

It is important in the context of disease management to note that hot pepper is cultivated throughout the entire year and each crop is cultivated for at least six (6) months. This means that every crop would have to pass through or experience part of the rainy season when environmental conditions are quite favourable for the development and spread of these diseases. High levels of production can be achieved for many vegetable crops by selecting the dry season for cultivation, but this is not the case for hot pepper. Moreover, with the recent export drive, there is need for high levels of production to be maintained throughout the year.

The department of Plant Pathology at Centeno, has been

investigating the diseases of hot pepper over a number of years. A number of diseases has been encountered by the department in fields in Trinidad and Tobago.

These diseases are as follows:-

Bacterial Leaf Spot: This disease is not at present widespread, but can become important in the rainy season. It is a splash-borne disease, i.e. spread by rain-splash or overhead irrigation; it is also spread through infected seed and crop residues in the soil. This disease can be effectively controlled by using copper sprays as soon as early symptoms appear in the crop. Using disease free seedlings is also important in control. If this disease is allowed to develop untreated, then control will become difficult in the rainy season. Other important measures of control are crop rotation and destruction of old fields and crop residues.

Anthracnose: A very common disease in the rainy season. This disease can result in 100% crop loss due to unmarketable fruits. This disease is again splash-borne, i.e. spread by rain-splash and overhead irrigation. Removal and destruction of diseased fruits early in the life of the crop, and throughout the crop is very important in control of this disease. Fungicide sprays can also be applied to control this disease.

Southern Blight: This disease seems to be not widespread on hot pepper and to be relatively unimportant. The disease is soil-borne and the disease-causing agent can survive in the soil for several years. It is spread through infected plant material and crop residues in the soil. Field sanitation and crop rotation are very important in control of this disease. Recommended fungicides can also be used as a drench at the base of the plant.

Collar Rot: A serious disease problem in the rainy season. This disease is soil-borne and can be spread through flowing water and crop residues in the soil. It is favoured when this crop is

cultivated on heavy soils which have poor internal drainage or in fields where drainage is poor or inadequate to remove excess water especially during heavy rainfall. This disease can be controlled by proper soil management, adequate drainage, selecting suitable soils for cultivation, field sanitation, crop rotation and applying recommended soil fungicide drenches.

Mosaic: This is another important disease that can become a serious problem in hot pepper cultivation if not properly managed. Heavily infected fields produce lower yields. The disease-causing agent (a virus), is spread by insects (aphids) from infected plants. Early detection, together with removal and destruction of diseased plants, are important in control of this disease. Controlling aphids by use of insecticides and destruction of old fields can also assist in control.

Sun Scald: A physiological disorder that affects the marketability of the fruits. This is not a serious problem in well managed cultivations. Maintaining good foliage cover of the fruit is sufficient to prevent the onset of this problem.

Other Diseases: Bacterial wilt has been observed frequently on sweet peppers in this country but has not been reported on hot pepper. Similarly, fungal leafspots and root knot have not been observed on the crop. Ectoparasitic nematodes (Rotylenchulus spp. Pratylenchus spp.), have been associated with hot pepper roots (Bala, 1984) but, in general, nematodes are not considered as important constraints to production (Bala, pers comm.).

A full description of these diseases, particularly in terms of their symptoms, is given in Table 1, together with recommended control measures.

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TABLE 1: Pre-harvest Diseases of Hot Pepper in Trinidad and Tobago

DISEASE	CAUSAL AGENT	DESCRIPTION OF SYMPTOMS	SPREAD	CONTROL
1. Bacterial Leaf Spot	Bacterium-splash-borne	Small, irregular, water-soaked spots on leaves that turn brownish. Leaf blighting. Falling off of heavily infected leaves.	Crop residues in soil. Seed-borne. Splash-borne (by rain).	Destroy old fields. Destroy crop residues. Crop rotation. Use healthy transplants. Copper sprays.
2. Anthracnose	Fungus - splash-borne	Small, circular, water-soaked spots on fruits which enlarge and develop black pinpoints in a concentric pattern; mummification of fruits	Rain-splash from infected fruits to healthy.	Destroy old fields. Remove and destroy infected fruits. Apply fungicide sprays eg. Daconil, Benlate or relatives with sticker after harvest, with a waiting period of 7 days before the next harvest.

DISEASE	CAUSAL AGENT	DESCRIPTION OF SYMPTOMS	SPREAD	CONTROL
3. Southern Blight	Fungus - soil-borne	Quick wilting of the plant; whitish fungal growth at base associated with white to brown cabbage seed - like bodies. Subsequent death of the plant within a few days.	Residues in soils. Soil-borne (survives in soil).	Remove and destroy infected plants (do not plough in). Crop rotation: do not follow with sweet pepper, tomato, melongene, bean or watermelon. Use recommended soil fungicides, eg. Rizolex, Rovral, Botran, etc. as a soil drench every 14-21 days.
4. Collar Rot	Fungus - soil-borne	Wilting of the plant, often quick; blackening of main stem (particularly collar region) and lower branches; black rot of roots; fruit rot. Subsequent death of the plant within a few days.	Crop residues. Flowing flood waters. Soil-borne (survives in soil).	Remove and destroy diseased plants (do not plough in). Crop Rotation. Plant in well-drained soils. Avoid heavy soils. Apply soil fungicides. eg. Banrot, Captan, Alliette

DISEASE	CAUSAL AGENT	DESCRIPTION OF SYMPTOMS	SPREAD	CONTROL
5. Mosaic	Virus	Greenish mosaic of leaves; leaf crinkling and puckering; some distortion of fruit.	Spread by aphids.	Remove and destroy infected plants and fields. Control aphids with insecticides.
6. Sun Scald	Physiological	White shiny areas on sides or top of fruits.	No spread. Caused by sudden exposure to direct sunlight.	Prevent sudden loss of leaves.

1/ Mite And Insect Pests Of Hot Peppers

by

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ABSTRACT

Pests of hot peppers include mole crickets, cut worms, the pepper flower moth, fruit piercing bugs, aphids, scales, mealy bugs, white flies, thrips and mites. Most pests occur during the dry season and are not economically significant on a national level. However, the recently recorded wet season mite Polyphagotarsonemus latus has become a serious threat to pepper production. Management of this mite incorporates a number of cultural practices and judicious use of pesticides. The recently introduced species Thrips palm; which thrives best in the dry season, has also become a very serious threat to pepper production.

INTRODUCTION

Hot peppers Capsicum sp. had been traditionally cultivated by vegetable farmers in Trinidad and Tobago. Both the fresh fruit and pickled sauce are now in great demand internationally and this has provided farmers with additional incentive for cultivating the crop. A total of 97.46 ha. were under hot pepper cultivation as at December 1987 with County Victoria accounting for the largest area (48.14 ha.) and County St. George next (27.24 ha.). Upwards of 31 million fruits were harvested in 1987, the wholesale price on the local market averaging about 11 cents per fruit for the year. Hot pepper cultivation is thus a profitable enterprise. Production has intensified with increased demand and factors which limit yield are now more acute.

Insects and mites have not historically been significant

limiting factors but the recent occurrence of the broad mite Polyphagotarsonemus latus has been observed to reduce yield by as much as 55%. Thrips palm; is equally dangerous. Other pests include mole crickets, cutworms, fruit piercing bugs, aphids, scales, mealy bugs, fruit worms, caterpillars of the pepper flower moth and spider mites. This paper attempts to address, identification of damage caused by these pests, and recommendations for their control. The recently recorded broad mite is being highlighted.

INSECT PESTS

Mole Crickets and cutworms

The mole cricket Scaptericus vicinus and the cutworms Agrotis repleta, Spodoptera eridania frugiperda, and sunia, may attack hot pepper seedlings cutting them near ground level. The cutworms may also climb up older plants creating shot holes in the leaves and may even remove chunks of fruit. If hardened seedlings are transplanted they are less likely to be destroyed by these insects. When land is rotated and allowed to bake in the hot sun for some time prior to transplanting, soil populations of these pests are considerably reduced by igrets and wasps, and some even become scorched and baked. Abrasion by soil particles is particularly harmful to the caterpillars. Weeds and grass surrounding the cultivated plots act as reservoirs where pest populations build up and then move on to the crop. A high level of field sanitation is therefore critical to any pest control programme. Insecticide baits consisting of cornmeal, molasses and an insecticide in the ratio 20:2:1 parts by weight may be distributed throughout the field or Furadan granules may be applied to the seed beds and planting holes. Foliar sprays such as Dipel, Belmark, Sevin and Tambo may be judiciously applied.

Fruit worms

The fruit worm Heliothis virescens or zea has been observed to bore into fruits but this is not a common phenomemon in hot peppers. Where this is observed to be significant, plants may be treated with the same foliar sprays which are used in army worm control.

Pepper flower moth

The pepper moth Symmetrischema capsica is a very significant pest which usually goes unobserved because of its tiny size. The caterpillar is almost microscopic and tunnels into flowers causing them to wilt. Flower drop reduces yield and farmers with low fruit set should examine flowers very carefully for presence of this pest. Sprays of malathion, Rogor 40, Tambo and Belmark are recommended but overhead irrigation is also an effective means of reducing populations of this pest.

Fruit piercing bugs

The vegetable fruit piercing bugs Nezara viridula and Phita picta may puncture fruits causing them to ripen prematurely with hard corky patches on their surfaces. Overhead irrigation and careful application of the chemicals used in control of pepper flower moth are recommended. The application schedule is different however. Spraying should commence as the first harvest is being approached, since populations are relatively low earlier in the crop cycle, and spraying is uneconomical. In addition it may be detrimental to the naturally occuring wasp parasites.

Aphids

The aphids Myzus persicae and Aphis gossypii both infest peppers in large numbers particularly during dry weather. They occur on the undersides of leaves from which they suck sap causing crinkling. They are of little economic significance in the absence

of diseases which they may transmit. High humidity and application of Actellic, Malathion or Roger 40 helps to reduce infestation levels. In the absence of disease causing agents it is usually uneconomical to utilize pesticide, and the natural enemy - Cocinellid beetles, exert sufficient control.

Scales, mealy bugs and white flies

Scales and mealy bugs are small waxy sucking insects which periodically attack hot peppers under dry conditions. Much sooty mold may be produced reducing chlorotic areas. In 1988 white flies have also appeared in large numbers on plants of the Solanaceae family including peppers. These are white and wooly insects which generally adhere to the leaf surfaces. When the plant is disturbed the winged adults fly off but soon resume their resting positions. As with scales and mealy bugs much sooty mold may be formed. Control measures include overhead irrigation, a high degree of field sanitation, crop rotation and application of foliar sprays with a mist blower. A spreader sticker should be added to the pesticide for better results. Insecticides such as Actellic, Rogor 40 and Selecron may be used.

MITES

Spider mites

Spider mites Tetranychus spp. generally attack open field crops in the dry season but green house cultivations may be infested all year round. They are microscopic, the mature female being just visible to the naked eye. They are usually found on the undersides of leaves in crevices and near leaf veins. They may occur under flattened discs of woven silk threads and when populations are very high they disperse by parachuting on a silk thread to new sites. Feeding by spider mites results in cracking and cupping of leaves, chlorosis and distortion. Leaf hairs elongate and leaves may eventually wilt and fall off. Increased

humidity, overhead irrigation and pesticide application may be utilized in control. Sulphur dust, Benlate, Torque, Tambo, Actellic or Rogor 40 have given good control. Excessive use of nitrogen fertilizers, Sevin and fungicides should be avoided as these favour mite development.

Broad mites

The broad mite P. latus is now undoubtedly the most serious threat to hot pepper cultivation in Trinidad. It was first recorded on hot peppers at Bonair in August of 1984, but is now well established on a variety of plants throughout the island. Infestations are highest during humid overcast periods, but low level infestations may persist during dry weather conditions. The adult mite is just over 0.2 mm long and cannot be seen with the naked eye. It is shiny amber in colour with a white patch down the middle of the back. Eggs are colourless, oval shaped and studded with rows of white tubercles which give them a beaded appearance. Infestation is limited to the young newly generated flushes of the plant as the mites cannot feed on hardened tissue.

Symptoms of attack are not very easily distinguished from viral infection, toxicity or growth regulatory problems and this has lead to incorrect diagnoses and control methods, with resultant losses. Chlorosis or yellowing is not as apparent as in the case of spider mite infestation. Instead, leaves and young stems demonstrate reddening or bronzing. Leaves become leathery with thick veins and fluted margins. Young shoots appear scorched and distorted and leaf hairs elongate. Young plants are stunted while older plants exhibit a high level of flower fall. Fruits are cracked, scarred, under developed and have abnormal shapes.

