VEGETABLE PRODUCTION PROGRAMME - BRUMDEC THIRD QUARTERLY REPORT PERIOD MARCH 19-JUNE 18,1982

IICA/JAMAICA
Miscellaneous Publication #322
Series ISSN-0534-5391

VEGETABLE PRODUCTION PROGRAMME - BRUMDEC
THIRD QUARTERLY REPORT
PERIOD MARCH 19th to JUNE 18th, 1982

by

Charles Percy Kennard
Vegetable Production Specialist

IICA/JAMAICA
July, 1982

TABLE OF CONTENTS

1. INTRODUCTION

The Progress of Work during the quarter was most satisfactory in that practically all of the trials sown during the first season were successfully harvested. The yields obtained from most of the vegetables particularly on the Morass Peat Soils were beyond expectation and comparable with that obtained in the more advanced countries with sophisticated technology. The stage is now set for large scale production of vegetables during the winter months once the marketing and other arrangements associated with the commercial production of vegetables can be worked out.

Unfortunately, practically all the trials sown during the present season was flooded out due to the heavy rainfall and deficiencies in the drainage system. Whilst the emphasis would appear to be at this point in time to produce vegetables for the Winter Markets, a project of the magnitude of BRUMDEC must have flexibility in its production systems so that production could be done during other times of the year. The second season's work was being done with this objective in mind.

The Consultant, as part of his assignment is required to develop a technological package of practices for implementing on farm production of vegetables at BRUMDEC. Whilst only one season's work was successfully completed, the information acquired can form the basis for the package of practices. However, it would have to be updated from time to time as more research is done in the project and at other locations and as more information becomes available. The package of practices presently recommended are included in this report. Recommendations are also made on the areas for future research which also form part of the assignment of the Consultant.

2. RESULTS OF FIRST SEASON'S WORK (January - April, 1982)

As previously indicated the results from the first season's work particularly on the Morass Peat Soil was rather spectacular. All of the vegetables evaluated except carrots,

cauliflower and beets gave yields which were extremely high. It is appreciated that the yields obtained from small plots cannot often be duplicated in commercial plantings. Nevertheless, the results do indicate that very high yields are possible and this would make production of the crops profitable, once the appropriate agronomic practices are followed and the marketing arrangements worked out.

Details of the methodology used for the various trials are detailed in Section 2, pages 1 - 22 of the Second Quarterly Report of the Vegetable Production Programme - BRUMDEC. For this reason, it is not repeated in this report.

2.1 Cabbage Varietal Evaluation Trials

2.1.1 Methodology

Details of this are presented in 2.1.2 (pages 3 - 4) and 2.2.2 (pages 12 - 13) of the Second Quarterly Report.

2.1.2 Results

The period of maturity and the yields are given in the Tables I & II and the Analysis of Variance in APPENDICES I & II.

TABLE I

Period of Maturity

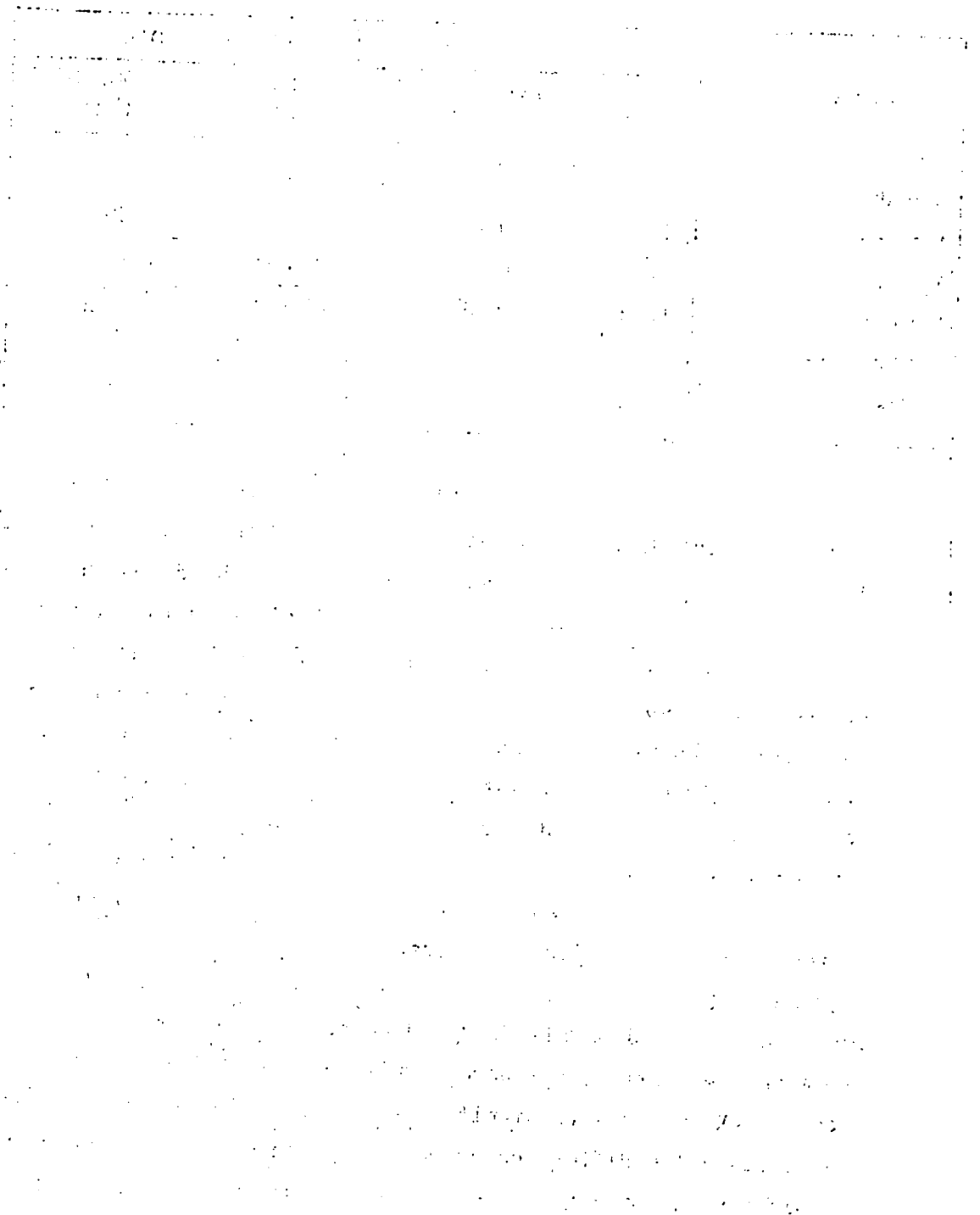
VARIETY	FOUR PATHS CLAY LOAM		MORASS PEAT SOIL	
	DAYS TO FIRST HARVEST	DAYS TO LAST HARVEST	DAYS TO FIRST HARVEST	DAYS TO LAST HARVEST
Roundup	93	113	85	99
K. K. Cross	85	104	76	91
YR Summer	90	113	79	99
Danish Ball Head	93	118	85	101
Early Jersey Wakefield	-	-	96	106

