NATIONAL LEGUME AND CASSAVA PROGRAMME

No.1

SITUATION STUDY ON LEGUME PRODUCTION IN GUYANA

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES - OAS
SIMON BOLIVAR FUND
GEORGETOWN, GUYANA

JUNE, 1978

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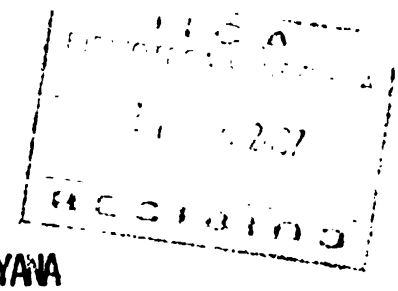

SITUATION STUDY ON LEGUME PRODUCTION IN GUYANA

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REP & PR

INTRODUCTION

Background Information

Although food legumes have been grown in Guyana traditionally, domestic production has always had to be supplemented by importation. Information on imports and estimated domestic production for the period 1966 to 1977 is given in Table 1. This shows a wide fluctuation in annual imports but in general, a gradual increase in local production over the years. The drastic increase in production between 1973 and 1974 and subsequent years is attributed largely to a change in the system used in estimating production and the high import figure in 1974 might in fact be the sum of two years.

In 1976, the Government began a National Legume Project aimed at accelerating and increasing domestic production to attain self-sufficiency within a three year period.

A substantial increase in acreage was planned and essentially two types of operations were envisaged for blackeye pea production i.e. largescale mechanised production systems by State Corporations and small scale production by small farmers.

Initially, emphasis was placed on production by State Corporations such as Guyana Agricultural Products Corporation (GAPC), Guyana National Service (GNS), Guyana Rice Board (GRB), Guyana Sugar Company (GUYSUCO), Guyana Bauxite Company (GUYBAU) and Guyana Defence Force (GDF) which were expected to cultivate 74, 87 and 88% of the projected acreage in 1976, 1977 and 1978, respectively (Table 2).

Because of adverse weather conditions and inadequate equipment, State Agencies which were to establish 3,500 of the proposed 4,500 acres in 1976, managed to achieve only 38% of the target. On the other hand, small farmers were able to establish an estimated 1,024 acres, almost 100% of what was envisaged.

The project has since been revised and increased emphasis has been placed on production by small farmers. Thus for blackeye pea, small farmers are expected to establish 47, 49, 46 and 48% of the anticipated acreage in 1978, 1979, 1980 and 1981, respectively (Table 3). Since small farmers produce practigally all of the other legumes, their acreage contribution to the overall project accordingly will be increased to 59,63, 62 and 65% in the respective years (Table 4).

Objectives

The main objectives of this study were:

1. To determine the level of technology currently applied in the production of legumes particularly blackeye pea,
2. To determine research needs and priorities, and
3. To assess the progress achieved in the National Legume Project.

Methodology

The activity was carried out mainly through farm visits and discussions with farmers, personnel of State Agencies, and research and extension staff of the Ministry of Agriculture, who have a good knowledge of the situation by virtue of their close contact with the farming community.

In addition, a simple questionaire was prepared and sent to State Agencies, and extension personnel were requested to interview farmers and fill the questionaire appropriately while on routine farm visits or otherwise in contact with farmers.

A total of 27 questionaires involving small farmers were completed and returned and four from State Agencies.

TABLE 1. Domestic production and imports of peas and beans excluding split peas and pigeon peas - 1966 to 1977 (000 lb).

Year	Production	Imports	Total
1966	178	2327	2505
1967	165	160	325
1968	175	424	599
1969	271	270	541
1970	346	1839	2185
1971	394	1441	1835
1972	420	494	914
1973	544	NA	-
1974	1800	3874	5674
1975	2200	1402	3602
1976	1600	1237	2837
1977	2400	905	3305

Source: (a) 1966 to 1972 - R. R. Nathan Assoc. Inc., (1974) Guyana's Food Crop Systems: An analysis for Development Planning 569p.

(b) Production 1973 to 1977 - Ministry of Agriculture

(c) Imports 1974 to 1977 - Ministry of Economic Development.