Alternate host plants in Trinidad include Watercress, Tomatoes, Sweet and Pimento peppers, Bodi, Spinach, Sesame, Datura, Gerbra, Avocado, Paw Paw Gardenia and Parthenium. These should not be intercropped or rotated with hot peppers which have been

infested since they would merely assist in perpetuating the mites. Similarly, the white tip weed should be removed. High humidity and shade favour mite development and reduction of these aids in controlling population levels. Overhead irrigation helps to remove mites physically. Extreme care must be exercised during picking as harvesters can transport mites to uninfested plants on their clothing or bodies. Chemical application needs very careful planning since the mite has an international reputation for developing resistence within a short time period. Torque is currently the best recommendation for Trinidad, but Actellic, Tambo or Selecron, Sulphur Dust and Tameron also give control.

CONCLUSION

The pest complex on hot peppers includes a great variety of insects and mites but most are of minor importance occurring seasonally. The newly recorded wet season mite, P. latus, by contrast is quite agressive and dramatically reduces both potential yield and fruit quality. Management includes a high level of field sanitation, selective intercropping and rotation, shade and humidity manipulation, as well as judicious use of pesticides. All forms of management are important and should be incorporated into a truly integrated programme.

NOTE: Since presentation of this paper a newly introduced pest Thrips palmi Karny, has been recorded on peppers. It also infests melongene, cucumbers, pumpkins, melon and beans. The pest may be quite devastating and must be mentioned here.

T. palmi or the southern yellow thrip is shiny greenish yellow in colour with darkly coloured body hair or setae, and bright red to dark brown eyes. The adult bears slender cream coloured wings which are covered with long dark setal hairs. Synptoms of damage include scarring of leaves, fruits, and stems; flower fall,

stunting and drying. Severe damage may result in plant death particularly the seedling stage. Fruit scarring may be easily confused with broad mite damage. However, foliar damage is not restricted to the young shoots as in broad mite attack, and leaf scarring is far more drastic.

Control is highly dependant on cultural practices, particularly field sanitation. The pest is wind borne and thus wind breaks should be utilized. Reduced application of foliar nitrogen, increased overhead irrigation, soil saturation, and use of mulch may be combined with mist blower application of Selecron for best results. Excessive use of pesticides in the current situation may give rise to a white fly outbreak so great caution must be exercised in pesticide application.

Standards For Grades Of Hot Peppers

(Draft Paper subject to any modification)

by

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1. Scope

These standards apply to hot peppers (Capsicum frutescens) for fresh consumption.

2. Classification in grades

In the initial stage we should include in this grade, the following variables; variety, form, degree of maturity and external and internal damages. At the beginning of a grading, it is not advisable to introduce an excessive number of grades, we should consider grade A and B and the unclassified.

Grade A

Consist of mature hot peppers, of similar varietal characteristics, with the form and colour of the specific variety, firm, fresh, clean, fairly well shaped, free from sunscald and decay, free from diseases, free from pests, free of pesticide residues, free of smell and/or foreign taste, free of abnormal external moisture, free from damage caused by hail, scars, sunburn, insects, mechanical or other means. The condition of the produce must be such that it can withstand handling and transport and meet market requirements at its destination.

Variety
Means that the lot of hot peppers fulfil the similar varietal characteristics.

Form
The lot of the hot pepper fruits must fulfil the characteristics of the specific variety.

Degree of Maturity
Means that each hot pepper should be well developed and firm.

External or Internal Damages
Free from diseases, free from sunscald, and decay, free from damages caused by hail, scars, sunburn, insects, mechanical or other means.

Grade B
Consist of mature hot pepers of similar varietal characteristics with the form and colour of the specific variety, firm, fresh, clean, well shaped, free from sunscald and decay, free from diseases, free from pests, free of pesticide residues, free from smell and/or foreign taste, free of abnormal external moisture, free from serious damages caused by hail, scars, sunburn, insects, mechanical or other means. The condition of the produce must be such that it can withstand handling and transport and meet market requirements at its destination.

Variety
Means that the lot of hot peppers fulfil the similar varietal characteristics.

Form

The lot of the hot pepper fruits must fulfil the characteristics of the specific variety.

Degree of Maturity

Means that at least 90% of the lot show a shadow part of the specific mature colour of the variety or green or mixed colour.

External or Internal Damages

Free from sunscald and decay, free from diseases, free from serious damages caused by hail, scars, sunburn, insects, mechanical and other means.

Unclassified

Consist of hot peppers which have not been classified in accordance with the foregoing. The term unclassified means that any grade have been assigned to the lot.

Tolerance

For both grades A and B not more than 5% and 8% respectively of the hot peppers shall be affected by any damages. There shall not be tolerances for mould or rot, or other serious damage causing the pepper to become inedible.

DEFINITION

Similar Varietal Characteristics

Means that each pepper is the same variety and that the colour and shape of the peppers are characteristic of that variety.

Mature

Means that each hot pepper should be well developed and firm.

Firm
Means that the pepper is not soft, shrivelled, limp or pliable, although it may yield to slight pressure.

Fresh
Means not dull in appearance and there should be no signs of wilting, shrivelling or loss of firmness.

Clean
Means that hot peppers should be free from adhering or loose chemical residue and other foreign matter.

Well shaped
Means that the pepper is not more than slightly curved, slightly indented or not otherwise more than slightly misshapen.

Fairly well shaped
Means that the pepper may be more than slightly indented or curved, but it is not decidedly crooked, constricted or deformed.

Free of smell and/or foreign taste
It is the fruit which does not show smell and/or foreign taste coming from the field, storage and transport and/or the presence of substances with odors such as kerosene, gas-oil, pesticides, etc.

Free of abnormal external moisture
It is the fruit previously washed, and it has been dried.

Damage
Means any defect that detracts from the appearance or the edible or shipping quality of the pepper, eg. scars, sunburn, bacterial spot, hail, etc.

Serious Damages
Means any defect which seriously detracts from the appearance, or the edible or shipping quality of the peppers, eg. actual rupture or severe scarring.

Acknowledgement:

Acknowledgement is given to the following organizations from their published standards for fresh produce having been used as references in the preparation of these grades and standards.

- United States Department of Agriculture
- Ministry of Agriculture - Jamaica
- Netherlands Quality Rules
- European Economic Commission
- Ministerio de Fomento, Venezuela

The Role of Standardization in the Marketing of Fresh Commodities

by

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INTRODUCTION

In the developed countries of Europe and North America as the standard of living improved, the demand for high quality fresh commodities increased. The fruit and vegetable industry responded by developing products in accordance with this demand. In order to meet the market requirements, the industry developed a system of standards and grades which reflected consumer preferences and facilitated the rapidly expanding trade.

Locally, the importance of standards and grades is gaining greater significance because of the need to increase foreign exchange earnings, through the export of horticultural products. Producers and traders are therefore forced to meet the requirements of these export markets, which often have pre-determined standards and grades for their commodities. Notwithstanding the fact there are no legal standards and grades for most of our tropical commodities in the developed countries, the expectations of the market place can be taken as a reflection of the required standards. High standards and appropriate grades however, are critical for the successful marketing of our tropical products.

In addition, our local consumers have become more quality conscious in their demand for fresh commodities as disposable income becomes scarcer.

DEFINITION OF STANDARDIZATION

Standardization can be described as the common acceptance of the practice of the classifying of commodities and offering it for sale in terms of quality characteristics that have been precisely defined and are constant over time and space. That is, the standards must recognise definite gradations in the quality of the entire supply for the particular commodity. A number of grades can be defined within a set of standards and is usually dependent on the relative commercial value of the product. For example, low-value commodities do not warrant sorting into too many grades. Although standards for grading are most important, there are also standards for other factors such as the packaging of commodities. Packaging plays an important function in maintaining the quality of the commodity at all stages of distribution.

Figure 1, gives a schematic diagram of the relationship between standards, grades and the market place.

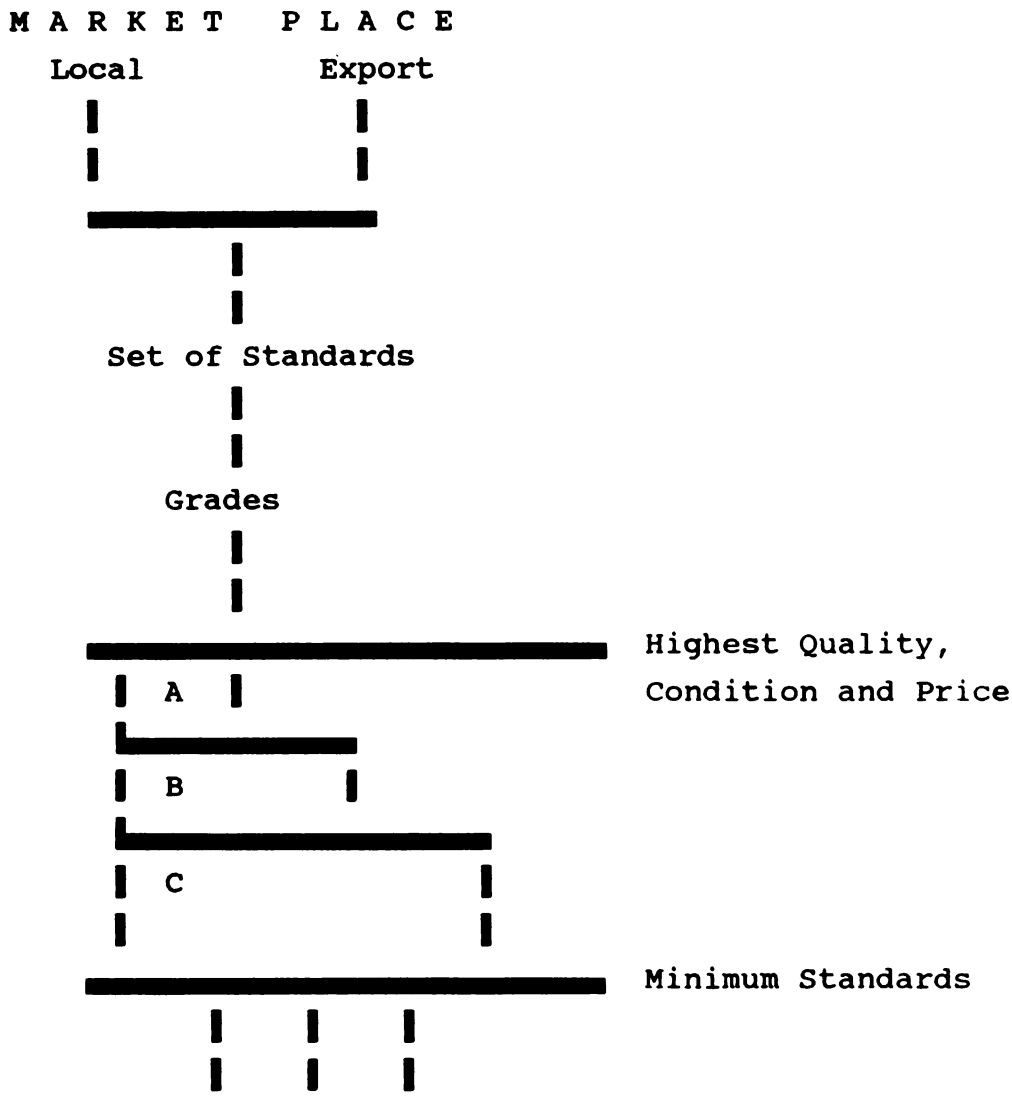

Fig.1: The relationship between standards, grades and the Market Place

COMMODITY QUALITY

Quality is a combination of characteristics, attributes or properties that gives the commodity a value in terms of human food. It is used in various ways in reference to fresh fruit and vegetables. Examples are as follows:-

1. Market quality - The particular characteristics which are desirable are dependent on which market is being considered: local, regional or export. For example, stage of maturity, level of sanitation and type of package would differ.

2. Shipping quality - The main concerns are length of shipping/storage life, type of package, the compatibility with other commodities and cost of freight.

3. Nutritional quality - This refers to the actual chemical composition of the commodity and its value to human health.

4. Table quality - This refers to the consumer's needs of which appearance, taste and nutritive value are important.

The assessment of the commodity's quality can vary considerably, depending on whether the group is involved in production, storage or marketing.

1. Plant breeders - Assess particular criteria depending on the breeding program. Often these criteria are few eg. colour, shape or composition.

2. Agronomists - In order to evaluate production techniques they assess varieties based on such criteria as plant characteristic, ease of harvest.

3. Post-harvest research workers - Assess effects of post harvest treatments on such criteria as storage and shelf life, appearance.

4. Growers - Assess readiness and suitability for market and are concerned with criteria such as appearances, visual defects. They require useful cultivars that are high yielding, disease resistant and easy to harvest.

5. Market distributors - (Wholesalers, retailers & shippers) - Assess criteria affecting shipping and storage life, stage of maturity, commodity compatibility and packaging.

6. Processors - Assess criteria of suitability for processing, eg. colour, composition.

7. Consumers - Assess suitability for required use, important criteria are appearance, flavour and nutritive value.

The important quality factors however, are those which determine final consumer acceptance whatever the target market may be.

Components of quality

The various quality components of fresh fruits and vegetables are given in Table 1. These are used in defining the specific grades for fresh commodities.