TABLE II

Yield and Size of Heads

VARIETY	FOUR PATHS CLAY LOAM		MORASS PEAT SOIL	
	YIELDS (kg/ha)	AVERAGE SIZE (kg)	YIELDS (kg/ha)	AVERAGE SIZE (kg)
Roundup	14,740	0.32	24,148	0.73
K. K. Cross	21,629	0.46	46,294	1.39
YR Summer	21,333	0.46	36,593	1.10
Danish Ball Head	13,259	0.28	20,148	0.63
Early Jersey Wakefield	-	-	17,407	0.52

As shown in the tables the yields of all the varieties when planted in the Peat was almost twice that of the Four Paths Clay Loam. The varieties also produced much larger heads on the Peat Soil. Difficulties were encountered in irrigating the crop on a regular basis and this no doubt affected the yields and size of heads on both soil types. The effect was much more adverse on the Four Paths Clay Loam and the plants at various stages showed signs of wilting. The moisture in the soil also apparently influenced the period of harvesting. Whilst rapid and excellent plant emergence was obtained on the Peat, the germination on the Four Paths Clay Loam was slower and emergence of the plants irregular. When subjected to statistical analysis, the yields obtained from K. K. Cross and YR Summer were significantly higher than that of Danish Ball Head and Roundup on the Four Path Clay Loam and the differences were significant at 5% level. On the Peat, K. K. Cross gave significantly higher yields than the other varieties. The difference between K. K. Cross and YR Summer was significant at 5% level and between the other varieties at the 1% level.



The differences between Y.R. Summer and the three other varieties were also highly significant. The differences between Roundup, Danish Ball Head and Early Jersey Wakefield were not significant. On both soils K. K. Cross produced the largest heads followed by Y. R. Summer, Danish Ball Head and Early Jersey Wakefield.

The crop on both soil types were relatively free from diseases. A rust brown discoloration was observed on the margins of the inner leaves during the heading stage. Boron was suspected to be the cause of this and a foliar application of a 0.2% borax solution made.

The main problem encountered in growing the crop was the damage done by pests e.g. cutworms and budworms. Frequent applications of insecticides had to be done to control them.

2.2 Lettuce Varietal Evaluation Trial

2.2.1 Methodology

Details are given in 2.2.3 (page 14) of the Second Quarterly Report. The trial was conducted only on the Morass Peat Soil - 152.

TABLE III

VARIETY	YIELD (kg/ha)	AVERAGE SIZE OF HEAD (gm)	DAYS TO FIRST HARVEST	DAYS TO LAST HARVEST
Minetto	24,666	148	56	68
Great Lakes	23,111	139	60	75
Mignonette	16,600	100	49	64

The varieties Minetto and Great Lakes yielded 8066 and 6511 kg/ha respectively more than Mignonette. The differences in yields between these two varieties and Mignonette were highly significant when the results were subjected to statistical analysis. However, it should be pointed out that the yields of the Mignonette probably could have been higher if a closer spacing was used.

The variety Minetto produced heads which were crisp and compact. The variety Great Lakes only produced a few compact heads and this was as a result of the prevailing high temperatures during the growing period (January to March): Probably, if it was planted in November it would have headed normally. The variety Mignonette produced small open heads.

2.3 Cauliflower Observation Plots

2.3.1 Methodology

The methodology is outlined in 2.1.5 of the Second Quarterly Report.

2.3.2 Results

Although the vegetative growth of the crop was satisfactory it failed to produce heads on the Four Paths Clay Loam and the Morass Peat Soil. This result was not unexpected since it is well known that cauliflower is a cool season plant. The crop was not sown until mid-January and during the growing period the maximum temperature was in excess of 30°C.

It is unlikely that this crop can be successfully grown within the project because of the prevailing temperatures. Should there be continued interest in the crop, it should be sown in November so that the entire growing period coincides with the period when conditions are more favourable.

Varieties with head at relatively high temperatures should be tried during this period, e.g. Tropical Sureheart, Snow Queen, Early Patna.

2.4 Tomato Varietal Evaluation Trials

2.4.1 Methodology

Details are given in 2.1.1 (pages 2 - 3) and 2.2.1 (pages 11 - 12) of the Second Quarterly Report.

2.4.2 Results

Table IV shows the results obtained from the trial on the Peat as well as the Four Paths Clay Loam. The analysis of variance are presented in APPENDICES IV and V.

TABLE IV

Yields and Average Size of Fruits

VARIETY	FOUR PATHS CLAY LOAM		MORASS PEAT SOIL	
	AVERAGE SIZE OF FRUITS (gm)	YIELD (kg/ha)	AVERAGE SIZE OF FRUITS (gm)	YIELD (kg/ha)
Floradade	78	35,489	168	75,039
Oxheart	84	26,067	186	72,121
Roma VF	34	29,844	67	71,938
Manapal	79	28,398	166	64,074
Manalucie	69	28,156	166	59,555
Tropic	87	33,400	197	63,863
Walter	70	27,178	152	64,419

As shown in the table above, all of the varieties gave much higher yields on the Peat when compared with that on the Four Paths Clay Loam. The fruits produced on the Peat were also much larger. The

performance of the varieties vary to some extent on the different soils. However, on both soils Floradade gave the highest yield. On the Four Paths Clay Loam the order of performance was Floradade Tropic Roma Manapal Manalucie Walter Oxheart and on the Peat - Floradade Oxheart Roma Walter Manapal Tropic Manalucie. On the Four Paths Clay Loam, the differences in yields between Floradade and the varieties Oxheart, Walter, Manalucie and Manapal were highly significant and between Floradade and Roma, the difference was significant at the 5% level. The differences between the Tropic and Oxheart and Walter were highly significant and between Tropic and Manalucie and Manapal - significant. The differences between the other varieties were not significant . On the Morass Peat, all of the varieties gave very high yields and the differences were not significant.

Tropic and Oxheart produced the largest fruits on both soils and this no doubt had some effect on their storage qualities particularly those produced on the Peat. In the later harvest and with the advent of the rains, cracking of fruits was observed in the variety Tropic.