TABLE 2. Summary of acreage and yield of grain legumes as initially planned in the National Legume Project.

Year	Acreage			Yield (million lb)
	State Corporations	Farmers	Total(ac)	
1976	3,524 (74%)	1034 (26%)	4558	2.00
1977	10,520 (87%)	1292 (13%)	11810	5.75
1978	13,845 (88%)	1525 (12%)	15370	9.80

(a) Projection for 1976 based on one crop whereas two crops were envisaged in subsequent years.

TABLE 3. Summary of acreage and yield of blackeye pea as projected in the revised National Legume Project, 1977.

Year	Acreage			Yield (million lb)
	State Agencies	Farmers	Total	
1978	4060 (53%)	3560 (47%)	7,620	4.6
1979	5060 (51%)	4800 (49%)	9,860	5.9
1980	5760 (54%)	4850 (46%)	10,610	6.9
1981	5760 (52%)	5350 (48%)	11,110	8.3

TABLE 4. Summary of acreage of food legumes in the revised National Legume Project, 1977

Year	Acreage								Yield (million lb)
	BEP SA	F	P. PEA F	RKB F	MUNG F	PEANUTS F	TOTAL	F (%)	
1978	4060	3560	450	990	400	600	9860	59	5.5
1979	5060	4800	700	1700	700	500	13460	63	7.6
1980	5760	4850	825	2400	800	550	15185	62	9.3
1981	5760	5350	875	2600	1000	770	16285	65	11.2

BEP - Blackeye Pea; P. Pea = Pigeon Pea;

RKB - Red Kidney Bean; SA - State Agencies; F - Farmers

PRODUCTION SITES

Blackeye pea has been identified as a potentially productive food legume, particularly on the sandy soils of the Intermediate Savannahs of Guyana. Thus, much of the work on fertilizer requirement, variety evaluation and mechanization was carried out on these soils at Ebini and Kairuni (1,2). The main problems encountered on these soils are low inherent soil fertility, moisture stress, and susceptibility to leaching and erosion during heavy rains. However, they have the advantage of being free-draining and problems of mechanization during the wet season are less than on the coastal clays.

On these soils, the main producing State Agencies were expected to be the Guyana National Service (GNS) at Kimbia, CARICOM Corn/Soyabean project at Eborabo and Guyana Agricultural Products Corporation (GAPC) at Kibilibiri, but there has been a recent decision to discontinue operations at Kibilibiri.

Cowpea, however, is adapted to a wide range of soils and can grow reasonably well on the coastal clays. There the main problems are likely to be poor drainage, surface crusting and soil stickiness which may preclude machine operations during the wet season.

On these soils, the main producing State Agencies were expected to be the Guyana Sugar Corporation (GUYSUCO) which has several estates from East Berbice to West Demerara and Guyana Rice Board (GRB) at Black Bush Polder.

Small farmers produce the crop under a wide range of conditions in different parts of the country and soil types include clays, sands, loams and pegasse.

CURRENT TECHNOLOGY

Systems of Production

Practically all blackeye pea is produced in Guyana under rain-fed conditions. One sugar estate reported using sprinkler irrigation to facilitate germination and some small farmers attempt to water by hand during dry periods.

Most small farmers grow the crop in pure stand. In the Pomeroon area, however, six of eleven farmers interviewed reported intercropping with a variety of crops such as young citrus, coconuts,plantains, cassava and corn. Intercropping appears to be done largely with a local prostrate variety known as "increase peas". Of the six farmers who intercropped, only one used California No. 5 in this system and in three cases where farmers used both the local variety and California No. 5 the latter was planted in pure stand whereas the local variety was interplanted with another crop. It also has been reported that some farmers in the West Demerara area interplant blackeye pea and sugarcane.

Some information on size of plot established by small farmers is given in Table 5. Disregardingthe 37 farmers in the Mahaicony area who grew backyard plots, it appears that the majority of farmers grow blackeye pea in plots of two acres or less.

Land Preparation

In general, land preparation for large scale operations involve ploughing and harrowing to a reasonably fine tilth. On sandy soils, ploughing generally is unnecessary except on new land.