Methods of Measurement of quality

The commodity characteristics used to determine quality can be assessed either by subjective or objective methods. This is an important aspect in ensuring that the commodities are correctly graded.

Subjective Methods are based on the opinion of the individual assessors. The assessor uses the human senses to determine such characteristics as colour, size, shape, gloss, external defects, texture and aroma. These methods are generally non-destructive, eg. taste panels are a group of assessors used as measuring instruments of the sensory aspects of quality (using subjective evaluations).

Objective Methods are based on specific measurements of representative sample of commodities. These may be destructive or non-destructive methods depending on the type of equipment. Many of the non-sensory aspects of quality eg. pesticide residues, vitamin C content uses these methods and are arrived at after chemical testing. Examples of instruments used in the assessment of quality criteria are as follows:-

1. Size and shape - Callipers, scales, rings.
2. Colour - Light meters (colour charts are sometimes used in addition).
3. Texture - Penetrometers, pressure and compression testers.
4. Composition - Refractometer (sugar), chemical tests (acid, starch).

Total assessment of commodity quality takes in account the relationship between appearance and internal condition and the correlation between chemical composition and sensory evaluation.

Locally, there is a lack of facilities and equipment for the assessment of commodity quality.

COMPONENTS OF STANDARDIZATION

Standards drawn up for fresh commodities usually cover the following provisions:-

1. Definition of commodity - Varieties are specified.

2. Quality - A minimum requirement for all grades or classes are specified usually in terms of appearance, wholesomeness, health and sanitation. More specific requirements for the individual classes in terms of quality and presentation are defined.
3. Packing and presentation - Requirements in terms of uniformity (eg. colour, size, packing arrangement, the package is defined.
4. Sizing - Definition of minimum size or weight and size grading. Each class may or may not include these specifications.
5. Tolerances - The level of tolerances of defects in terms of quality and size outside each class is specified. This is given in percentage by the number or weight of commodities in a sample. This level varies with different commodities (5-10%).
6. Labelling of package - Information required usually include identification of packer, nature of commodity, origin of commodity and commercial specification of grade and size.

BENEFITS OF STANDARDIZATION

The following are the major benefits for adoption of standardization of fresh commodities.

1. Standards furnish the yardstick for measuring variation in quality.
2. Trading with a common language at all stages of marketing, eliminates the need for traders to personally inspect all produce. Long distance transactions are also facilitated.
3. Clear and definite standards assist in the settlement of disputes between buyers, handling agents and sellers.

4. Standardization enhances the flow of information between producer and consumer. Standardised grades form a basis for market news prices, allowing comparison of price as it relates to quality.
5. Separation of commodities into various grades furnishes a basis for growers to pool their commodities in Cooperative Marketing Associations.
6. Standardised grades facilitate future contracts.

PROBLEMS IN DEVELOPING APPROPRIATE STANDARDIZED SYSTEM

The establishment of standards is sometimes a difficult exercise, since it requires that a common language be used and understood by all participants at all stages in marketing channel of the particular industry.

Agreement is needed on the following:-

1. Correct interpretation of the terms used in the standards, they should be simple without any ambiguity.
2. Number of grades or classes that should exist. It must be applicable to all commodities supplied by the particular industry.
3. System of nomenclature for grades eg. letters, numericals or names.
4. Defining the terms of assessment for quality characteristics.
5. Institutional framework - By whom and the method of enforcement.

CONCLUSION

It is hoped that this paper has given a better understanding of the function of standards and grades as it relates to the marketing of fresh commodities. Regardless of the problems encountered in establishing an appropriate standardized system, two important factors would make the response positive.

1. Agreement and hence confidence by all participants in the system.
2. Voluntary or mandatory legislation to control and regulate the system depending on the market.

Both the local and especially on the export markets, the commercial value of commodities is a function of their grades. In addition trading on the basis of quality is the greatest stimulus to better methods of production.

TABLE 1 - Quality Components of Fresh Fruits and Vegetables

Main Factors	Components	Examples
1. Appearance (Visual)	Size	Dimension, weight, volume
	Shape	diameter/depth ratio
	Colour	uniformity, intensity
	Gloss	surface wax
	Defects	(External & internal)
	- Physical	- Cuts, punctures, bruises
		- Shrivelling
		- Growth cracks
	- Morphological	- Sprouting, rooting
	- Physiological	- Temperature related disorders; chilling, sunburn
		- Internal breakdown
	- Pathological	- Rots due to fungi, bacteria and virus attack
	- Others	- Pest - insects, birds, chemical
2. Texture (touch and feel in mouth)	Firmness	- Hardness, softness
	Smoothness	
	Succulence	- Juiciness
	Grittiness	
	Fibrousness	
3. Flavour	Sweetness	
	Sourness	
	Bitterness	
	Astringency	
	Aroma	Volatile compounds
	Off-flavour	
4. Nutritive Value (Composition)	Carbohydrates	Starch, sugar
	Proteins	
	Lipids	Oil content
	Vitamins	
	Minerals	

Table 1 (cont'd.)

Main Factors	Components	Examples
5. Safety	Toxicity	Natural occuring toxicants chemical contaminants eg. pesticide residue
	Sanitation	Pre and post harvest operations

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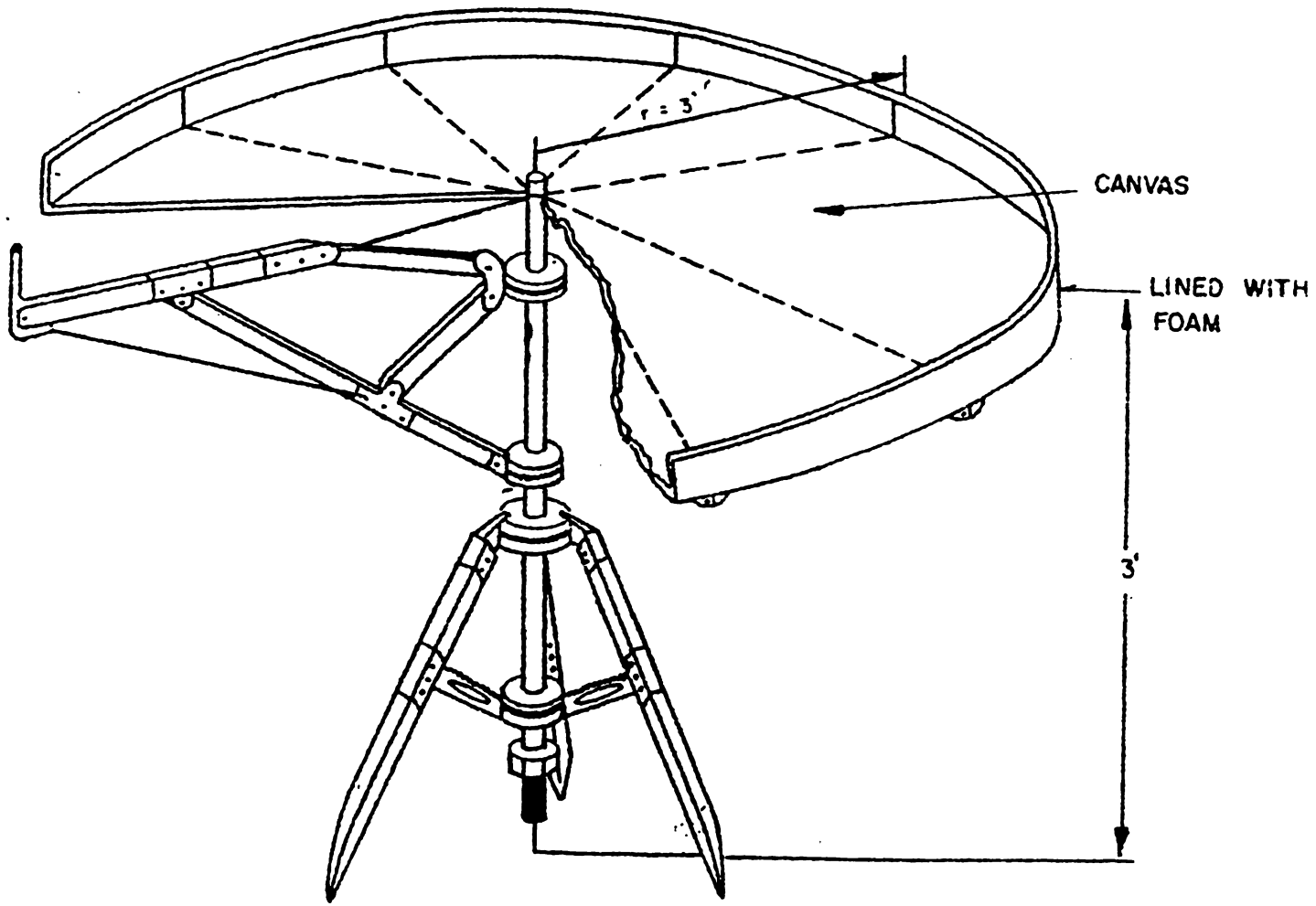
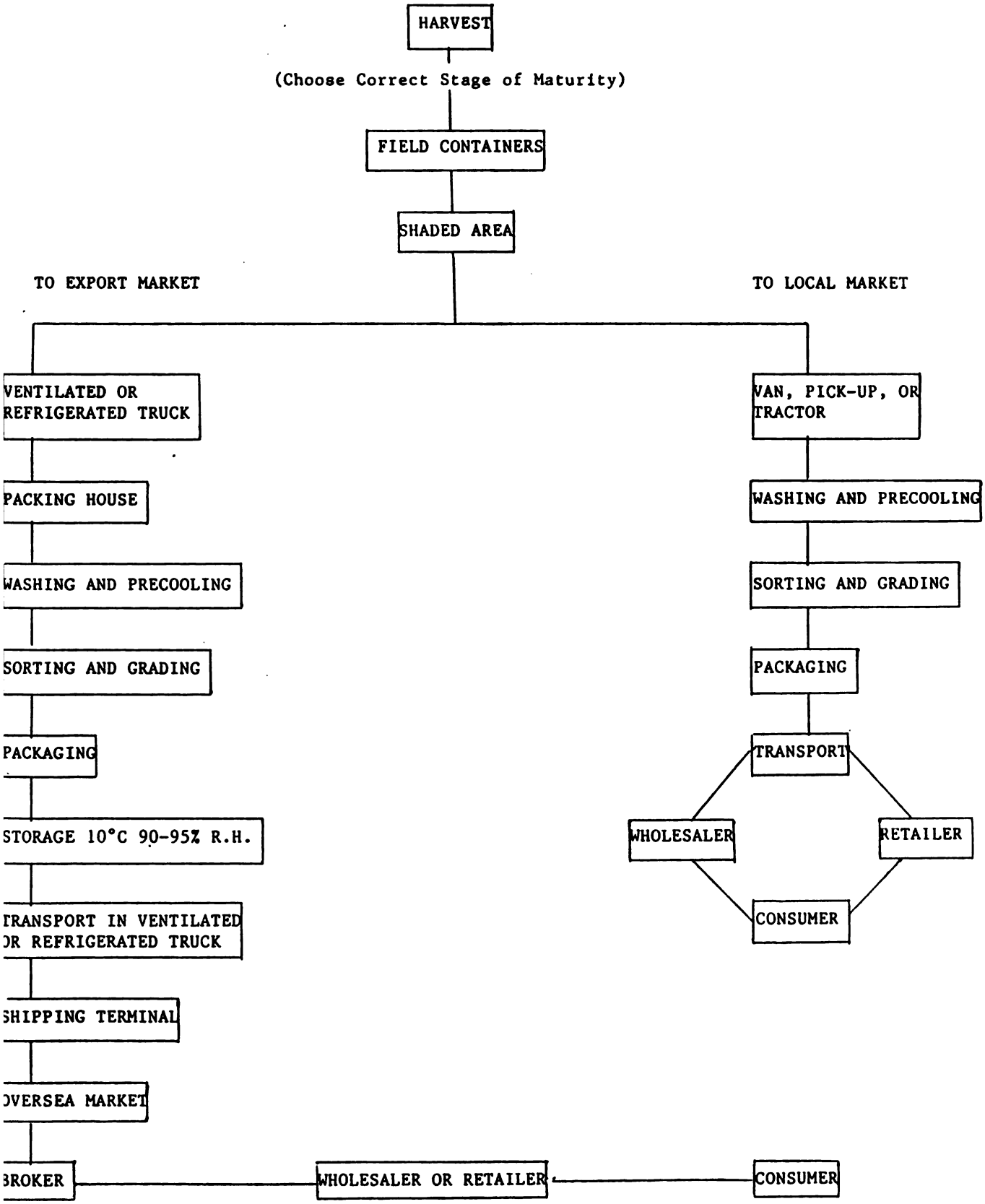


Figure 1 Portable sorting table

FIGURE 2: POST HARVEST HANDLING SYSTEM FOR HOT PEPPERS



Post Harvest Handling, Packaging, Storage and Transportation of Hot Peppers (Capsicum frutescens)

by

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INTRODUCTION

The production of hot peppers (Capsicum frutescens) in Trinidad and Tobago has been characterised with a demand not only in the domestic markets but more recently in the foreign markets. This timely shift in demand is welcomed in view of the national thrust towards growing vegetables for export as a means of securing foreign exchange.