Damage to the young seedlings was done by the cut-worms in the early stages, and at a later stage, slight fruit damage was caused by the tomato fruit worm. Much more serious damage was caused by diseases and the incidence was more severe on the Four Paths Clay Loam during the period when irrigation water could not be provided on a regular basis. Incidence of leaf mold, also occurred on the varieties some seventy (70) days after sowing on the Four Path Clay Loam. The fact that

the crop was at that stage suffering from severe water stress could be a contributary cause since no such condition occurred on the Peat. At the fruiting stage incidence of early blight was observed on the crop on both soils.

The ratings of the different varieties against Leaf Mold and Early Blight are given below. The ratings were done on the crop grown on the Four Paths Clay Loam because of the heavier incidence of the diseases.

Variety	LEAF MOLD (Cladosporium)	EARLY BLIGHT (Alternaria Sloani)
Manalucie	2	1
Manapal	3	2
Tropic	3	2
Floradade	3	2
Roma VF	4	2
Walter	4	3
Oxheart	5	3

N.B. Scale 0 - no leaves with spots
1 - 1-3 leaves with spots
2 - 3-6 leaves with spots
3 - 50% of plant infected
4 - 75% of plant infected
5 - 100% of plant infected

From the above, it can be concluded that Manalucie was much more resistant than the other varieties to the two diseases and Oxheart the most susceptible. The factor of disease resistance is likely to play a more significant role in determining yields if production is done during the wet season when conditions are more favourable for the diseases. Signs of root rot disease appeared on the plants

on the Peat but the development of this condition was arrested when the drains between beds were deepened from 30cm to 45cm.

2.5 Pepper Varietal Observation Trials

2.5.1 Methodology

Details of the methodology are given in 2.1.3 and 2.2.8 of the Second Quarterly Report.

2.5.2 Results

2.5.2.1 Sweet Peppers

TABLE V

VARIETY	FOUR PATHS CLAY LOAM		MORASS PEAT SOIL	
	YIELDS (kg/ha)	AVERAGE SIZE OF FRUITS (gm)	YIELDS (kg/ha)	AVERAGE SIZE OF FRUITS (gm)
California Wonder	11,407	63.2	20,000	90.0
Resistant Giant	14,350	75.0	36,444	95.3

The results above indicate that the yields were higher for the Peat Soil and in both soil types, Resistant Giant gave the higher yields and produced the larger fruit. Harvest of the fruits commenced in both varieties after 75 days on the Peat and after 86 days on the Four Paths Clay Loam. This was mainly due to more rapid germination of the seeds on the Peat. Harvesting of the crop on both Peat and Clay was brought to a premature end as a result of the flooding of the plots after 119 and 117 days respectively.

Anthracnose was observed on the fruits with the advent of the rains towards the end of April but the incidence was rather low. No other problem was encountered with pests and diseases.

2.5.2.2 Hot Peppers

Because of the complete flooding of the plots, as soon as harvesting had commenced, no information could have been obtained on the yields. The conclusions that can be drawn from this trial are (i) that the crop can be successfully grown on both soils; (ii) that harvesting can be expected to commence between 125-139 days and (iii) that the spacing of the plants should be wider than that used in the trial - spacing of 90cm between rows and 75cm between plants in the rows seem to be more suitable.

On both soil types, the crop was almost completely free of pests and disease.

2.6 Egg Plant Observation Trials

2.6.1 Methodology

Details of this are presented in 2.1.4 and 2.2.6 of the Second Quarterly Report.

2.6.2 Results

TABLE VI

Soil Type	Days to First Harvest	Days to Last Harvest	Yields (kg/ha)	Average Size of Fruits (grams)
Four Paths Clay Loam - 203	95	132	15,444	106
Morass Peat Soil - 152	87	119	21,666	140

The yields as well as the average size of fruits were greater for the crop grown on the Morass Peat Soil as compared with the crop on the Four Paths Clay Loam.

This was in spite of the fact that harvesting came to a premature end on the peat because of the flooding of the plots as a result of the heavy rainfall.

There were no major disease problems with the crop either on the Peat or Clay. Some damage was done by the leaf eating Chrysomelid beetles but these were controlled by the routine spraying of insecticides.

2.7 Bean Varietal Observational Plots

2.7.1 Methodology

Details of the methodology are given in 2.1.6 and 2.2.5 of the Second Quarterly Report.

2.7.2 Results

TABLE VII

VARIETY	FOUR PATHS CLAY LOAM 204			MORASS PEAT SOIL 152		
	Yields kg/ha	Days to first harvest	Days to last harvest	Yields kg/ha	Days to first harvest	Days to last harvest
Harvester	3939	46	81	8111	48	73
Contender	4535	46	81	-	-	-

As shown in the table above, the yields of the variety Contender was slightly higher (596 kg/ha) than that of Harvester when planted on the Four

Paths Clay Loam - 204. The maturity period of the varieties was about the same. On the Morass Peat Soil - 152, the yield of the variety Harvester was 8,111 kg/ha. This was more than twice the yield obtained from the same variety planted on the Four Paths Clay Loam. The variety Contender was not tried on the Peat because of the non-availability of seeds.

There was no conspicious difference in the incidence of pests and diseases on the crop planted on the two soils. The main pest was the leaf eating Chrysomelids and these were controlled by the regular application of the appropriate insecticides. A fungal disease which was suspected to be Fusarium resulted in the death of some of the plants around the flowering stage. Incidence of Bean Mosaic occurred at a very late stage and had no apparent effect on yields.

2.8 Cucumber Varietal Observation Plots

2.8.1 Methodology

Details are presented in 2.1.7 and 2.2.10 of the Second Quarterly Report.

2.8.2 Results

TABLE VIII

VARIETY	FOUR PATHS CLAY LOAM 204				MORASS PEAT SOIL 152			
	Yield kg/ha	Average Fruit Size (gram)	Days to First Harvest	Days to Last Harvest	Yield kg/ha	Average Fruit Size (gram)	Days to First Harvest	Days to Last Harv
Ashley	35,966	214	45	90	49,814	230	48	9
Poinsett	35,499	187	49	90	38,611	200	52	

The results showed very little difference in the yields between the variety Ashley and Poinsett when planted on the Four Paths Clay Loam. The variety Ashley produced a slightly larger fruit (214 gm to 187 gm). However, on the Morass Peat Soil - 152, the yields of both varieties were higher than that of the clay with the yield of Ashley being some 11,203 kg/ha higher than that of Poinsett. The fruits of both varieties were larger when grown on the Peat. On the Clay Ashley produced larger fruits than Poinsett (230 gm - 200 gm).

2.9 Watermelon Observation Trial

2.9.1 Methodology

Details of the methodology are given in 2.1.8 and 2.2.10 of the Second Quarterly Report.