On the coastal clays, sugarcane has been grown on cambered beds with field layout based either on the Dutch system or the English system of drainage. Either system is considered suitable for blackeye pea cultivation since they both facilitate drainage. However, the sugar estates are gradually converting their fields from cambered beds into a ridge and furrow system suited to mechanical harvesting of sugarcane and in a number of cases, blackeye pea has been planted on the flat in fields that are in the process of being converted. This has resulted in poor drainage in sections particularly in areas overlying old drains.

With small farmers, land preparation ranges from hand forking to ploughing and harrowing by tractor. Some farmers simply cut and burn an area then plant. Planting generally is on flat or slightly cambered beds with drains 18-36 feet apart. Some farmers plant on raised beds and a few utilize small machines e.g. Solo garden tiller in land preparation operations.

Varieties

The main variety in use is California No. 5, but farmers in the Pomeroon area have traditionally grown a prostrate blackeye known as "increase peas". Four other cowpea varieties (Brown Crowder, Cream Crowder, Pinkeye Purple Hull, Long Red Pod) are currently being multiplied by the Ministry of Agriculture for distribution to farmers.

Practically all seeds used for planting are supplied by the Ministry of Agriculture and are either imported or locally produced from imported registered seeds. The seeds are treated with a fungicide prior to distribution and Rhizobium inoculum also is supplied by the Ministry of Agriculture. It is claimed that some farmers consume treated seeds and the Ministry is therefore, hesitant to include an insecticide in the seed treatment. The net result is that bruchids often cause damage to seeds sent to the districts for distribution to farmers, since no cold storage facilities are available in these areas.

Time of Planting

This is one of the most critical factors in the production of cowpea. The crop requires adequate moisture in the early growth through the pod-filling stage of its life cycle and a dry period for harvest. The variety California No. 5 matures in 65 - 75 days dependant on soil moisture conditions and the recommended planting times are July and December.

TABLE 5. Size of Blackeye pea plot established by small farmers in selected areas

	Mahaicony(a)	West Demerara(a)	Pomeroon(b)	Black Bush Polder(b)	W. Berbice(b)
Backyard Plot	37				
Under 1 acre	16	30	4	5	
1.0 - 2.0	16	46	4	6	
2.1 - 3.0	-	9	2	1	1
Over 3.0	4	14	1		3
Largest Plot (ac)	30	9	44	2.5	8

(a) Extracted from general report prepated by Agricultural Officers

(b) Farmers interviewed

Forsythe (3) has worked out the 75% rainfall probability and atmospheric water balance for Georgetown, Ebini and Wauna(Table 6) and assuming a 70 day period to the end of the pod-filling stage, has recommended planting dates of June 15, June 20 and October 20 for the respective areas. This is a bit too specific because of the variation in the maturation as indicated earlier.

During 1977, most sugar estates planted in May and November/December. Planting in May is generally considered too early for this crop but fortunately weather conditions were too unfavourable during 1977 and crop loss was minimal. Of 22 small farmers who responded to the question, 13 planted in December/January, six in February and three in March. Planting during the mid-year season ranged from May through September but the majority appeared to plant in June.

Method of Planting

The largescale operators generally plant by machine using either 4, 6 or 8-row planters with fertilizer attachments. However, several sugar estates have planted by hand because of unavailability of planting equipment and this has increased production costs considerably. Of 27 small farmers interviewed, one farmer used the Push Pull planter unit which was modified by IICA staff in the Grain Legume Project. All others planted by hand, variously spaced or broadcast.

Spacing

The recommended spacing for blackeye pea is 24" x 6" on clay soils and 20" x 6" on sandy soils. Most largescale operators appear to follow these recommendations although there may be some modification owing to the type of planting equipment used. Of 27 small farmers interviewed, eight used the recommended spacing, in 12 cases the spacing was too wide, two were too close and four farmers used a broadcast system of planting.