From 1984-1987 both the acreages and quantities of hot peppers have been on the increase. The 1986-1987 period has recorded a total of 245,005 kg. of hot peppers exported from Trinidad and Tobago amounting to approximately one million dollars in foreign exchange earnings. Indications are that the external markets penetrated will continue to expand in view of the massive migration of West Indians and Asians to Europe and North America. Added to this, unlike the other crops exported, hot peppers are not only in demand during the Winter period but throughout the year. Importers are willing to increase quantities of hot peppers providing they can get a regular supply of high quality pods. To meet this demand both growers and traders will have to become more quality conscious and adopt post harvest practices such as stage of maturity at harvest, sorting, grading, packaging, storage and pests and disease control to obtain pods of the required quality in order to market over longer periods. This article attempts to outline in detail those post harvest conditions that will be useful to both growers

and traders in reaching this goal.

QUALITY AND VARIETAL SUITABILITY

Maximum shelf life can be attained only by using high quality pods and providing them to the consumer as rapidly as possible. Unlike the domestic or local markets there are certain specific quality requirements for hot peppers destined for export. These include pods having:

1. A minimum diameter of 1" or 2.5 cm.
2. Bonnet-shaped rather than elongated
3. Fresh and turgid
4. No dark streaking or discolouration
5. No bird or insect damage
6. No chemical residue
7. Stem length up to a maximum of 1.5" or 3.7 cm.
8. Green stem and calyx

As much as possible pods must be free as possible from skin breaks, mechanical injuries, bruises or decay. These injuries:-

1. Provide an entrance for decay organism
2. Increase in moisture loss
3. Increase in decay, and
4. Detract from appearance of the pod

Maturity of hot peppers at the time of harvest is directly related to market life and quality. Pods harvested at an immature stage will not have a properly developed outer protective layer called the waxy cuticle and so will lose moisture rapidly to give a shrivelled or wilted appearance. Futhermore these pods will not ripen properly.

A range of cultivars of hot peppers are available and marketed locally varying in shape, size, wall thickness and colour. Both the Local Red and Local Yellow are among the two most popular cultivars used in the domestic and foreign markets. Studies by Mohammed (1988) indicate that the 'Local Yellow' has a longer shelf

life than the 'Local Red' cultivar.

HARVESTING

Hot peppers should be harvested during the cooler part of the day, that is, early in the morning or late in the evening. For export pods should be harvested on the day preceding or on the same day of shipment. Hot peppers should not be harvested in the rain or when conditions are excessively wet. Deposits of dirt and water droplets particularly if pods have many ridges can lead to fast breakdown. Pick hot peppers from plants to ensure that stem and calyx are intact. If at all pods are wet following harvest, precautions must be taken to air-dry before putting into a packaging material. On harvesting approximately 1.5 inches or 3.7 cm. of stem should remain attached to pod. Pods harvested with a split stem-end or a decapped calyx is an ideal avenue for micro-organism to enter and eventually result in decay of the entire pod. Pods should be handled with care, using rubber gloves in order to prevent fingernail damages. These damages can induce decay and increase post harvest losses. Bruised or decaying pods can ruin an entire shipment and reduce a wholesaler, retailer or importer's confidence in the grower and trader. Products in this condition:-

1. Spread decay to other pods in the same container
2. Produce a gas called ethylene which causes further ripening and decay
3. Produce more heat which causes further ripening and decay
4. Discourage repeat sales
5. Reduce profits
6. Lose more water which results in shrivelling and wilting

FIELD CONTAINERS

Harvesting bags should be used for collecting pods and field crates for transport prior to packing. Field crates should be light in colour, ventilated and shallow. When full, crates must

be kept in the shade and prevented from becoming wet. The use of sacks or feed bags should not be used since these are poorly ventilated, they encourage overfilling, cannot be stacked and very much prone to incur damage. When moving field crates to collecting area or shed or transporting to packing-house, ensure crates are covered with a light coloured material eg. tarpaulin. The covering material should be light in colour to limit absorption of sun rays and so limit heat build-up.

PRECOOLING

To maintain a fresh appearance, prevent decay, and extend the market life of hot peppers; it is necessary to start lowering the temperature and removing the field heat from the pods as soon after harvest as possible. This can be done by dipping or spraying pods with cold water. This is called hydrocooling. It is very important to air-dry pods after hydrocooling. If available an air-conditioned room can also be used. This is room cooling. Simple pratices like ensuring pods are not left exposed to the sun rays in the field or during transport, preventing delays between harvest and consumption, or placing pods in the coolest part of a building that is well ventilated will help in the removal of field heat.

SORTING AND GRADING PRACTICES

Importers and consumers of hot peppers demand high quality fresh pods in return for high prices they pay. A proper sorting and grading system will ensure that growers, wholesalers, retailers and exporters adhere to specifications in order to monitor quality condition, size and maturity. For the export market in particular, high quality appearance and taste is essential to increasing importer and consumer willingness to try and buy again. Important grading practices are:

1. Wash off dirt and debris from harvest operations

2. Discard bruised, cut, decayed, insect infested, odd sized, immature pods.

The portable sorting table shown in Figure 1 can make the sorting and grading operations faster and less labour intensive.

Quality control of hot peppers with grading helps growers, traders and exporters to:-

1. Meet the needs of different markets
2. Become reliable suppliers
3. Receive higher prices
4. Reduce risk of financial loss from down graded or rejected pods.

PACKAGING

Proper packaging of hot peppers is essential to maintaining quality during transportation and marketing. In addition to protection a package must also serve to enclose the pods and provide a means of handling. It makes no sense to sell high quality, high value hot peppers in poor quality packaging which will lead to damage, decay, low prices, or outright rejection of the pods by the buyer. In general packaging must withstand:-

1. Rough handling during loading and unloading
2. Compression from the overhead weight of other containers
3. Impact and vibration during transportation
4. High humidity during precooling, transit and storage.

Many importers prefer smaller packages than the ones presently used in local markets. They complain that their retailers have limited display and storage space, and insist that sales can be increased considerably with packages holding quantities that can be disposed of in a day or two. For example shipping containers with quantities exceeding 18kg. (40 lbs) are generally not preferred for many commodities including hot peppers. A 5-7 kg. (10-15 lbs) package to eliminate repacking in smaller size units would satisfy most overseas marketing demands. (McGregor, 1987)

The most important choice of selection of a package for export is its strength and its resistance to moisture. Packages must not only be sized properly but must also be filled properly. Packages which are very wide and weigh more than 18-23 kg. (40-50 lbs) encourage rougher handling, pod damage and package failure, (Nicholas, 1985). Overfilling causes pod bruising and excessive bulging of the sides of the package which leads to decreased compression strength and package failure. Underfilling on the other hand causes pod damage. The pods are bruised as it moves around inside the package during transport and handling.

TRANSPORTATION

For the domestic market, transport of hot peppers to various outlets should be protected from the direct rays of the sun to reduce fresh weight losses, shrivelling and loss of pod quality. It is therefore suggested that pods should be transported during the cooler part of the day and the boxes or crates of pods should be covered with a damp, light coloured cover.

For export markets where transit time is much longer, it is essential that hot peppers be loaded and transported at or near the recommended storage temperature and relative humidity ie. 10-12°C and 90-95% r.h. to maintain quality, (Mohammed, 1988). The design and condition of the transport equipment, and the loading method used are critical to maintaining pod quality.

Refrigerated containers and van containers are recommended since after transit there must be enough remaining pod life for marketing. All crops on the whole exported from Trinidad are shipped in unrefrigerated air containers. Under these difficult circumstances, lack of pod protection, flight delays, etc. must be at a minimum. Refrigerated transport is necessary particularly so when the produce has to be at the Airport at least four hours before flight departure. A proper holding shed at the Airport, with cold storage facilities is needed to ensure product quality.

The original purpose of using air transport is to take advantage of brief market opportunities such as the beginning of a season when prices are high and supply is limited. Often an importer or broker who is first to receive a supply of pods is able to build goodwill and increase sales throughout the season.

The condition of the equipment used for transporting hot peppers is critical in order to maintain quality. Exporters should insist on clean equipment. A load of hot peppers can be ruined by:

1. Odours from previous shipments
2. Toxic chemical residues
3. Insects nesting in the equipment
4. Decaying remains of other produce

STORAGE

Hot peppers must be in excellent condition and have excellent quality if maximum storage life is desired. The two major problems affecting pod quality are decay and shrivelling due to moisture loss. Under ambient conditions these problems are enhanced causing a short shelf life of 1-3 days. Refrigerated storage can reduce both of these problems and extend shelf life. The best storage conditions for hot peppers is 10°C at 90-95% relative humidity. Under these storage conditions shelf life range from 6-10 days. Storage below 10°C results in chilling injury.

Pre-storage treatment of hot peppers can further increase shelf life of pods up to 15 days. The pre-treatment involves dipping or spraying pods with Milton (500 ppm), allowing to air-dry and then storing in perforated polyethylene bags at 10°C at 90-95% r.h. (Mohammed, 1988).

Hot peppers must not be stored with ripening fruits eg. mango, pawpaw, bananas, tomatoes, etc. since the ethylene released can further enhance ripening and decay of pods.

DISORDERS

Weight Loss or Desiccation

Loss of water from harvesting hot peppers is a major cause of deterioration during marketing. The rate of water loss from pods which must be reduced to avoid loss in saleable weight and avoid wilting and shrivelling can be controlled by good handling conditions at the recommended storage temperature and relative humidity mentioned in the previous section (10°C and 90-95% r.h.). Water loss results not only in appreciable weight loss but also a less attractive and of poorer quality pod. Packaging pods in polyethylene bags can also limit weight loss.

However, a word of caution is necessary here since sealing pods in polyethylene bags can cause the relative humidity to raise above 95% and this can lead to decay. Thus the use of perforated polyethylene bags will provide adequate ventilation to minimise water deposit on pods (condensation) and limit decay.

Chilling Injury

This is a disorder of hot peppers caused by exposure to temperature below 10°C but above 0°C. Symptoms of chilling injury include:-

1. Pitting (sunken spots)
2. Darkening of stem and calyx
3. Dark-brown seeds
4. Increased susceptibility to decay

DISEASES

Anthracnose

This is a fungal disease caused by Colletotrichum gloeosporiodes. It is a field disease which can appear on both ripe and unripe pods. Black spots appear very small at first on pod surface and at this stage it may not be visible to the person harvesting and as such may eventually find its way at a later stage in marketing. Eventually the small spots enlarge rapidly. The

need for proper field sanitation and regular spraying with Benlate alternating with Dithane M-45 at a rate of 1 tablespoon to 1 gallon of water is necessary for control of this disease. The use of a sticker eg. Agral is essential during the rainy season.

Bacterial Soft Rot

This bacterial infection caused by Erwinia sp. is noted for invading hot peppers at sites of injury. Such injuries caused by fingernail damage, split stem-end, decapped calyx and other injuries caused by bruising or compression provide ideal avenue for this bacteria to enter. It causes the affected area to become watery and may eventually cause breakdown of the entire pod. The importance of proper sorting to eliminate infected pods is vital since one infected pod in a package can spread to other infected pods and result in rapid spread of this disease.

CONCLUSION

It is important to note that the above mentioned principles must be seen as a set of operations, the success of which is dependent on the integration of the operations such as harvesting, precooling, sorting, grading, packaging, storage, transportation, etc. If anyone of these operations is omitted final pod quality would be reduced. This sequence of operations make up a post harvest handling system for hot peppers and is summarised in Figure 2.

Acknowledgements:

The author wishes to express his sincerest gratitude to Mr. Mario Fortune, Mr. Assim Dilbar and Mr. George Bala of the Plant Pathology Section, Central Experiment Station, for their assistance in the identification of diseases.

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Marketing & Processing of Hot Peppers (Capsicum frutescens) in Trinidad and Tobago

by

L.H. Sealy and E. Sambury,
Central Marketing Agency

INTRODUCTION

Pepper production in Trinidad and Tobago has been confined largely to the cultivation of two major species Capsicum annum and Capsicum frutescens of the Solanaceae family. These two species exist in a multiplicity of forms and carry an equal amount of descriptive names. (Table 1). Varieties of Capsicum annum ("the sweet or mild pepper"), are more important from a commercial point of view although both species contain a range of sweet, mild and hot types. Nonetheless, the majority of hot types are found within the species Capsicum frutescens.

The popular sweet pepper types belonging to the species Capsicum annum are generally milder than the Capsicum frutescens variety, their commercial importance (on the international market) being due to their popular use as a fresh vegetable. The mild types of Capsicum annum commonly referred to as 'paprika' as well as the hot types of Capsicum frutescens owe their importance to their usage as a condiment.