2.9.2 Results

The yields of the trials on the Four Paths Clay Loam and the Morass Peat Soil are given in Table IX.

TABLE IX

Variety	Soil Type	Days to First Harvest	Days to Last Harvest	Average Size of Fruits (kg)	Actual Yield (kg/ha)	Potential Yield (kg/ha)
Jubilee	Four Paths Clay Loam	69	97	4.0	25,416	70,208
Charles-ton Grey		69	97	4.25	32,430	92,0130
Jubilee	Morass Peat	86	106	7.10	24,545	31,004
Charles-ton Grey		86	106	7.28	32,666	116,444

N.B. Potential yield = actual yield plus estimated losses due to blossom end rot and praedial larceny.

As shown by the figures there was practically no difference in the actual yields between the varieties on the Four Path Clay Loam and the Morass Peat Soil, although the fruits were larger on the Peat. On both soils, the Charleston Grey out yielded the Jubilee. The main problem encountered on the clay was the high incidence of blossom rot. Some 54 and 48 percent of the fruits of Charleston Gray and Jubilee respectively were affected by this physiological disease. This high incidence of Blossom End Rot was mainly due to irrigation not being provided on a regular basis at the most critical stages. On Morass Peat, the incidence of Blossom End Rot was only about 7% in Charleston Gray and 3% in Jubilee. Because of the late planting, harvesting could not be completed before the advent of the heavy rains towards the end of April. This was particularly disastrous for the crop on the Peat which was sown some two weeks later than that on the Four Paths Clay Loam. Approximately 64% of the fruits of Charleston Gray and 32% of Jubilee was lost due to the rains.

The next major problem to those enumerated above was that of praedial larceny. In order to make an assessment of the losses due to this and that caused by Blossom End Rot, fruit counts were made at least once a week and the fruits weighed on the vines. The potential yield was obtained by adding the calculated loss from these two factors to the actual yields. The potential yield gives an indication of very high yields which can be obtained under favourable conditions.

The problems stated above except for praedial larceny can be minimized by:

(i) Sowing the crop early so that harvesting is completed before the advent of the heavy rains, e.g. sowing between mid-November to mid-December and between mid-April and mid-May.

(ii) Ensuring that irrigation facilities are in place so that water can be provided on a regular basis when it is needed.

"Damping off" of the seedlings occurred on both varieties on the Four Paths Clay Loam during the first 2 - 3 weeks after sowing. Anthracnose appeared on the leaves around the flowering stage. It was more severe on the variety Jubilee on the Four Paths Clay Loam.

2.10 Carrot Varietal Observation Plots

2.10.1 Methodology

Details are given in 2.2.4 of the Second Quarterly Report.

2.10.2 Results

Although growth was satisfactory and the yields reasonably good (equivalent to 8,111 kg/ha), the quality of the tubers were not such as they could be marketed. The tubers were abnormally shaped for the variety Danvers 126 although edible. The ab-abnormal shapes of the tubers have been attributed to the compact of the soil. To overcome this problem, tilling of the soil to a depth of 20 - 25 cm as well as inter-row cultivation to maintain the soil in a friable state seems to be necessary.

In the fertilizer trial conducted on the Four Paths Clay Loam, the best fertilizer treatment gave a yield of 9617 kg/ha and the quality of the tubers were acceptable for marketing. The crop was relatively free from pest and diseases.

2.11 Fertilizer Studies with Tomatoes on Four Paths Clay Loam

2.11.1 Methodology

The design was a randomized block with three (3) replications. Plot size was 3.24 sq. metres with eighteen (18) plants in each plot. Originally, it was planned to carry out a 3 x 3 x 3 factorial experiment but because of limitations in space the design had to be modified. The fertilizer treatments were as shown in the Table X.

Plots were directly seeded on the 8th of January, 1982 on ridges - 75cm apart and the variety Tropic was used. Thinning and supplying were done after three (3) weeks. Weed control was done manually after 3 and 8 weeks. Half of N and K and all of the P were applied at seeding and incorporated into the soil. The rest of N and K were applied forty six (46) days after seeding.

2.11.2 Results

The yields obtained from the different treatments are shown in Table X.

The results indicate that the first two treatments in the table (treatments - 60N.90P.135K and 45N. 135P.90K) gave highly significant increases in yields over the other treatments. The differences between the other treatments were not significant.

The results seem to have been influenced by the difficulties encountered in irrigating the plots on a regular basis, the high incidence of diseases and the delay in applying the fertilizers.

TABLE X

Yields from the Different Fertilizer Treatments

TREATMENTS	YIELDS (kg/ha)
60N - 90P - 135K	25,333
45N - 135P - 90K	25,111
45N - 90P - 90K	14,777
60N - 90P - 90K	14,000
45N - 135P - 135K	13,555
60N - 135P - 135K	13,555
45N - 90P - 135K	13,333
60N - 135P - 90K	11,333

These two treatments could be used until other results are obtained. The cost per hectare of the 60N - 90P - 135K treatment is JA$317.25 (JA$128.44 per acre) and the 45N - 135P - 90K treatment is JS$309.15 (JA$125.26 per acre). There is very little to choose between the two treatments when the cost and yields are taken into consideration.

2.12 Fertilizer Studies with Carrot on Four Paths Clay Loam

2.12.1 Methodology

The design was a randomized block with three (3) replications. Plot size was 3.24 sq. metres.

The variety Danvers 126 was directly seeded on ridges - 75cm apart on the 8th of January, 1982

and thinned at four weeks to a spacing of 5cm between plants in the rows.

Weed control was done by a pre-emergence application of Kerosene oil at the rate of 336 litres/ha and manually at 6 weeks. Application of insecticides and fungicides were done at fortnightly intervals.

The fertilizer treatments were as shown in the Table XI. All of the treatments were applied at the time of seeding and incorporated into the soil.

2.12.2 Results

The yields obtained from the various treatments as well as the economic benefits are shown in Table XI.

The results were rather dramatic in that all of the treatments gave highly significant increases over the treatment with the low level of N, P and K. (30N - 90P - 120K). All of the treatments with the higher level of N irrespective of the levels of P and K gave highly significant increases over the treatment with the lower rate of N. The best of these treatments was that with the lower levels of P and K (treatment 60N - 90P - 120K). The yield was highly significant when compared with the other three treatments with the high rates of N. The result was not totally unexpected as during the growth of the crop, there were very conspicuous differences in the vegetative growth between the plots. The plots with the higher rates of Nitrogen were more vigorous and that with 60N - 90P - 120K outstanding. The economic benefits were highest for this treatment also.