TABLE 6. Monthly Rainfall probabilities (75%) in inches - 1951 - 1975

	Georgetown		Ebini		Wauna	
	Rainfall	AWB	Rainfall	AWB	Rainfall	AWB
January	4.89	-0.06	4.10	-0.72	2.59	-1.83
February	1.48	-3.86	2.32	-2.99	1.35	-3.59
March	1.47	-5.18	2.68	-3.52	2.35	-2.97
April	2.89	-3.19	2.70	-3.67	2.05	-4.10
May	6.52	1.08	8.80	3.08	7.30	1.56
June	11.20	6.73	8.76	3.82	11.34	6.71
July	8.81	4.96	10.28	5.11	10.56	6.71
August	4.91	-0.74	5.87	0.02	8.52	3.25
September	2.07	-4.07	1.82	-5.06	8.84	3.88
October	2.38	-3.61	1.79	-5.57	8.02	3.26
November	3.71	-1.42	4.20	-2.05	7.88	3.98
December	5.28	0.73	3.88	-1.47	8.15	5.13

AWB - Atmospheric Water Balance which is the difference between rainfall and evapotranspiration.

Use of Fertilizers and Lime

Since most of Guyana's soils are highly acid, it is recommended that soils be limed based on the results of soil tests. In general, 2 tons/acre and 1 ton/acre on clay and sandy soils, respectively appear to be adequate. Largescale operators tend to follow these recommendations but none of the farmers interviewed reported using lime prior to planting this crop.

Two fertilizer applications are recommended, one at planting and a second application 3 - 4 weeks after planting. The rates are as follows:

Clay Soils: First - 50/100/100 lb/ac urea, tripple superphosphate and muriate of potash respectively.

Second - 100 lb/ac muriate of potash

Sandy Soils: First - 25/200/100 lb/ac urea, tripple superphosphate and muriate of potash, respectively plus 50 lb/ac each of kieserite (Mg) and trace elements.

Second - 100/100/10 tripple superphosphate, muriate of potash and Kieserite, respectively.

It is further recommended that double the amount of sulphate of ammonia be used instead of urea for machine application.

Largescale operators tend to follow these recommendations particularly on the sandy soils. Sugar estates use a single application consisting of 1 cwt each of sulphate of ammonia, tripple superphosphate and muriate of potash on the clays. Of the small farmers interviewed, 17 used no fertilizer, six used too little and applied only one or two major nutrients, and four used fertilizer at about the recommended rate for the initial application only. No small farmer reported using Rhizobium inoculum but most State Agencies utilized this material when available.

Weed Control

Planavin (nitralin) at 2.0 lb per acre (pre-emergence) is recommended for control of grasses and Gesagard (prometryne) 3.0 lb/acre (pre-emergence) for the control of broadleaf weed species. It is also recommended that Gramoxone (paraquat) be used at 1.5 pint per acre as a directed spray if necessary.

Planavin is volatile chemical which, according to the manufacturers, should be incorporated into the soil pre-planting for best results. However, in trials conducted by the Ministry of Agriculture, there appeared to be no advantage to incorporation under the conditions used, hence the recommendation for the less costly pre-emergence application.

This herbicide has been used by most State Corporations but there has been some question with regard to the method of application and its effectiveness. Both methods of application pre-plant incorporated and pre-emergence, have been used by sugar estates. Another agency has reported good results with a mixture of Planavin and Bladex (cyanazine) applied pre-emergence.

In the case of farmers weed control, when it is practiced, generally is done manually. Of 27 farmers interviewed, two indicated using gramoxone in addition to hand weeding.

Disease and Pest Control

Current Recommendations are as follows:

- Post-planting soil application of aldrin or chlordane to control cutworms and crickets.
- Monocrotophos or Fenitrothion for control of foliar pests such as beetles and aphids.
- Sevin 85 WP - 1.5 lb/ac for control of pod borers and sucking insects.
- Dipterex 1 lb/ac for control of caterpillars and beetles.
- Kocide (2.5 lb/ac) or Dithane M45 (2.5 lb/ac) for control of powdery mildew and pod rot.

All State Agencies utilize pesticides for control of pests and diseases as deemed necessary. The chemicals used include Aldrin, Dieldrin, Dipterex, Monocrotophos, Rogor, Sevin and Dithane M45. The knapsack sprayer was frequently used to apply pesticides. Other equipment include the mist blower, tractor mounted sprayer and in one case aerial application.