In terms of the marketable product the fruit Capsicum frutescens is generally smaller than Capsicum annum, (5-7 cm) usually of deep red and/or green colour, very pungent and wrinkled. Capsicum annum on the other hand is larger (7-20 cm) in length with colours ranging from brown to yellows and red, mild tasting and is generally smooth skinned whilst the paprika types tend to fall somewhere in between.

TABLE 1

CAPSICUM SPP.

A SIMPLE CLASSIFICATION

TYPE	C. ANNUUM	C.FRUTESCENS
Sweet	-Sw. pepper -Spanish paprika	———
Mild	-Paprika	-Japanese chilles -Chilles
Hot	-Chilles -Hungarian paprika	-Cayenne pepper -African chiiiies

REFERENCES: COBELY, PURSEGLOVE

This paper focuses on Capsicum frutescens; briefly highlights some of the problems associated with its marketing and comments on some of the processed products which have been developed over the years. In this part of the world Capsicum frutescens is referred to as 'pepper' whilst capsicum annum is known as 'sweet pepper'. Internationally, however, the hot pepper has become known under the name "chilli pepper" and under the broad category of the chillies the many varieties of capsicum frutescens often have their own market niche. This means that what we call hot pepper is seen as a type of chilli pepper and this has implications for the marketing of this product. In areas of the world familiar with chilli we may well have to market hot pepper as a new type of chilli.

In terms of other uses outside of consumption as a fresh product or as chilli sauce some medicinal properties have also been attributed to the hot pepper mainly as an agent which assists in eliminating mucus congestion.

Generally speaking, however, because of the worldwide classification, ie. "Chilli pepper" it is difficult to obtain accurate data on international trends in the fresh market for our "hot pepper". Indications are, however, that both fresh and processed hot pepper products continue to increase in terms of volume consumed on the world market.

This paper does not consider the black pepper P. nigrum of the Piperaceae family which is also an important condiment in world trade also known for its pungency.

MARKETING OF THE HOT PEPPER

In terms of the marketing chain for hot peppers the post harvest handling systems are probably where the attention needs to be focused if high quality peppers are to be delivered especially to export markets. Our hot pepper varieties already have a small market niche in some European markets as a fresh product and a

limited market for the processed product known as "West Indian Hot Pepper Sauce".

The hot pepper is grouped in 'the fresh fruit and vegetable' category so that market channels, pre and post harvest practices, eg. fertilizer regime, antifungal treatments including storage, etc., must be approached in the usual manner as in the handling of tropical perishables.

Locally varieties of the yellow and red pepper (Capsicum frutescens) predominate. These fruits which are characteristically small to medium (5-7 cm.) in size, wrinkled and bonnet shaped, ripen red or yellow in colour and are 'very pungent'.

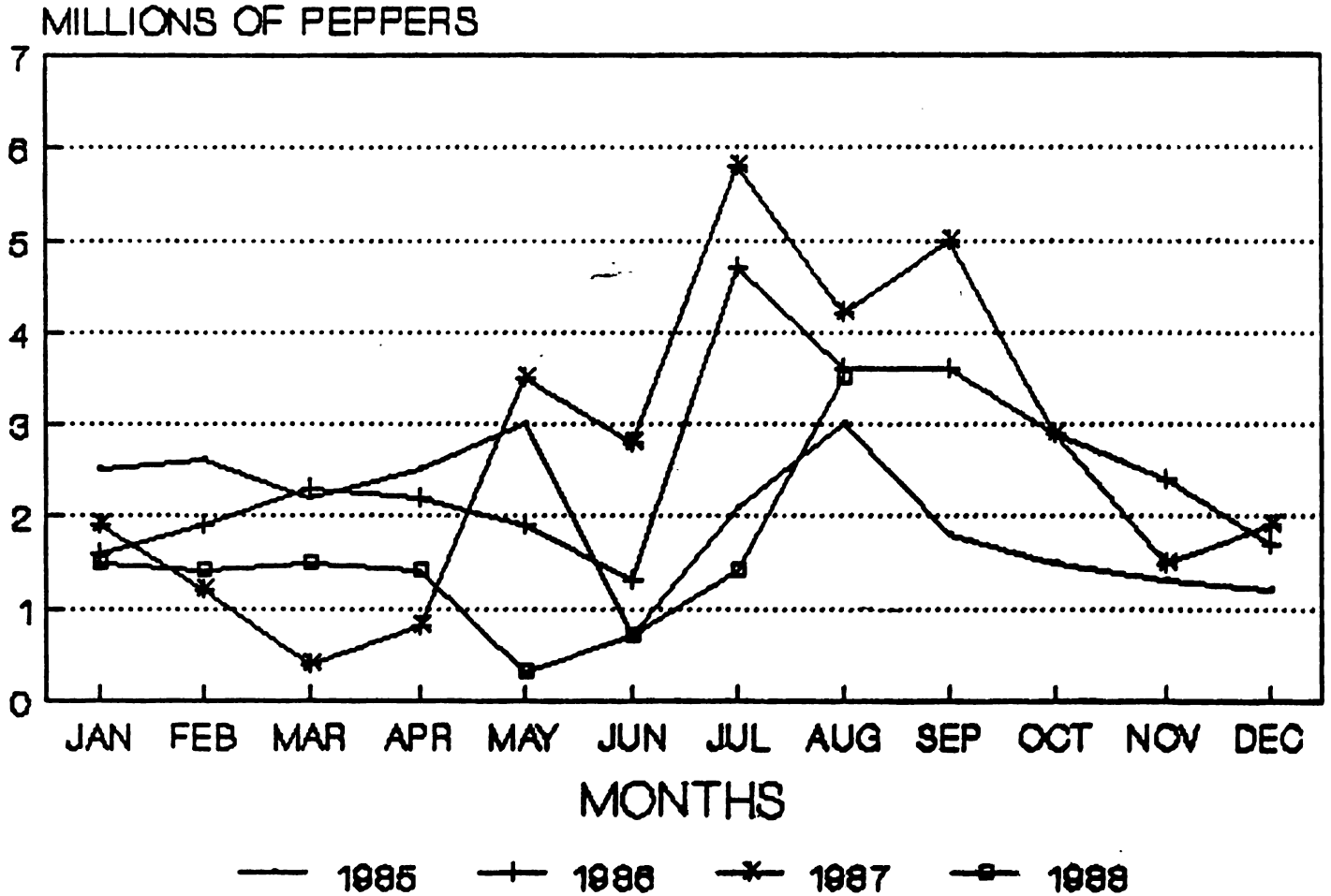
The problem associated with the marketing of this product is typical of other fruits and vegetables which have to do with the absence of well defined handling systems and established agronomic practices for both wet and dry season production. These weaknesses result in quality problems during the marketing chain. On the positive side is the fact that an increasing number of small farmers have been able to improve product quality through improved fertilization and improved knowledge of proper post harvest practices. As a result the volume of peppers exported is constantly increasing.

The Domestic Market

In Trinidad and Tobago Hot Peppers are produced throughout the year particularly in the rainy season months of July to September as shown in Figure 1. Major growers (2-5 hectares plot size) in Counties Caroni, Victoria and St. George produce for export; however, the domestic market is serviced by a large number of small producers scattered throughout the island.

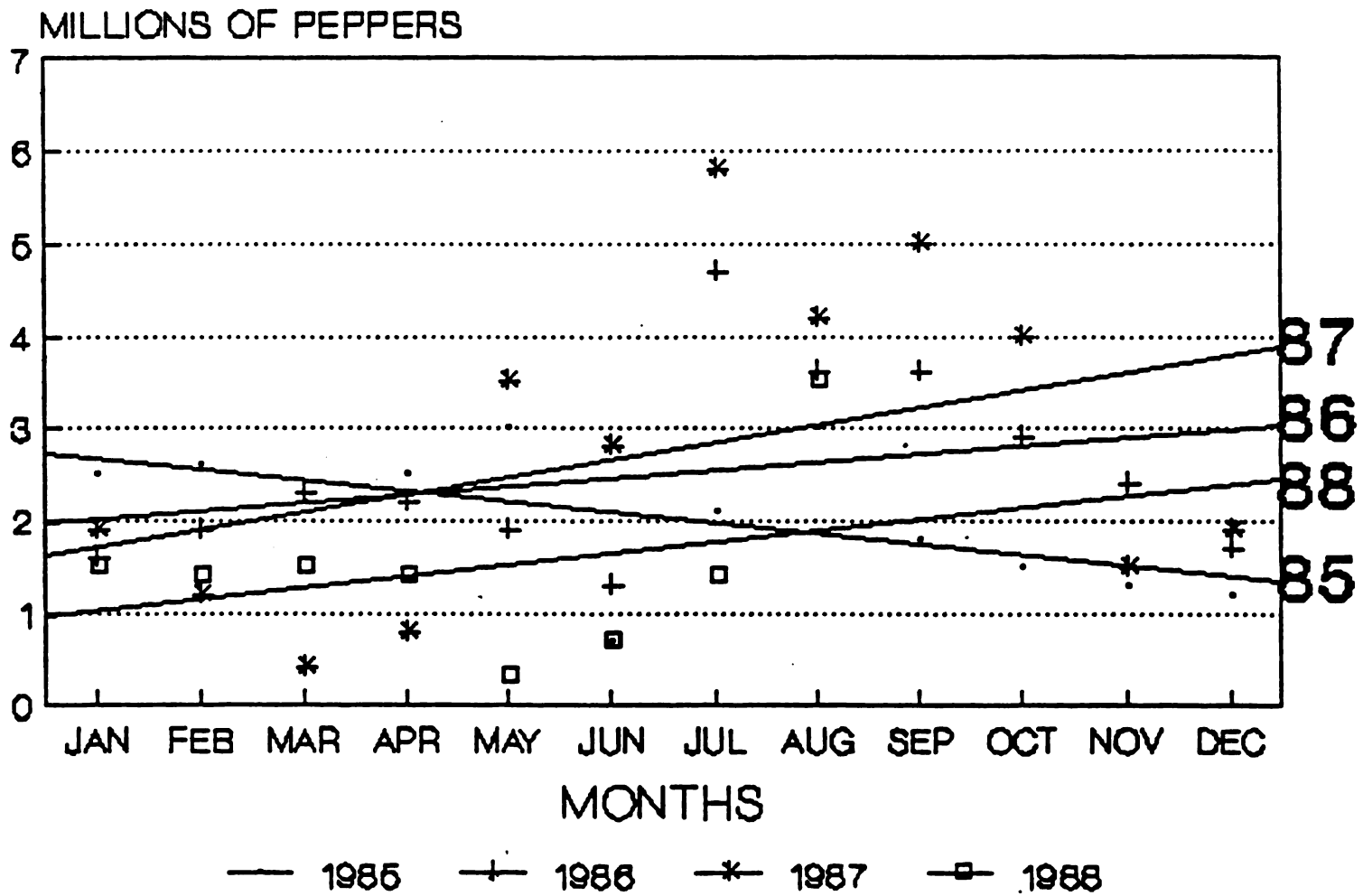
Over the past four (4) years (except 1985), there has been an increasing trend in the quantities of hot pepper harvest

HOT PEPPER PRODUCTION (85-88)
QUANTITES HARVESTED (ESTIMATED)



DATA COURTESY C.S.O FOOD CROP SURVEYS

HOT PEPPER PRODUCTION (85-88)
TRENDS-QUANTITES HARVESTED (ESTIMATED)



DATA COURTESY C.S.O FOOD CROP SURVEYS

although the usual seasonal fluctuation was evident. (Figure 2).

According to the data produced by the Central Statistical Office approximately thirty one (31) million individual hot peppers approx. (402,600 kg.) were harvested in 1987 (see Fig. 1). Of this amount, 175,628 kg. were exported to the major markets (see Fig. 1.2). This quantity represents a 4% increase above 1986 imports. The trend also seems to be towards increases in the export of hot peppers. In addition over the past four (4) years (except 1985) there has been an increasing trend in the quantities of hot pepper harvested although the usual seasonal fluctuation was evident. (Figure 2).

For the local market, the hot pepper is usually harvested by hand 75% green or totally green, packed in 18-20 kg. 'feed bags' and sold to the wholesaler or by the farmer mainly in the Producers Market, Port of Spain. Bulk sales are also made to local processors. The product therefore finds its way into the retail trade and finally to the consumer in its fresh state or as processed products such as hot sauces, chows and chutneys, etc. A list of local processors utilizing hot peppers is included in Appendix 1 for information.