The main problem encountered with the crop was the rotting of the tips of the tubers. This was probably as a result of the soil not being ploughed to the correct depth and the ridges not being high enough.

It would appear at this point in time that carrot is one of the few vegetables which can be more profitably grown on the Four Paths Clay Loam as compared with the Morass Peat Soil.

TABLE XI

Yields and Economic Benefits per hectare

I	II	III	IV	V	VI	(V - VI)
Treatment	Yield (kg)	Increase (kg)	Percent Increase	Gross Value J$	Cost of Fertilizers J$	Returns less Fertilizer Costs J$
30 - 90 - 120	3549	-	-	3,123.12	248.70	2,874.42
30 - 135 - 180	5246	1697	148	4,616.48	344.10	4,271.90
30 - 135 - 120	5494	1945	154	4,834.72	301.50	4,533.22
30 - 90 - 180	5617	2068	158	4,942.96	291.30	4,651.66
60 - 135 - 120	7284	3735	205	6,409.92	359.40	6,050.52
60 - 90 - 180	7347	3798	207	6,465.36	349.20	6,116.16
60 - 135 - 180	7438	3889	209	6,545.44	402.00	6,143.44
60 - 90 - 120	9598	6049	270	8,446.64	306.60	8,139.64

(N.B. - Price of carrot calculated at Ja$0.40/lb - (Ja$0.88/kg), N - Ja$1.93/kg, P - Ja$1.17/kg, K - Ja$0.71/kg)

2.13 Fertilizer Studies with Cabbage on Peat

2.13.1 Methodology

Details of the methodology are presented in section 2.2.9 of the Second Quarterly Report. However, the fertilizer rates used were in some cases lower than those originally planned, e.g. No - 0 kg/ha, N_1 - 20 kg/ha, N_2 - 40 kg/ha, P_o - 0 kg/ha, P_1 - 100 kg/ha, P_2 - 200 kg/ha, K_o - 0 kg/ha, K_2 - 125 kg/ha and K_2 - 250 kg/ha.

2.13.2 Results

The results are now being statistically analysed and these will be presented and discussed in the subsequent report.

A few preliminary observations are made at this time based on the results presented in Table XII. The treatments with 20N - 200P - oK gave the highest yield (39,778 kg/ha), produced the largest heads (av. size 1.19 kg) and the best returns (Ja$25,980/ha). However, the heads were loose and this would no doubt affect their marketing and keeping qualities. The next best treatment was that with ON - 200P - 250 K which gave a yield of 39,111 kg/ha, average size of heads of 1.17 kg and returns of Ja$25,401. The heads were compact and this enhances the marketing and keeping qualities. This is the treatment now being recommended. A slight top dressing of N may be necessary as the Peat is cropped for more than one season.

TABLE XII

AVERAGE SIZE OF HEADS, YIELDS AND ECONOMIC BENEFITS

Treatments	Av. size of Heads (kg)	Yields (kg/ha)	Increase (kg/ha)	Percent increase	Gross Value (J$)	Fertiliser Costs (J$)	Returns less Fertiliser Costs (J$)
ON- OP- OK	0.57	18,889	-	-	12,467	-	12,467
20N- OP- OK	0.80	26,666	7,777	141	17,600	39	17,561
40P- OP- OK	0.93	31,111	12,222	165	20,533	77	20,455
ON-100P- OK	0.77	25,555	6,666	135	16,866	117	16,749
ON-200P- OK	0.87	29,111	10,222	154	19,213	234	11,793
ON- OP-125K	0.55	18,222	-	-	12,027	89	11,938
ON- OP-250K	0.67	22,222	3,333	118	14,666	178	14,488
20N-100P- OK	0.97	32,222	13,333	171	21,267	156	21,111
20N-200P- OK	1.19	39,778	20,889	211	26,253	273	25,980
40N-100P- OK	0.96	32,000	13,111	170	21,220	194	21,025
20N- OP-125K	0.97	32,444	13,555	172	21,413	311	21,101
20N- OP-250K	0.92	30,676	11,787	162	20,246	216	20,030
40N- OP-125K	0.87	28,888	9,999	153	19,066	166	18,900
40N- OP-250K	0.78	26,000	7,111	138	17,160	255	16,905
ON-100P-125K	1.07	35,555	16,666	188	23,466	206	23,260
ON-100P-250K	1.02	34,000	15,111	180	22,400	278	22,122
ON-200P-125K	0.93	31,111	12,222	165	20,533	323	20,210
ON-200P-250K	1.17	39,111	20,222	207	25,813	412	25,401
20N-100P-125K	0.72	24,000	5,111	127	15,840	244	15,595
20N-100P-250K	0.77	25,777	6,888	136	17,012	333	16,678
20N-200P-125K	0.95	31,778	12,889	168	20,973	362	20,611
20N-200P-250K	0.97	32,444	13,555	172	21,413	450	20,962
20N- OP-125K	0.87	28,888	9,999	153	19,066	127	18,938
40N-100P-125K	1.14	38,000	19,111	201	25,080	283	24,797
40N-100P-250K	1.04	34,889	16,000	185	23,027	372	22,655
40N-200P-125K	1.06	35,339	16,450	187	23,322	400	22,922
40N-200P-250K	0.95	31,778	12,889	168	20,973	488	20,484

Note: (i) Value of cabbage calculated at J$0.66/kg (0.30 c/lb)
(ii) N - J$1.93/kg, P - J$1.17/kg, K - J$0.71/kg

3. PROGRAMME OF WORK FOR SECOND SEASON - APRIL TO AUGUST, 1982

Because of the better results obtained with practically all the vegetables on the Peat and the limited time and facilities available for the programme, work during the second season was confined to the Morass Peat Soil. In order to achieve the overall objectives of the programme, the following studies which could not be done in the first season was laid down:

(i) Varietal trial with Onions
(ii) Varietal trial with String beans
(iii) Varietal trial with Carrots
(iv) Micro-Nutrients studies with Egg Plant
(v) Fertilizer studies with Egg Plant and Peppers; these two (2) vegetables were selected because of BRUMDEC's interest in their commercial production.

In addition to trials listed above, selected vegetables were sown on a semi-commercial scale to obtain information on the problems likely to be encountered when the crops are grown on a commercial scale and during the wet season. The crops and varieties selected were those which performed well during the first season.

Cabbage - varieties K.K Cross and Roundup
Tomatoes - varieties Floradade, Manapal and Manalucie
Watermelons - varieties Charleston Gray and Jubilee. Sugar Baby was included although it was not previously tested.
Cucumbers - variety Ashley. Cheroke - a new variety was also included

The new crops were included in the semi-commercial trial as it was felt that adequate information was already available on these crops, e.g. Sweet Corn and Okro. Unfortunately, after all these trials were sown, the area was completely flooded and the crops destroyed. The semi-commercial trials with

tomatoes, ochroes, string beans, sweet corn, cucumbers, watermelons and cabbage were resown between the 14th and 19th of June, 1982. Two additional semi-commercial trials with Egg Plant and Sweet Peppers have also now been sown.