Of the 27 small farmers interviewed only three failed to use pesticides. Twenty four farmers used an insecticide and six of them used a fungicide in addition. The main chemicals used were Monocrotophos and Aldrin but others include Anthio, Dieldrin, Sevin, Rogor, Malathion, Agrocide, Dithane M45 and Kocide. The knapsack sprayer was the main equipment used by small farmers but two reported using a mist blower. The majority of small farmers used two applications of pesticides per crop.

Harvesting

The three State Corporations in the Savannahs possess combine harvesters. A number of problems have been encountered during combine harvesting of the crop in these areas. These include:

1. Failure: to harvest some rows at one end or conversely picking up dirt at the other due to tilting of the header unit on uneven ground.
2. Stunted crop growth due to moisture stress. This makes it difficult for the combine to pick up plants and available material generally is insufficient for efficient machine operation.
3. Excessive shattering and grain damage when combine harvesting during hot dry days. This drastically reduces the number of opportune harvesting hours.

TABLE 7. Number of pesticide applications per crop by small farmers.

Number of Applications	Number of Farmers	%
1	4	17
2	14	58
3	4	17
4	1	4
5	1	4

All other State Agencies generally harvest by hand. However, during the early 1978 crop, one sugar estate tried harvesting with a modified Laverda Rice Combine and another tried a Hume Tractor Rower (Windrower) followed by a Long Edible Bean combine, which is essentially a mobile thresher. The modified Laverda Rice Combine performed quite well but the windrower/mobile thresher combination was unsatisfactory. The ease of modification and satisfactory performance of the rice combine, many of which are available in the country, opens up the possibility of considerably reducing harvesting costs and increasing the rate of harvest.

Small farmers generally harvest by hand. Of 20 farmers growing the variety California No. 5, 45% harvested twice, 35% harvested once and 20% harvested three to four times. Farmers growing the local prostrate variety made an estimated 10 - 12 harvests.

Threshing, Drying and Storage

On State Agencies where harvesting is done by hand, the Cecoco thresher is utilized. Artificial drying is carried out by most State Agencies in batch driers.

Most small farmers thresh by beating the dry pods in a bag. Seeds are then cleaned and may be further sun dried. Harvested produce is stored on the farm only for short periods and no special measures are taken. Peas are simply kept in bags in a sheltered area either before or after threshing.

Yields

It is very difficult to determine the accuracy of information obtained on yield particularly from small farmers. However, Table 8 shows farmers estimates of acreage and yields. Of the farmers interviewed in this study, yields in the Black Bush Polder ranged from 280 to 800 and averaged 563 lb per acre. In the Pomeroon, the ranged was 200 to 1500 and averaged 838, whereas in West Berbice, the yields were rather low, ranging from 120 to 350 and averaging 245 lb per acre.

It is noteworthy that all farmers who obtained high yields used production practices of a reasonably high standard including use of fertilizers and control of pests and weeds. On the other hand, most farmers who obtained unusually low yields complained of poor seed germination, seed damage by rats, and excessively dry weather during the growing period because of late planting.

Yields also vary tremendously on State Farms. On the sugar estates, for example yields ranged from 218 to 767 and averaged 474 lb/ac in the mid-year planting, 1977 whereas in the late 1977 planting the yield range was 278 to 909 and averaged 518 lb per acre (Table 9).

PROBLEMS ENCOUNTERED

The main production problems identified by State Agencies and farmers were as follows:

(a) State Agencies:

1. Poor site selection
2. Insufficiently fine tilth.
3. Poor drainage.
4. Poor seed quality - low viability and insect damage.
5. High cost of planting and harvesting by hand.
6. Uneven ripening of variety.
7. Praedial larceny.
8. Insect damage (cutworms. locusts, army worms, ants).
9. Poor weed control.
10. Powdery mildew.
11. Foliar distortion on young plants.
12. Losses due to rainfall during harvest - pod rot and seed discolouration.
13. Shattering losses with mechanical harvesting.
14. Stunted crop growth - combine harvester unable to pick up plants.
15. Frequent breakdown of harvesting machinery.