For the export market, the mature or just turning to freshly ripe hot peppers are packed in ventilated carton boxes (approx. 10 kg. per box) for shipping. Both the processed and export markets show a preference for the red hot pepper variety. There is a growing demand for this variety for the processed market and at present even the current demand cannot be met by existing available supplies. There are major problems of seasonality of produce and the tendency for farmers to sell on the fresh market when prices are higher

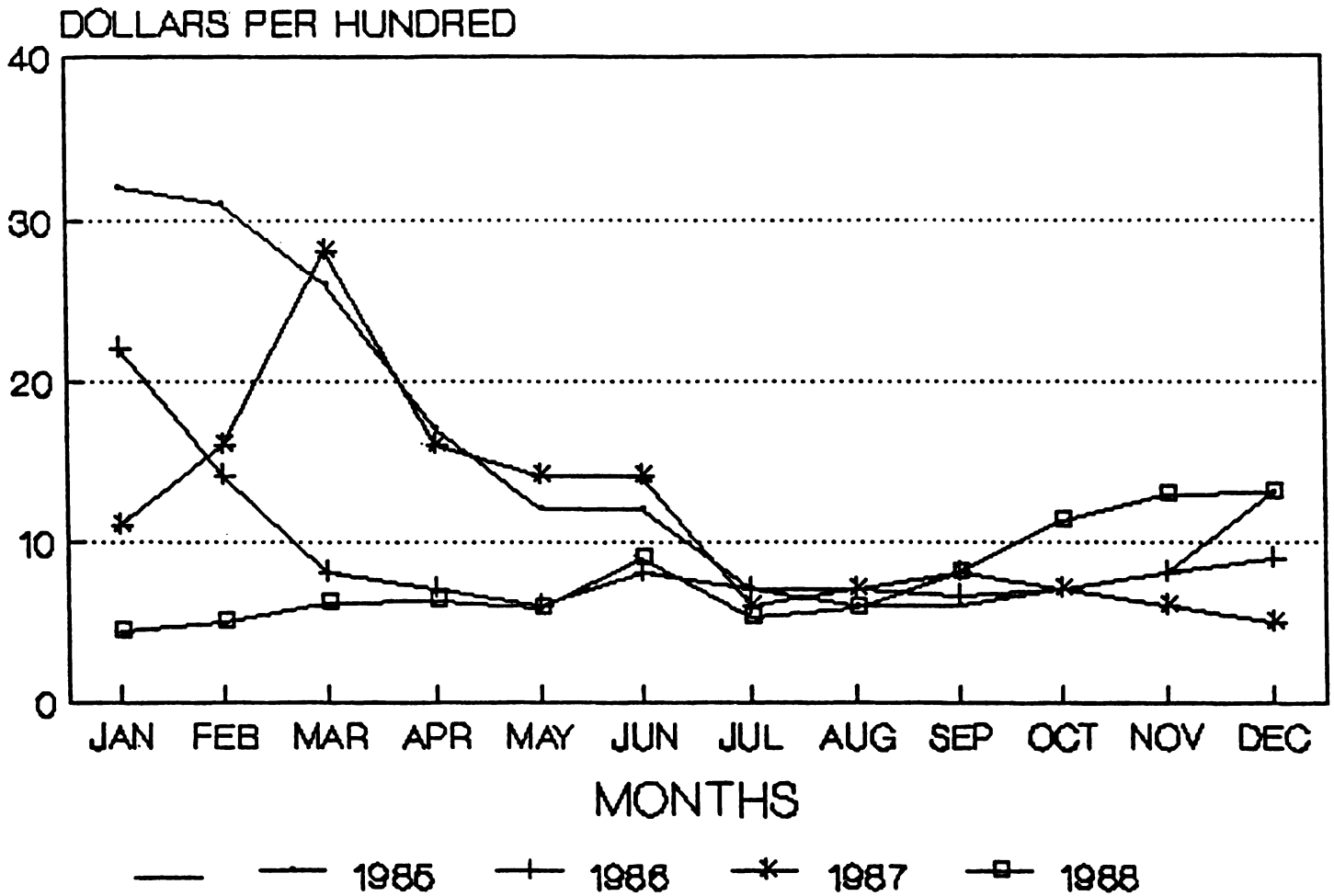
than that offered by the processor. This is an important problem for the processor. With the increased number of large farmers coming on stream this problem should be reduced.
The average wholesale price in 1988 was $8.24 per hundred hot peppers. The monthly wholesale price is usually lowest during the rainy season months when it approximates $7.00 per hundred as shown in Figure 3 coinciding with the peak in production. In the last quarter of 1988, however, a noteworthy increase was observed in product prices. This was reportedly due to an unexpected decrease in supply. Reduced supplies were caused by significant crop losses brought on by excessive floods, and a new strain of mite which devastated several hectares of well established fields. The temporary shortage pushed up the wholesale price of hot pepper in December as much as 280% over December 1987. Except for 1988, the trend over the past four (4) years seems to be towards lower prices in each successive year. (Figure 4).

Product pricing particularly for the fresh market is unrelated to specific grades and standards. Given the expected increases in supply based on current trends and the greater demand in the processed market and the export market, it is paramount that an appropriate system of grading and standardization be introduced. Such a system is a key element in improving confidence in the final quality of the marketed product.

The International Market

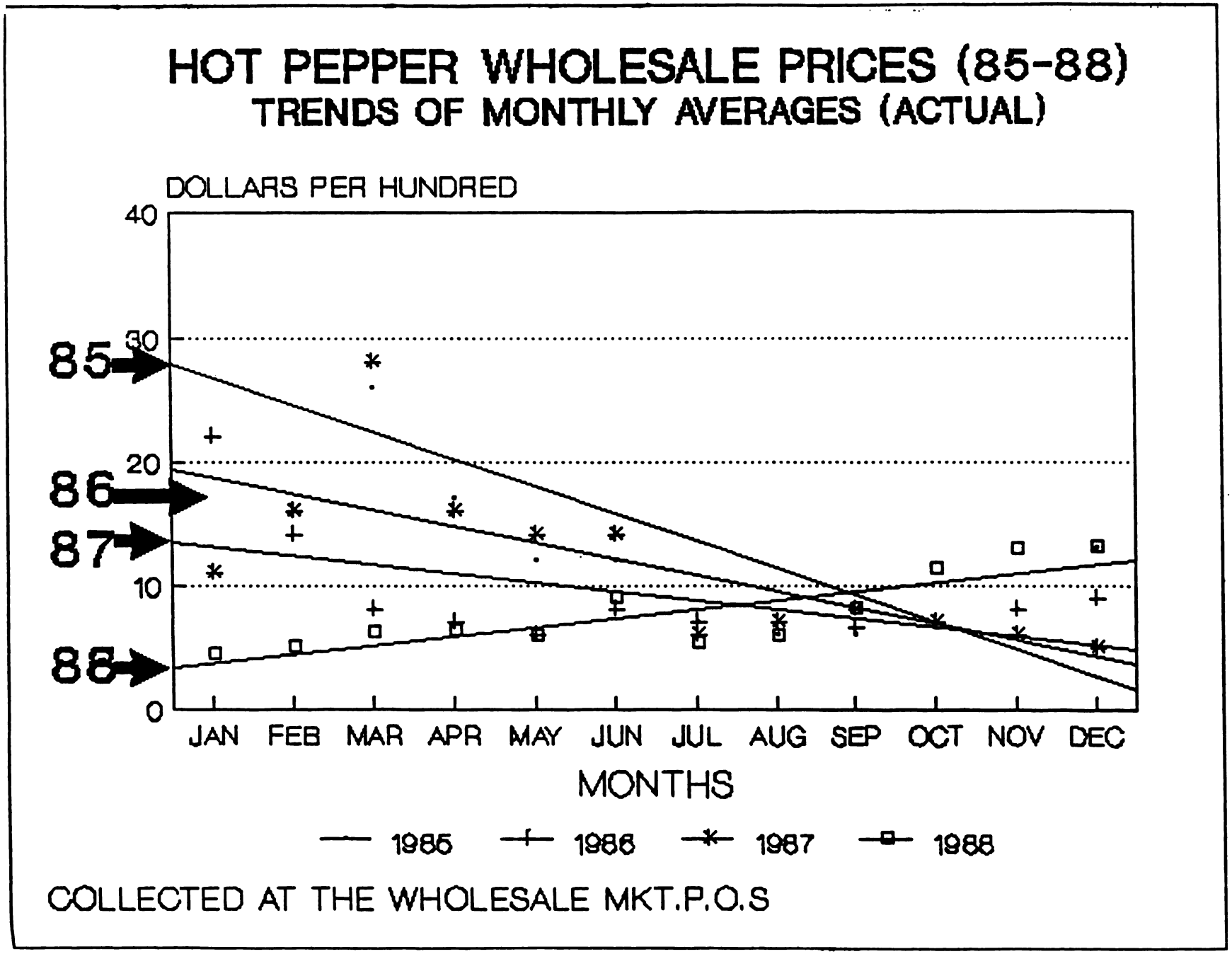
The international market recognizes the hot pepper as chillies in the fresh form, in the powdered form as cayenne and in the form of a sauce, as the tabasco. Different varieties are traded under the broad heading **Capsicum** hence a precise analysis of international trade is difficult. Commercially,

HOT PEPPER WHOLESALE PRICES (85-88)
MONTHLY AVERAGES (ACTUAL)



COLLECTED AT THE WHOLESALE MKT.P.O.S

FIGURE 4


HOT PEPPER WHOLESALE PRICES (85-88)
TRENDS OF MONTHLY AVERAGES (ACTUAL)
DOLLARS PER HUNDRED
40
30
20
10
0
85
86
87
88
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
MONTHS
1985
1986
1987
1988
COLLECTED AT THE WHOLESALE MKT.P.O.S

the hot pepper is classified according to :-

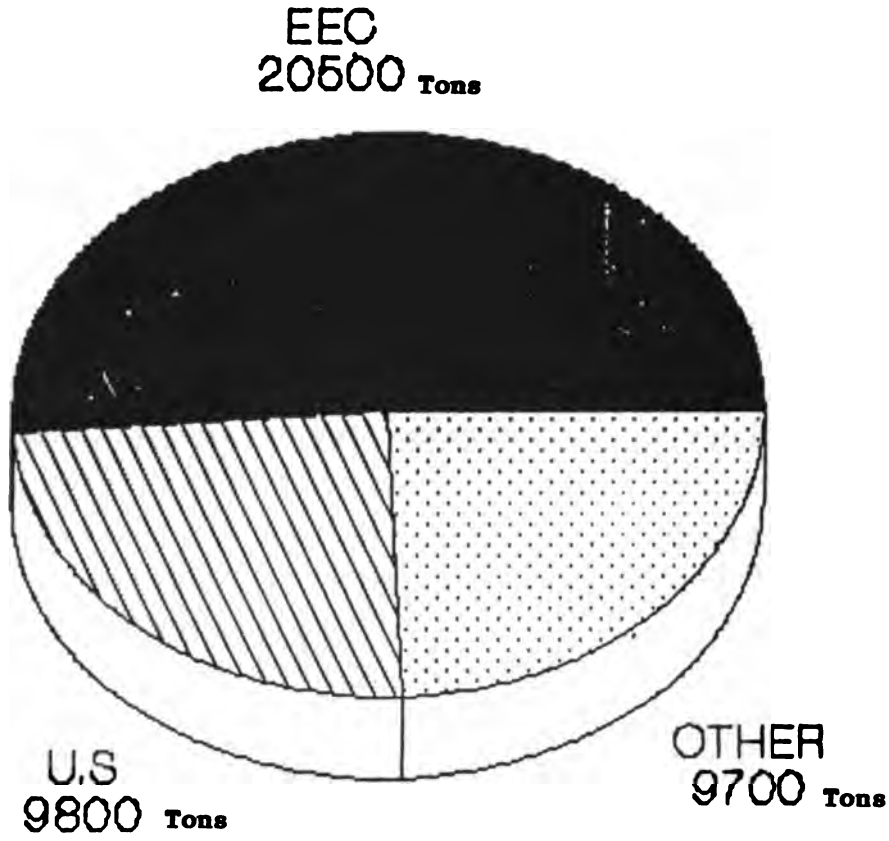
a. colour
b. size
c. pungency, and
d. end use

For major importing countries, there is no distinction between paprika and the chillies in the trade statistics. The total world market (for the paprika and chillies) is approximately 40,000 tons per annum (1980 - 1986); 30% by weight comprises of chillies, 70% by weight of both paprika and sweet pepper. As shown in Figure 5, the US and EEC countries are the major importing group in the world market with annual imports equivalent to 9,800 tons and 20,500 tons respectively. Trends indicate that there is scope for further growth in these markets for chillies.

In terms of local varieties and their ability to penetrate export markets, it is noteworthy that the popular variety in "Scotch Bonnet" is known for its unique flavour as a fresh product enjoys a unique market share in foreign markets with large immigrant population, mainly the United States with Canada and the UK being of lesser importance. The price on the US market is $10.00 US/box. Local exporters can therefore aim at increasing their share in the foreign 'ethnic' market for fresh hot peppers where the demand already exists. In order to achieve an increased share however local producers/exporters must first overcome the problems that may affect the attaining of a high quality marketable product and inconsistent supplies due to seasonality. The most important suppliers of hot peppers are in Asian countries such as China, India, Pakistan and Indonesia.