3.1 Micro-Nutrient Experiment

3.1.1 Design - Randomized block with four (4) replications Plot size - 1.8 x 2.4 m (4.32 sq. metres) - 12 plants per plot.

3.1.2 Crop - Egg plant variety Black Beauty

3.1.3 Seeding/Spacing - Seeds sown in nursery and transplanted on the 29th March, 1982 - forty (40) days after sowing and four weeks after germination of seeds. Spacing between rows - 75cm (2½') and between plants in the rows - 60cm (2').

3.1.4 Fertilizer Application

P_2O_5 - 180 kg/ha
K_2O - 270 kg/ha

Application of fertilizer made by broadcasting to the surface of the soil, three (3) days before transplanting.

3.1.5 Micro-Nutrient Treatments

1 = No micro-nutrients
2 = Complete package consisting of

Cu - 8.4 kg/ha
Mn - 5.6 kg/ha - applied as Manganese Chelate (12% Mn)
Zn - 5.6 kg/ha
B - 4.5 kg/ha

3 = Cu - 8.4 kg/ha
4 = Mn - 5.6 kg/ha
5 = Zn - 5.6 kg/ha
6 = B - 4.5 kg/ha

All of the micro-nutrients were applied by broadcasting to surface of the soil at the same time as the fertilizer application. Cu was applied in the form of Tribasic Copper Sulphate (53% Cu), Mn as Manganese Chelate (12% Mn), Zn as Zinc Sulphate (25% Zn), and Boron as B_2O_3 (Solubor-60% B_2O_3).

3.1.6 Weed, Pest and Disease Control

Weed control was done manually after 4 weeks. The leaf eating chrysomelids was the only pest of any importance.

3.1.7 General Remarks

The plots were destroyed by flooding just as harvest had commenced and as a result the effects of the different micro-nutrients could not be ascertained. Inspite of this a few conclusions can be drawn. (1) That the crop can be successfully grown on the Peat even during the wet season provided it can be protected against flooding; (II) fruits of a very high quality and weighing as much as 0.6 to 0.9 kg can be produced; and (III) a spacing of 90cm between rows and 75cm between plants in the rows needs to be used when growing the crop on Peat.

3.2 Fertilizer studies with Pepper and Egg Plant

3.2.1 Design

The design of the experiments was a 3 x 3 x 3 factorial arranged in blocks of nine (9) with two (2) replications.

3.2.2 Crop and Variety

Sweet Pepper variety California Wonder.
Egg Plant variety Ichiban.

3.2.3 Seeding/Spacing

Sweet Pepper - spacing between rows - 60cm and between plants in the rows - 45cm.

Egg Plant - spacing between rows and between plants in the rows - 60cm.

Seedlings were transplanted to the plots on the 29th of March, 1982 when they were four (4) weeks old.

3.2.4 Fertilizer Treatments

N_0 - 0
N_1 - 20 kg/ha
N_2 - 40 kg/ha
P_0 - 0
P_1 - 100 kg/ha
P_2 - 200 kg/ha
K_0 - 0
K_1 - 150 kg/ha
K_2 - 300 kg/ha

All of P and half of N and K applied prior to transplanting and the rest of N and K at first flowering.

3.2.5 Weed Control

Done manually at four (4) weeks after transplanting.

3.2.6 Pest and Disease Control

Routine applications of the fungicide Benlate and Daconil and the insecticides Sevin and Trichorofon were made as a preventative spray.

3.2.7 General Comments

The plots were completely destroyed before harvesting of the crop was completed. Harvesting

of the sweet peppers commenced 45 days after transplanting and 73 days after sowing of seeds. The average weight of fruits in all treatments was 100 grams. The harvesting of the egg plant commenced 39 days after transplanting and 68 days after sowing of the seeds. The variety Ichiban used in this trial appears to be an earlier and more vigorous growing variety than the variety Black Beauty. It produces a very long fruit (between 225-300cm) weighing between 0.30 - 0.50 kg and dark purple in coloration. It is also a very heavy producer. However, the acceptability of the fruits on the market particularly the local market may be a problem. If this problem can be overcome, the growing of the variety can be most profitable.

3.3 Onion Varietal Trial

3.3.1 Design - Randomized block with four (4) replications. Plot size - 1.8 x 2.4 m (4.32 sq. metres).

3.3.2 Varieties

(i) Tropicano Red
(ii) Red Creole
(iii) New Mexico Yellow
(iv) El Toro White
(v) Texas Early Grano
(vi) Yellow Granex

3.3.3 Seeding/Spacing

Direct seeding in rows - 25cm (10") apart on March 29, 1982, and thinned to a spacing of 10cm (4") between plants in the rows when plants six (6) weeks old.

3.3.4 Fertilizer Application

P_2O_5 - 150 kg/ha
K_2O - 200 kg/ha
Cu - 8.4 kg/ha
Mn - 5.6 kg/ha
Zn - 5.6 kg/ha
B - 4.5 kg/ha

Application of fertilizer and micro-nutrients made three (3) days before sowing by broadcasting to the surface of the soil.

3.3.5 Weed Control

Pre-emergence application of Dacthal 75W at the rate of 11.2 kg in 336 litres/ha made just after seeding.

3.3.6 Pest and Disease Control

The crop was relatively free of pests and disease up to the time it was destroyed by flooding.

3.3.7 General Remarks

Germination and growth of this was satisfactory up to the time it was destroyed by flooding. No conclusion can be drawn as to whether onions can be grown on the Peat until further studies are undertaken.

3.4 Carrot Varietal Observation Trial

3.4.1 Layout

Each variety sown in a plot 5.4 x 3.0 m (16.2 sq. metres) and replicated twice.

3.4.2 Varieties

Danvers 126
Chantenay Corless Royal
Nantes Corless

3.4.3 Seeding/Spacing

Direct seeding in furrows approximately 5cm deep and spaced 30cm apart.

3.4.4 Fertilizer Application

P_2O_5 - 225 kg/ha
K_2O - 270 kg/ha
Cu - 8 kg/ha

Applied by broadcasting to the surface of the soil at the time of seeding.

3.4.5 Weed Control

Pre-emergence application of Dacthal 75W at 11.2 kg/ha.

3.4.6 Pest and Disease Control

Periodic application of a suitable insecticide and fungicide.