TABLE 8. Estimated yields obtained by small farmers interviewed in this study

	Black Bush Polder		Pomeroon		West Berbice	
	Acreage	Yield/ac	Acreage	Yield/ac	Acreage	Yield/ac
	2.5	800	44.0	1500	7.0	350
	1.0	690	2.0	1500	2.5	350
	0.75	660	0.25	1500	4.0	160
	2.5	650	0.25	960	5.0	120
	1.0	650	3.0	750		
	0.75	630	0.5	720		
	0.5	600	0.1	600		
	5.0	500	1.5	450		
	0.5	500	1.0	200		
	1.0	450	0.5	200		
	2.5	350				
	0.5	280				
Average		563		838		245

TABLE 9. Production of blackeye pea on sugar estates during mid-1977 and 1977/78 seasons

	Mid 1977			1977/78		
Estates	Acreage	Yield	Yield/ac	Acreage	Yield	Yield/ac
1	28	17440	623	120	88622	738
2	70	29009	414	90	27910	310
3	24	12265	511			
4	47	22010	468			
5	29	17426	601	63	17514	278
6	53	40655	767	60	38795	646
7	35	7623	218			
8	25	7233	289	9	8180	909
9	24	9100	379	47	23419	498
10	34	14465	425	70	33410	477
11	13	4015	309	-	-	
Total	382	181241		459	237850	
Average	474					518

(b) Small farmers:

1. Unavailability of insecticides, fertilizers etc.
2. Poor weed control.
3. Poor seed germination.
4. Drainage problems.
5. Stunting of crop due to excessively dry weather.
6. High cost of hand planting and harvesting.
7. Pest Damage (rats, rabbits, cutworms).
8. Poor land preparation.
9. Praedial larceny.

Except for the unavailability of inputs from which only small farmers suffered and the problems relating to mechanical harvesting which are applicable to State Agencies, there is a remarkable similarity in the problems encountered by both farming groups.

RESEARCH NEEDS

The main areas identified for further research are variety evaluation, plant population, fertilizer use, weed control, plant disease and pest control. In addition, attention should be given to the development and use of small field equipment and simple on-farm storage facilities for small farmers.

On a more long term basis, attention should be given to systems of rotation, for example rice/cowpea on the coastal areas and corn/cowpea on the intermediate savannahs.

Varieties

Present production is centered around the variety California No. 5 which performs reasonably well and is easily available commercially. However, this variety is not very determinate and growth continues if adequate soil moisture is available. This occurs on the coastal clays with the result that seeds are discoloured by the green plant parts during combine harvesting. There is, therefore, need for a more determinate variety for these soils. In addition, a variety with a longer growth period will be more suitable for planting on the coastal clays during the long wet season, since with the present variety, one is faced with the dilemma of either planting in the dry period and having the crop mature during the wet season or run the risk of not being able to get machines on the land to prepare and plant once the rains have started.

A more drought resistant variety would be of tremendous advantage on the savannahs where moisture stress often results in stunted crop growth which makes combine harvesting difficult especially on uneven ground. Attention should also be given to varietal resistance to pest and diseases.

Plant Population

Sub-optimal plant populations apparently contribute significantly to the low yields which are obtained. Of course, optimum plant population for a given set of conditions is variety dependant, but there is a need to determine initially the optimum plant population of California N. 5 with a view to intensifying small farmer production.

Soil Fertility

Since most of the work in this area has been carried out on the sandy soils of the intermediate savannahs, there is need for work to establish the fertilizer requirements on the coastal clays and pegasse soils in terms of both major and minor nutrients. Measures to reduce leaching losses e.g. the use of 'slow release' fertilizers, conserve and improve soil fertility and reduce erosion are essential on the sandy soils of the Intermediate Savannahs.

Weed Control

Indications are that Planavin is not effective under all conditions. This is not surprising because of variations in environmental conditions,weed species etc. There is need to evaluate other potentially useful herbicides e.g. Preforan, Maloran, Tenoran, Alachlor, in relation to efficacy and crop safety.

Disease and Pest Control

The main requirement is for an integrated system of disease and pest control at lowest cost. Attention should be given to choice of material, particularly in regard to mammalian toxicity and efficacy together with timing and frequency of application.