FIGURE 5

WORLD HOT PEPPER MARKET
MAJOR AREAS



INTERNATIONAL TRADE CENTER (1982)

Processing of Hot Pepper

Chemistry & Chemical Composition

The capsicum fruits owe their pungency to the presence of a volatile phenolic compound closely related to vanillin known as capsaicin. This compound is distributed throughout the plant but tends to collect in the penduncles and seeds and is present in the fruit mainly in the placenta (90%).

As little as 1 part/1000 parts of water burns and based on the ability to detect a threshold level a proposed system of "Scoville Heat Units" has been used to measure the "heat of pepper". This system has been widely accepted. In terms of the nutritional value, pepper has its major nutrients Vitamin C and Vitamin A. Table 2 outlines its nutritional value per 100 gms.

Processed Products

Hot peppers are used mainly in the food processing industry. A variety of processed products can be identified as follows:

1. Condiments
2. Curries
3. Dried Whole Pepper/Powder
4. Chilli Powder
5. Dried paprika (mild red pods)/powder
6. Pepper Sauce
7. Pickled Sauce
8. Mexican Sauce
9. Mandram
10. Chutneys
11. Snack Food Flavour
12. Colorants in Meat Industry
13. Oleoresin Manufacture
14. Lime Pepper

TABLE 2

C. FRUTESCENS

NUTRITIONAL VALUE PER 100 GM

COMPONENTS	GREEN	RED
-Water (%)	88.8	74.3
-Energy (Cal.)	37	65
-Protein (gm.)	1.3	2.3
-Niacin (mg.)	1.7	2.9
-Carbohydrate (gm)	9.1	15.8
-Vitamin C (mg.)	235	369
-Calcium (mg.)	10	16
-Phosphorus (mg.)	25	49
-Iron (mg.)	0.7	1.4
-Sodium (mg.)	-	25
-Potassium (mg.)	-	564
-Vitamin A (I.U)	770	21600
-Thiamine (mg.)	0.09	0.1
-Riboflavin (mg.)	0.06	0.2

U.S.D.A. (1975) AGRIC. HANDBOOK #8

Local Companies

Over fifty (50) local firms produce a range of products from hot peppers. A list of these firms is presented in the Appendix 1. Locally produced products include hot sauce, chutneys, cocktail sauce, lime pepper and seasonings. There is potential for the production of relishes, pickles and other products.

Medicinal & Other Uses

There are a number of suggested medicinal and other uses of hot pepper and its preparations. Some medicinal uses are:-

i. in counter irritant formulations from capsicum oleonesins obtained by extracting capsicum with acetone or ether.

ii. inducing strong peristalsis by intensifying secretions and by stimulating movements of the bowels and aiding digestion.

iii. to dislodge mucus congestion.

Other uses are:-

iv. as a repellent in aerosols.

v. as mace in human repellents, and

vi. even reputed to be an aphrodisiac.

CONCLUSION

Improvements in the marketing of hot pepper can be achieved by the introduction of established agronomic practices, organized post harvest handling systems and grades and standards. Trends

indicate that there is a very strong demand for "Trinidad hot peppers" in both the local processed and the export markets. Nonetheless, the problems associated with inadequate/irregular supplies, product price on the fresh market and product quality must be overcome in order to increase its use both in the local processed market and expand its market share in the North American and European markets.

A wider range of processed products can be obtained in the food industry and there is also potential for greater use for medicinal and other purposes.

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HOT PEPPER PROCESSORS
COMPILED DECEMBER, 1988

COMPANY NAME	ADDRESS
Diaz, M. & H.	N.A.
Julien, R.	N.A.
Langdon, S. & Willlams, R.	N.A.
Campbell, M.	N.A.
Sookhan, M.	N.A.
Morrison, C.	N.A.
Chin Kee Food Co.	N.A.
David, R.	N.A.
H. N. Look & Co. Ltd.	Southern Main Road, Chase Vge., Chaguanas.
Ramganese	Caroni Savannah Rd., Chaguanas.

SOURCES: A.D.B., I.D.C., M.O.F.P.

COMPANY NAME	ADDRESS
Ramsaroop, R.S.	Caroni Savannah Rd. Chaguanas.
Deodath, R.	Caroni Savannah Rd. Chaguanas.
La Vega Pepper Sauce	Pepper Vge., Couva.
Carib Int. Ltd.	La Vega, Gran Couv
Li, A. E.	Upper Carapichaima.
Ali, T. & Sons	Calcutta No. 1, Freeport.
Daisy Fresh Foods	La Paille Vge., Caroni.
Cummings Bros.	#9 High St., S/F'do.
Casey's Products	Circular Rd., Plaisance Park.

COMPANY NAME	ADDRESS
CABS	St. Madeleine.
Noel's	#17 Oleander Dr., Pleasantville.
Tropical Food Products	#15 Dinoo Rd., Charlieville.
Universal Enterprises Ltd.	Carapo Rd., Arima.
Chow Chan	Montrose St., Montr
Nandlal, S.	Southern Main Rd., Chase Vge.
Selby's	#11 Dinoo Rd., Charlieville.
Mohammed, N.	Carlsen Field

COMPANY NAME	ADDRESS
Chin	Joyce Rd., Ext. Tr. North.
Alabaster Products	Lendore Vge., Chaguanas.
Chase Foods Ltd.	Chase Vge., Chaguanas
Gowasack, E.	Main Rd., Chaguanas.
Holder's Products	Lendore Vge., Chaguanas.
Lallah, S.	Ravine Sable, Longdenville.
Simpson's Products	#45 Third St., Barataria.
Caribbean Int. Co. Ltd	#8 St. Anns Rd., St. Anns.

COMPANY NAME	ADDRESS
Ramnath, S.	#27 El Socorro Rd., San Juan.
See Gees	Catherine Rd., Belmont
Chen's Products	Havelock St., Curepe.
Panks	Lopinot Rd., Arouca.
Kitch Mix	#10 Gerald Ramkissoon Rd., Petit Valley.
Thora Investments	#48 Pelican Dr., Phiilipine.
Vis Country Style	#360 Webber Housing Project, Arima.
All	Boundary Rd., Aranguez
Itman's	#16 Mission Rd., Barataria.

COMPANY NAME	ADDRESS
Chief Brand Products	Uriah Butler Highway, Chaguanas.
Turban Brand Products	186-188 Eastern Main Road, Tunapuna.
Catelli Primo Ltd.	#31 Wrightson Rd., Port-of-Spain.
National Canners	Churchill/Roosevelt Highway, Arima.
Farrow, H.	#15 Cassia Av., Pleasantville.
Thomas, D.	Golden Grove Rd., Canaan, Tobago.
Hot Stuff Co.	Maracas Bay Rd.

COMPANY NAME	ADDRESS
Future Products Ltd.	Shakir Tr., El Socorro Rd., San Juan.
Dynasty Products	#24 Crawford St., Vistabella.
J. G. M. Products	L.P.15, Ragoonanan Rd. Enterprise, Chaguanas.
Charles Diamond Ind.	Paradise Gardens, Wilson Rd., Coryal.
Hot and Tasty	4 3/4 mm Oropouche.
Christian Food Processing	#10 Chaconia Cir. Rd. Macoya.
Phillips, C.	San Fernando St., San Fernando.

COMPANY NAME	ADDRESS
Wendy's	Gulf View, La Romain.
Atal, R.	Buen Intento, P/Town.
M & C Copper	Thick Vge., Fyzabad.
Kitchen Magic	Ramjohn Tr., Penal.
Wilson & Wilson	Dow Vge., Oropouche.
Nyack, N.	Rancho Quemado, Erin.
Deonarine, R.	Whiteland, Mayo.
Jonathan, P.	Bonne Aventure Main Rd
Narinesingh, A.	Caratal Vge.
Ramlal, S.	Houssa Trace, Bonne Aventure.
Little Kitchen Agro-ind. Ltd.	Winnie Mohammed Rd., Diego Martin.

Export Potential of Hot Peppers

by

Vassel Stewart, Regional Trading Manager
Caribbean Agricultural Trading Company Limited (CATCO)

INTRODUCTION

Hot peppers or Capsicum frutescens constitute the species of the genus Capsicum which is characterised by a high level of capsaicin, a crystalline substance possessing a burning taste and very acrid vapours, which causes the hotness or pungency of the pepper.

Hot peppers have traditionally been grown and consumed throughout the tropics and sub-tropics, but are now being grown even in temperate areas during the summer months in green houses.

Hot peppers are undoubtedly one of the most widely used spices and its consumption has been showing significant increase, particularly in developed metropolitian countries, where the demand for 'exotic foods' is growing at a tremendous rate.

OVERVIEW OF THE INDUSTRY

There are numerous varieties of Hot Peppers, but only a small number of these are grown commercially. The hot pepper industry, however, can be divided into four (4) segments based on the hotness or heat level of the pods. The heat level is measured in scoville heat units, which ranges from below 5,000 to over 100,000.

The four(4) segments based on the scoville system reportedly used by the American Spice Trade Association, can be classified very broadly as follows:-

Unit Range	Class	Product
Under 5,000 units	Mild	Paprika
6,000 - 15,000 units	Low Heat	Chilli Pepper or Powder
20,000 - 60,000 units	Medium Heat	Hot Pepper or Red Pepper
61,000 - 100,000 +	High Heat	Medicinal and Industrial Products

Paprika

This constitutes the ground form of any number of varieties of mild peppers grown for their colour and flavour. The pods are normally dried and ground where they are grown, thus the product is traded exclusively in its ground form under very strict international quality standards. It is utilised by a wide cross section of consumers in all types of dishes.

Chilli Pepper (Ground) and Chilli Powder

The ground product is generally obtained from pepper with a heat range of 6,000 - 15,000 units. In the United States of America, which is the major market, two (2) varieties - the Anaheim, (a slender 6-7 inches red pepper) and the Ancho, (attractive, heart-shaped, 5-6 inches deep red pepper) are the ones most used. They are produced primarily in California, New Mexico and Mexico.

Chilli powder is a generic name used to describe a blend of different species, of which ground chilli pepper is the main ingredient, usually about 80%.

These products also find wide international usage. Chilli powder is a main ingredient in Mexican type foods, which is the fastest growing segment in the restaurants and fast food industry in the United States of America.

Hot Peppers or Red Peppers

Products in this segment are obtained from peppers with heat units ranging from 20,000-60,000. They are marketed as:-

a. Whole Pods - Fresh, frozen or in pickles
b. Crushed - Fresh or dried
c. Ground - Often sold under the name of 'Cayenne' or 'Ground Red Pepper'

Products derived from these peppers are consumed primarily by people from South-East Asia, Central America, Africa and the Caribbean, who are consumers of hot spicy foods.

Hot peppers exported from the Caribbean fall in this category.

Industrial Peppers

Peppers with scoville heat unit exceeding 100,000 units are generally used in the manufacture of other products. This is done through extracting and concentrating the oleorisin from the peppers and using this in varying amounts in a range of pharmaceutical and prepared food products, where precise control of the degree of heat or hotness is required.

THE MAIN EXPORT MARKETS

The main export markets for hot peppers from the Caribbean Region are:-

1. United States of America
2. Canada
3. United Kingdom and Holland
4. Other European countries (France, Spain, Italy and West Germany)

The United States of America is the biggest market with an estimated annual consumption of over forty (40) million lbs. of pepper products (mainly dried, whole or ground) about 40% of which is imported.

The total European Communities' demand (including United Kingdom and Holland), is estimated to be excess of fifteen (15) million lbs, including the fresh and various dried forms. A significant quantity of this is produced locally in Holland, Italy, France and Spain.

Canadian demand is crudely estimated at over five (5) million lbs. of both the fresh and dried product in its various forms.

MAIN COMPETITORS

The main competitors for the North American market (United States of America and Canada) are:-

1. United States of America's domestic production - mainly for paprika and chilli peppers. Main production areas are, New Mexico, California, Texas and Louisiana.

2. Mexico, Pakistan, China and India, supplying all forms of dried peppers, as well as sauces. Mexico also supplies fresh peppers.

3. Central America (Costa Rica, Dominican Republic and Honduras) and the Caribbean (Jamaica, Trinidad and Tobago, Barbados and St. Lucia), supplying fresh, dried and processed sauces.

4. Hungary, Spain and other European countries, supplying mainly paprika.

In the European Market the main competitors are:-

1. Local production from Holland, Italy, France and Spain. They supply fresh, dried and processed sauces.

2. Mediterranean countries - Greece, Morocco and Cyprus. They supply mainly the fresh market.

3. Asian suppliers - India, China and Pakistan - They supply mainly the dried product for the industrial market.

4. Africa, the Caribbean and Central American countries. They supply mainly the fresh market.

The unground dry pepper market is dominated by China, India, Mexico and Pakistan, with Pakistan being the low price leader.

C.I.F. prices for the unground product ranges from US$0.45 - US$0.85/lb. during 1985. The market for the ground product is dominated by Korea, which holds over 50% of the market share. Average c.i.f. price in 1985 was US$1.15/lb.