3.4.7 General Remarks

Plots were flooded out even before germination of the seeds. The results with this crop has been inconclusive and further work must be done before commercial production is attempted.

3.5 String Bean - Varietal Observation Trial

3.5.1 Layout

Each variety was sown on a flat bed - 2.1 x 10.5m (22 sq. metres) with drain 30cm deep separating beds. Beds were previously used for growing lettuce.

3.5.2 Variety

Contender
Top Crop
Tender Best

3.5.3 Seeding/Spacing

Direct seeding in rows - 30cm apart with spacing between plants in the rows being 15cm.

3.5.4 Fertilizer Application

P_2O_5 - 67 kg/ha
K_2O - 135 kg/ha

Application of the fertilizers made by broadcasting to surface of the soil after seeding.

3.5.5 Weed Control

Control of weeds to be done manually after four weeks.

3.5.6 Pest and Disease Control

Fortnightly application of the fungicides - Benlate 50wp (0.56 kg/ha) or Daconil (1.68 kg/ha) and the appropriate insecticides to be made as from the second week after plant emergence.

3.5.7 General Comment

Excellent germination was obtained after four (4) days but the plots were flooded out soon after. The plots were resown on the 15th June, 1982.

3.6 Tomato Semi-Commercial Trial

3.6.1 Layout

Each variety sown in a flat bed 1.8 m wide and 15 m long (27 sq. metres) with drain 45cm deep between beds.

3.6.2 Variety

Manalucie
Floradade
Manapal

3.6.3 Seeding/Spacing

Direct seeding on the 11th of May, 1982 with spacing between rows and between plants in the rows being 60cm.

3.6.4 Fertilizer Treatments

P_2O_5 - 180 kg/ha
K_2O - 269 kg/ha
Cu - 8 kg/ha

Applied by broadcasting to the surface of the soil at the time of seeding.

3.6.5 Weed Control

Weed Control to be done manually just prior to thinning (28 days after sowing).

3.6.6 Staking/Pruning

Staking and pruning the plants to be done between 35 - 40 days.

3.6.7 Pest and Disease Control

Weekly application of a fungicide (Kocide at 1.68 kg/ha or Benlate - 0.56 kg/ha) and an insecticide (Sevin, Malathian etc) to be made as from the second week after sowing.

3.6.8 Comments

Plots flooded out before germination of seeds. However, it was resown on the 15th of June, 1982.

Each variety is now planted on a bed 1.8 m x 21.0 m (37 sq. metres)

3.7 Cabbage Semi-Commercial Trial

3.7.1 Layout

Each variety sown in a flat bed 1.8 m wide by 39 m long (70 sq. metres) with drain 45cm deep separating the beds.

3.7.2 Variety

K.K.Cross
Roundup

3.7.3 Seeding/Spacing

Direct seeding with spacing between rows being 60 cm and thinned at 3-4 weeks to a spacing of 45 cm between plants in the rows.

3.7.4 Fertilizer Treatments

P_2O_5 - 150 kg/ha
K_2O - 200 kg/ha
Cu - 8 kg/ha

Application made by broadcasting to the surface of the soil at seeding.

3.7.5 Weed Control

Dacthal 75w applied at rate of 11.2 kg in 336 litres/ha as a pre-emergence application. Hand weeding at 4-6 weeks.

3.7.6 Pest and Disease Control

Weekly application of an insecticide (Sevin, Dipterex or Malathian) and a fungicide (Kocide, Daconil or Benlate) to be made as from two (2)

weeks after sowing until one (1) week prior to harvesting.

3.7.7 General Comments

Excellent germination was obtained but the plots were flooded out soon after. Resowing was done on the 18th of June, 1982 and only variety K.K. Cross was used.

3.8 Sweet Corn Semi-Commercial Trial

3.8.1 Layout

The plots previously used for growing legumes are being used for the sweet corn - 32 beds each measuring 2.1 x 5.4 m (11,34 sq. m/plot - total area 363 sq. metres) was used for the first sowing. For the second sowing it was planned to use twelve (12) plots - 5.4 x 4.8m (25 sq. metres/plot) and with total area of 300 sq. metres.

3.8.2 Variety

5204 Florida Staysweet

3.8.3 Seeding/Spacing

Direct seeded in rows - 45cm apart with spacing between rows being 30cm. First sowing to be done on the 5th of May and second sowing two (2) weeks after on the 19th of May, 1982.

3.8.4 Fertilizer Application

P_2O_5 - 200 kg/ha
K_2O - 269 kg/ha
Cu - 8.4 kg/ha

Application of fertilizers and micro-nutrients made by broadcasting to the surface at the time of seeding.

3.8.5 Weed Control

Pre-emergence application of Gesaprim 80 at the rate of 1.4 kg/ha immediately after seeding.

3.8.6 General Comments

Excellent germination was obtained after only four (4) days but the trial suffered the fate of the other trials. The trial was resown on the 14th of June, 1982 and only one sowing will be done. Plot size is 32 beds - 2.1 m x 5.4 m each.

3.9 Cucumbers - Semi-Commercial Trial

3.9.1 Layout

Each variety sown in a flat bed 1.8 m wide by 32.4 m long (58.3 sq. metres) with drain 45cm deep between each bed.

3.9.2 Variety

Ashley
Cheroke

3.9.3 Seeding/Spacing

Direct seeding in mounds spaced 0.9 m apart in the centre of each bed, on the 13th of May, 1982 and thinned two (2) after two (2) seedlings per mound.

3.9.4 Fertilizer Treatments

P_2O_5 - 160 kg/ha
K_2O - 240 kg/ha
Cu - 8 kg/ha

Fertilizer applied to the surface of the soil on each mount and incorporated in just prior to sowing.

3.9.5 Weed Control

Manual at four (4) weeks after sowing.

3.9.6 Pest and Disease Control

Weekly application of the fungicides Benlate 50wp at 0.90 kg/ha or Daconil at 2.25 kg/ha and the insecticides Dimethoate at 1.41/ha.

3.9.7 General Remarks

Plots flooded out before germination of seeds. Resowing was done on the 14th June, 1982. Ashley was sown on one (1) bed and Cherokee on the remaining two (2) beds.

3.10 Watermelons - Semi-Commercial Trial

3.10.1 Layout

Each variety is sown on a flat bed .18 m wide by 32.4 m long (58.3 sq. metres) with 45cm deep drain between beds.

3.10.2 Varieties

Charleston Gray
Jubilee
Sugar Baby

3.10.3 Seeding/Spacing

Direct seeding on mound spaced 1.8 m in the centre of each bed on the 13th May, 1982. Thinned to two (2) plants per mound at 2-3 weeks.