ACHIEVEMENTS TO DATE

Production and Productivity

It is somewhat difficult to assess the achievements of the National Legume Project in terms of production and productivity owing to the lack of accurate information on acreage and yields. In 1976, production of peas and beans, of which blackeye peas was a major component, was estimated at 1.6 million pounds, some 73% of the estimated production in 1975 (Table 1). A target acreage of 4,500 of blackeye pea was expected to yield 2.2 million lb in one season only. It is estimated that small farmers established 1024 acres and reaped some 950 acres which yielded over 300,000 lb, an average of 315 lb per acre. State Corporations, on the other hand, established approximately 1,344 of the targeted 3,500 acres. Assuming an average yield of 500 lb/acre, a total of 672,000 lb would have been produced thus making a total of 972,000 lb or 44% of the production target.

The preliminary estimate of 2.4 million pounds for 1977 shows a 9% increase over the 1975 figure but is only 42% of the production target initially set for blackeye pea for that year.

It is clear that production targets have not been achieved. The low production in 1976 was attributed to adverse weather conditions but it appears that insufficient attention was given to the infrastructural, human and financial capability of the producing agencies when targets were set initially.

With regard to productivity, the overall average yield on the sugar estates increased from 474 lb per acre in the mid-year season 1977 to 518 lb per acre in the 1977/78 season (Table 9). There was a considerable range in the average yield from different estates - 218 to 767 in the first season and 278 to 909 in the second.

Several factors are likely to have contributed to this among which are poor site selection, land preparation and drainage; low plant population; poor weed control; praedial larceny; harvesting losses and weather conditions.

Organizational

In mid 1977, Guysuco established a total of 382 acres spread over 11 estates in fields ranging from 13 - 70 acres. By the end of 1977 some measure of consolidation had occurred. The number of estates producing the crop was reduced to seven, the total acreage increased to 459 and the acreage ranged from 9 to 120 (Table 9).

It is expected that production will be consolidated even more and in fact, it is proposed to establish two state farms at Albion and Manarabisi each of which will produce 600 acres of blackeye pea in each season.

Very little has been achieved in regard to organization of small farmers and much greater emphasis is required in this area both in regard to individual farmers and co-operatives.

Technological

The noteworthy technological achievements include:

1. The successful modification of the rice combine many of which are available in the country for harvesting this crop.
2. Use of aerial spraying for pest control.
3. Use of the Push - Pull Seeder Unit as modified by IICA by some small farmers. The widespread use of this piece of equipment when it becomes more readily available would greatly assist the small farmer to increase the acreage cultivated.

DISCUSSION AND RECOMMENDATIONS

There is an element of risk in the production of grain legumes under rainfed conditions particularly in view of the unpredictable weather pattern in Guyana. This is shown for the Georgetown area in Table 10.

The small farmer has an advantage in that he is likely to be able to harvest his small plot quickly during periods of adverse weather. In addition, the presumed availability of family labour also should permit more intensive farming and better crop husbandry. But most small farmers do not appear to take advantage of this. Plant population often is low, weed control poor and only limited use is made of fertilizers.

The largescale producer, on the other hand, has the advantage of being able to fully mechanise operations but full advantage cannot be taken of this unless the areas of production are sufficiently consolidated.

With regard to the production recommendations, certain aspects need re-examination. For example, the value of split fertilizer application on clay soils for a short term crop as blackeye is questionable and one wonders about the economics of spraying once weekly to control diseases and pests.

Our observations lead us to suggest that:

1. Greater emphasis be placed on production on the coastal areas during the short wet season and in the Intermediate Savannahs during the long wet season. Efforts should be made to increase small farmer production during both seasons.

2. Production on sugar estates be further consolidated in order to make more efficient use of available machinery.

3. State Agencies should mechanise as many operations as possible.

4. On the coastal areas more attention should be given to site selection particularly in regard to accessibility in wet weather, ease of drainage and susceptibility to flooding.

5. Specific production plans be developed by each State Agency with due consideration to infrastructure, human resources and financial capability.