The market for fresh hot peppers and processed hot sauces are the most competitive.

Supplies of fresh hot peppers vary significantly throughout the year depending on the seasonal supplies from countries which supply various segments of the fresh pepper market. This variation in supplies is also reflected in significant price variations, for example, wholesale price in the United Kingdom may vary from £0.40 - £1.00/lb. and in the United States of America from US$0.80 - US$2.00/lb.

There are numerous suppliers of hot sauces, with the product showing wide variation in formulation, degree of hotness and price.

PROSPECTS FOR EXPORTERS

Hot peppers as a generic product has been used in various ways and for many purposes for decades and as such, should be in the mature stage of its life cycle. However, the demand for exotic foods, including hot and spicy foods has resulted in the product entering into a new growth phase.

The fastest growing areas of the industry are the chilli powder and chilli pepper segments. This has been due mainly to the tremendous increase in Tex-Mex dishes in the United States, where sales of this food line is reported to have exceeded US$2.2 billion

in 1985. It is felt that in the near future, these Tex-Mex dishes will be introduced in Canada and Europe, but that growth will be very much slower even with strong promotional programmes.

The demand for the fresh red pepper or hot pepper product is also showing growth, but at a much slower rate. The fresh market is dominated by long and thin chillies, although the demand for the Lantern and Scotch-bonnet types from the West Indies, Cyprus and Costa Rica are increasing in popularity in all the export markets, particularly the United States of America. These West Indian varieties are still however, mainly confined to the ethnic West Indian market.

The size and growth of the chilli powder and chilli pepper segments suggest good opportunities for new exporters. It must be borne in mind however, that strict adherence to the very high quality standards and stringent delivery schedules are essential and may present greater problems than competitive pricing and desirable levels of scoville heat units, which are also important factors.

Opportunities for new entrants into the red or hot pepper segments is limited, due to the much slower growth rate and the entrenchment of the many existing competitors. New entrants have better opportunities in the fresh market, if they can:-

a. supply during the off-season of current suppliers;
b. supply equal or better quality at lower prices, thus capturing existing suppliers share of the market.
c. supply a product which is more flavourful.

Despite the apparent stagnancy of the hot sauce segment, it is felt that growth can be stimulated by new formulation aimed at creating new exotic flavoured sauces.

C L O S I N G S E S S I O N

DISCUSSION OF TECHNICAL PAPERS

Morning Session

1. **Question:**

Evans Ramkhelawan: Where can the farmer obtain disease-free hot pepper seeds?

Answer:

Garth Rajnauth: This is a problem in the area of seed pathology. The present system of operation does not guarantee to the farmer, disease-free materials.

2. **Question:**

Patrick Sun Kow: Is there any cost of production exercise on hot peppers being done in Trinidad and Tobago?

Answer:

Dr. Lennox Sealy: Yes, but further information concerning details of production costs will be supplied in subsequent seminars.

3. **Question:**

Satnarine Baboolal: From the presentations, it was revealed that there are various chemicals to control specific pests and diseases. Would a farmer apply all the various chemicals on his crop or would it be better to use a type of chemical to cover a wide range of pests and diseases?

Answer:

Anthony St. Hill: From the handout provided you can see we have different pests and diseases coming from different causative agents. Chemical spraying is not the only answer since some sprays would not be effective against specific diseases. One must also note the importance of chemical as well as cultural operations. An understanding of the causative agent is also very necessary.

4. **Question:**

Patrick Sun Kow: How accurate are the prices on cost of production which are advertised on Television?

Answer:

Dr. Lennox Sealy: Prices provided are those collected on the wholesale and retail market on a day to day basis and not a cost of production figure as you suggested. There is a difference between cost of production and actual commodity prices.

5. **Question:**

Zainaul Mohammed: In the export sector, we have a very good market already for our hot peppers in that they are unique. Why should we attempt to look at new varieties of hot peppers rather than try to strengthen the cultural and post harvest practices of our present varieties?

Answer:

Musa Mohammed: The breeding work undertaken to look at new varieties of hot pepper is aimed at getting desirable characteristics with the local varieties such as improved shape, variations in colour, larger size with a range of pungency values, etc.

6. **Question:**

Satnarine Baboolal: Is the mosaic virus in hot peppers seed borne?

Answer:

Anthony St. Hill: It is not seed borne.

7. **Question:**

Debra Maharaj: Is it economical with the present downturn in the economy in Trinidad and Tobago to consider grades and specific standards for hot peppers?

Answer:

Joanne Samuel: Yes, in order to uplift the quality of the hot peppers and more so to continue to compete in the export market where this crop is at the present time obtaining very good prices, the importance of grades and standards is a must.

8. **Question:**

Debra Maharaj: Isn't that going to create a problem with produce in the local market?

Answer:

Mona Jones: No, actually it is going to create a more efficient grower, enabling him to compete more successfully in both the domestic and foreign markets.

Evening Session

1. **Question:**

Debra Maharaj: Explain specific details about the method involved in hydro-cooling of hot peppers.

Answer:

Majeed Mohammed: The purpose of hydro-cooling hot peppers is to remove field heat. This can be done by dipping in ice-cold water at 4-5°C for 20-25 minutes. It is expected that in this period of time the internal pod temperature will drop from 30-35°C to around 14-15°C.

2. **Question:**

Debra Maharaj: What are some precautions the farmer will have to bear in mind when hydro-cooling?

Answer:

Majeed Mohammed: First of all, he has to ensure that the water he is using is not contaminated. He also has to avoid dipping pods several times in the same medium. In this way he will limit further cross contamination between pathogens from one pod to another. It might be useful to add in the hydrocooling medium a bactericide to destroy pathogens. Milton at 500 ppm is quite effective. In this way both the field heat and pathogens are eliminated.

3. **Question:**

Deodath Ramjattan: Can someone explain the pungency status in hot peppers?

Answer:

Debra Maharaj: The pungent factor in hot peppers is called capsaicin. This substance may be located in the underside of the pod or on the pepper seed. Pungency can be evaluated on a subjective basis using a method referred to as the scoffel test. On an objective basis pungency can be evaluated by paper chromotography.

4. **Question:**

Chris Bernard: What effects does pungency of hot peppers have on humans?

Answer:

Debra Maharaj: There are a number of medical properties related to this pungency factor in hot peppers, particularly in relation to digestion of foods.

5. **Question:**

Patrick Sun Kow: What processing potential and marketing opportunities are there with hot peppers?

Answer:

Dr. Lennox Sealy: There are a great number of processing opportunities for hot peppers, starting from pepper sauce, chutney, in the dried form, for salads, etc. Presently, these products are in demand in both the domestic market as well as the international markets, eg. Canada, Europe, United States of America.

6. **Question:**

Fayume Mohammed: Where can someone get information with respect to export marketing requirements such as quality standards, prices, etc.?

Answer:

Mr. Vassel Stewart: Information on external market for hot peppers can be obtained at the Export Development Corporation. CATCO is also willing to get into contracts with producers to supply them with hot peppers on a regular basis for their markets abroad. The prices will vary according to the particular target market. Information on quality requirements can be obtained at CATCO not only for hot peppers but other perishable crops as well.

7. **Question:**

Shaffie Mohammed: Where can someone get information on the drying of hot peppers?

Answer:

Dr. Lennox Sealy: This information can be obtained from CARIRI's Technical Information Service, International Trade Centre Journal, Library at U.W.I.

8. **Question:**

Vassel Stewart: Have we determined the hotness or pungency status in our locally grown hot peppers?

Answer:

Deborah Maharaj: We are doing this project at the Food Technology Department at U.W.I., now.

9. **Question:**

Patrick Sun Kow: With the present high price for hot peppers our farmers are demanding, is making it extremely difficult to buy and sell to the exporter. Towards this end as an exporter, my only solution is seek supplies elsewhere. What plans are there in the future to achieve a system of getting a regular supply at reasonable prices?

Answer:

Dr. Reginald Griffith: The trend in the past has a pattern whereby the exporter or even the private processor often asks farmers to produce and when they do so these exporters and processors fail to buy the produce. Farmers are therefore not willing to produce for processor because the latter always claim they can get supplies elsewhere.

10. **Question:**

Kamal Rattan: Would you like to indicate the prices you get for hot peppers in the export markets?

Answer:

Vassel Stewart: I said already that prices depend on the market and time of the year and quality. In the U.K. market, it is a 40-60 pence/lb., in the U.S. market US$1.50/lb., in the Canadian market it is CAN$0.80-1.10/lb.

11. **Question:**

Kenneth Pollard: What is the best way to pick hot peppers?

Answer:

Majeed Mohammed: Pick hot peppers from the plant at the natural fracture line that is approximately 1-11/2" from the calyx end. Avoid pulling or plucking the pod from the plant. This can cause both the stem and calyx to be removed. This now leaves the pod decapped exposing the soft inner tissue which can be subjected to invading pathogens and which can lead to rapid decay.

11. **Question:**

Deodath Ramjattan: Who is going to follow the draft grades and standards suggested on hot peppers?

Answer:

Dr. Rafael Salazar: IICA is supporting a CARICOM initiative for developing standards and grades for fresh produce in the Caribbean. It is also expected to continue to have a series of seminars in 1989 in Post Harvest Handling of other crops.

13. **Question:**

Nazrudeen Juman: During the periods of electricity failures, how long can hot peppers last?

Answer:

Majeed Mohammed: Following storage of hot peppers at refrigerated temperatures, eg. 8-10°C and then subjecting to higher temperatures during electricity failures can lead to spoilage very rapidly ranging from 3-5 hours and more. If the peppers are kept in polyethylene bags, condensation will take place. This provides an ideal environment for pathogens to multiply rapidly. As much as possible a constant temperature of 8-10°C is desirable, as such the need for a reliable back-up system like a generator is essential, particularly for a place like a supermarket where you work and where more perishable crops are displayed for sale.

CLOSING REMARKS

by

The Chairman
Reginald Griffith D.Sc.

We have learnt many things today about the post harvest requirements of hot peppers, apart from learning why they are called hot peppers and the methods for determining the various grades of 'hotness'. I was indeed struck though by the fact that we still continue to import large quantitites of hot peppers for our daily utilization from countries as far as India. This is particularly distressing when hot peppers, as we have heard, can grow all year through in Trinidad and Tobago and they are not particularly fastidious about soils.

Considering, therefore, our local market demands which have not as yet been satisfied, this seminar seems clearly to have justified it's keep. Since, as it would appear, the shelf-life of hot peppers locally is severely restricted by generally poor post harvest strategy. From the point of view of initial profits when oriented to our local market, the adoption of certain post harvest techniques can give immediate returns.

The market studies have indicated that the price for fresh fruit has never been properly explored by our local farmers. It has shown also that markets are available for prepared products as hot sauces which by custom and taste ought to carry a traditional flavour. But various imported substitutes are still present copiously on the shelves of our supermarkets. Further, we do not produce dried-pepper products which are always imported. Our haste, therefore, to export, which is comendable, is certainly based on an assumption that greater profit margins exist elsewhere in markets which we can find.

We have been advised about the foreign markets. Whereas they exist we must individually seek them since competition is keen. It was why someone had asked about any uniqueness in our local pepper. I would not be too concerned about uniquesness as much as I would be concerned about upholding rigid standards and maintaining a reliable supply. These two aspects have been laboured on today. The standards of course are important and if further seminars and training programmes in post harvest technology transfer would help, we of the Ministry will only be too glad to continue with these programmes for hot peppers.

You must be tired now as the lectures were very intense in content, nevertheless, in the near future we will be having similar courses for the other vegetable crops which are capable of being exported and, of course, being consumed locally. We implore you to keep in touch as we continue with our drive.

Vote of Thanks

Dr. Rafael Ernesto Salazar
Marketing Specialist, IICA Office in Trinidad and Tobago

On behalf of the Inter-American Institute for Cooperation on Agriculture and myself, I would like sincerely, to thank the Ministry of Food Production, Marine Exploitation, Forestry and the Environment, through the Central Experiment Station (Centeno), their staff and especially to the Post Harvest Unit that made this seminar possible.

Also I would like to thank Chief Brand Products, Tramac Engineering and Mr. Deodath Ramjattan for their contribution in the presentation of the displays. I express my gratitude to the participants, speakers and all the people who worked to make this seminar a success.

I would like to thank Drs. Lennox Sealy and Reginald Griffith for their cooperation during the seminar in their capacity as chairpersons of the morning and evening sessions. Finally, I would like to point out the extraordinary collaboration and efforts made by Mr. Majeed Mohammed in the organization and development of this seminar and on behalf of our Institute and on my own behalf to say a special word of thanks to him and to all of the IICA staff especially Ms. Francilla Stewart for the support given to me in this exercise.

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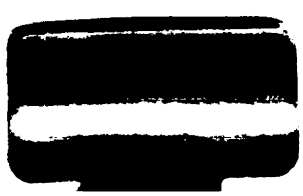

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