6. More effort be made to increase production by small farmers and co-op groups. Reliable blackeye pea growers in the main producing areas should be identified and registered. Attention should be focused on these farmers with the aim of getting them to increase their acreage and adopt practices and techniques which would increase the yields and profitability of their operations. Production promotion should be accelerated particularly in view of the recent decision to remove subsidies on seeds, fertilizers and pesticides.

7. Greater emphasis be placed on practical demonstrations in the training of farmers.

8. A mechanism for coordinating and monitoring the progress of the project is essential. Information on acreage and actual production should be collected and there should be some follow up action to ensure that State Agencies attain allocated production targets.

9. The priority area for research should be evaluation of varieties. Other areas requiring attention include fertilizer use on the clay and pegasse soils, weed control, disease and pest control and plant population. Measures to reduce leaching losses e.g. the use of 'slow increase' fertilizers, conserve and improve soil fertility and reduce soil erosion also require attention on the sandy soils of the Intermediate Savannahs and the North West District.

10. Inputs required by small farmers should be more readily available.

SUMMARY OF CURRENT RECOMMENDATIONS FOR PRODUCTION OF BLACKEYE PEA

The following is a summary of recommendations based on the work of officers of the Ministry of Agriculture (5, 6).

Soils and Land Preparation

- Good drainage essential
- Plough and harrow to a fine tilth before planting

Variety

- California No. 5
- Other possible varieties include Pinkeye Purple Hull, Brown Crowder, Long Red Pod, Cream Crowder.

Time of Planting

- December/January and July to ensure maturation in dry period.

Seed Treatment

- Fungicide treated seeds supplied by Ministry of Agriculture
- Inoculation with Rhizobium (also supplied by the Ministry of Agriculture) recommended especially when planting in areas in which cowpea had not been planted previously.
- Use slurry treatment of seed with inoculum immediately before planting.

TABLE 10. Monthly rainfall recorded at Botanical Gardens, Georgetown, Guyana - 1974 - 1978

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
1974	11.25	4.89	5.34	4.35	3.33	13.28	11.38	11.44	8.07	3.38	9.27	9.47	95.45
1975	7.22	3.06	2.61	4.56	14.83	11.67	13.73	9.94	5.53	3.53	8.56	20.06	105.00
1976	18.07	16.63	11.04	7.74	12.05	18.10	5.19	4.25	0.64	0.35	9.61	11.09	114.76
1977	2.58	1.47	0.99	9.84	12.06	9.12	11.57	6.33	4.44	2.75	4.67	7.25	73.35
1978	5.78	1.20	1.37	2.98	17.51								

Spacing

- Clay soils. 24"x 6" x 1.5"
- Sandy soils 20" x 6" x 1.5"

Lime

- Base on soil test. In general 2 tons/ac on clays and 1 ton/ac on sands.
- Incorporate into soil 3 - 4 weeks before planting.

Fertilizers - Two Applications

At planting:

- Clays: 50/100/100 lb/ac urea, tripple super phosphate and muriate of potash, respectively.
- Sands: 25/200/100 lb/ac urea, tripple super phosphate and muriate of potash, respectively, plus 50 lb/ac each of kieserite and trace elements.

  Use band application 3" to side of and 2" below seed.

At 3 - 4 weeks after planting

- Clays: 100 lb/ac muriate of potash
- Sands: 100/100/10 lb/ac tripple super phosphate, muriate of potash and kieserite respectively.

  For machine application use double amount of sulphate of ammonia instead of urea.

Weed Control

- Planavin 2.0 lb/ac for control of grasses, Gesagard 3.0 lb/ac for control of broadleaf weeds.
- Gramoxone 1.5 pt/ac as a directed spray if necessary.

Pest and Disease Control

- Aldrin 5% dust at 20 lb/ac post-planting for control of crickets and cutworms.
- Dipterex 1 lb/ac for control of caterpillars and beetles
- Monocrotophos 60% EC - 7 oz/ac or Fenitrothion 50% EC - 14 oz/ac for control of beetles and aphids.
- Sevin 85 WP - 1.5 lb/ac for control of pod borers and sucking insect.
- Dithane M45 - 2.5 lb/ac or Kocide 101-2.5 lb/ac for control of powdery mildew, the former also for control of pod rot.

Spray weekly especially during rainy weather.

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