3.10.4 Fertilizer Treatments

P_2O_5 - 160 kg/ha
K_2O - 240 kg/ha
Cu - 8 kg/ha

Applied to the soil on each mound and incorporated in at the time of seeding.

3.10.5 Weed Control

Manual at 3-4 weeks.

3.10.6 Pest and Disease Control

Weekly application of Daconil or Benlate as a preventative measure against disease. Application of Sevin, Malathian or Dipterex for control of plots.

3.10.7 General Comments

Plots flooded out before germination of seeds. The three varieties were resown on the 15th June, 1982.

3.11 Okro Semi-Commercial Trial

3.11.1 Layout

Sown in two (2) flat beds - 2.1 m wide with drains 45cm deep separating the beds. Total area sown - 76 sq. metres.

3.11.2 Variety

Emerald

3.11.3 Seeding/Spacing

Direct seeding in rows - 60cm apart with spacing of plants in the rows being 45cm.

3.11.4 Fertilizer Application

P_2O_5 - 80 kg/ha
K_2O - 120 kg/ha
Cu - 8 kg/ha

Fertilizer application made to the surface of the soil at the time of seeding.

3.11.5 Weed Control

(i) Dacthal 75W at 11.2 kg/ha as a pre-emergence spray.

(ii) Hand weeding at 4 and 8 weeks after seeding.

3.11.6 Pest and Disease Control

Fortnightly application of Climethoate at 0.56 1/ha.

3.11.7 General Comments

Plots destroyed by flooding before germination of seeds. Resowing was done on the 15th June, 1982. Three (3) flat beds each measuring 1.8 x 21.0 m are now being used.

4. TECHNICAL PACKAGE OF PRACTICES FOR VEGETABLE CULTIVATION UNDER CONDITIONS PREVAILING AT BRUMDEC

4.1 General Considerations

It needs to be pointed out from the inception that the package of practices being recommended are based on one season's work (January and April, 1982) and on current available information. As additional information becomes available, these would have to be updated.

The most favourable period for production of vegetables at BRUMDEC appears to be the winter months (November - March) and this is in keeping with the national policy of producing vegetables for export to the Winter markets. One of the main limiting factors as far as growing vegetables is concerned during this period is irrigation. Steps must be taken to ensure that this is in place before any commercial production is attempted. Irrigation on the peat can be in the form of surface and/or overhead. However, on the Four Paths Series overhead irrigation is vital.

Whilst it is appreciated that production of vegetables can best be done during the winter months, a project of the magnitude of the Black River Upper Morass Development Company Limited (BRUMDEC) must gear itself to produce vegetables at other times of the year (April to September). One of the major constraints and perhaps the limiting one as far as growing vegetables appears to be drainage during the wet months (May - June). Two approaches can be adopted to overcome this problem. One is to commence planting of the vegetables after the heavy rains are over (planting to be done between mid-June and mid-July). However, this would restrict production to vegetables with a short maturity period (60 - 90)days since harvesting must be completed before the advent of heavy rains around mid-September. A more logical approach would be to select the higher areas of the peat for production during the wet months and these be provided with additional drainage be it gravity or small pumps. Sowing of the longer maturing crops, e.g. cabbage, tomatoes, onions, sweet corn, egg plant, peppers can then be done between mid-March to mid-April. This would allow the crop to become fully established by the time the heavy rains came.

Another important aspect in the utilisation of the peat soil is the problem of subsidence due to oxidation of the organic matter and shrinkage. Flooding will also assist in the control of certain soil pests and diseases, e.g. nematodes. The ideal situation would be to utilise the low areas for production during the winter months (November to March) and to keep it flooded during the period May to October. Similarly, the higher areas can be cropped during April to September and flooded between October to February. Alternatively both areas can be used during the off period for rice or even fish culture.

4.2 Crops to be Sown

The crops and varieties recommended for cultivation are those which have been successfully cultivated during the first season. Onions, garlic and carrots (on the Peat) are not being recommended because the results obtained so far have been inconclusive. The crop and varieties which should be produced will eventually depend on the market requirements.

4.2.1 Morass Peat Soil

Crop	Varieties
Cabbage	K.K. Cross (flat head)
	Y.R. Summer (flat head)
	Roundup (upright head)
Lettuce	Minetto (Crisp head)
	Great Lakes (large head)
	Mignonette (leaf)
Tomatoes	Floradade
	Manapal
	Tropic
	Roma VF (Plum type)
	Manalucie (wet season production)
Egg Plant	Black Beauty
	Long Purple
	Ichiban (if market can be found)
Sweet Peppers	Resistant Giant
	California Wonder
	Yole Wonder
Hot Peppers	Scotch Bonnet
String Beans	Harvester
	Contender

Crop	Variety
Watermelons	Charleston Gray
	Jubilee
Cucumbers	Ashley
	Poinsett

4.2.2 Four Paths Clay Loam

Tomatoes	Floradade
	Tropic
	Roma VF
	Manapal
	Manalucie (wet season production)
Sweet Peppers	Scotch Bonnet
Cucumbers	Ashley
	Poinsett
Watermelon	Charleston Gray
	Jubilee
Carrots	Danvers 126
	Danvers Half Long

4.3 Cultural Practices

4.3.1 Peat

Experience has shown that on the Peat, vegetables can best be grown on flat beds. Beds 1.5 to 1.8 metres wide were used with great success during the first season. Wider beds probably can be used during the dry season provided the land is levelled. The depth of the drains between beds for the shallow rooted vegetables - cabbage, lettuce, cucumbers, watermelons, etc., should be 30-45cm. For the deep rooted vegetables, e.g. tomatoes, peppers, egg plant etc., the drain depth should be 60-70cm.

Areas which are to be brought into cultivation for the first time should be ploughed to a depth of 20-25cm. Ripping should be done with a chesel plough or tyne harrow to remove roots, tubers, etc. It should then be harrowed, levelled and drains dug.

4.3.2 Four Paths Clay Loam

Certain vegetables, e.g. tomatoes and peppers can probably be best planted on ridges on this soil. However, the ridges on the Four Paths Clay Loam tend to settle down and the soil becomes compact. Periodic building up of the ridges and tilling of the soil will be necessary for successful cultivation. Other vegetables, e.g. cucumbers, watermelons and carrots are more suited to raise beds.

Prior to ridging or making of the beds, the land should be ploughed to a depth of 25-30 cm and allowed to weather for 2-3 weeks. Following this, it should be harrowed to a fine tilth.

4.4 Method and Time of Sowing

All of the vegetables can be directly seeded on the peat once flat beds are used and irrigation is available to maintain the seed bed in a moist state. This method is advocated as it saves time, reduces labour costs and the operation lends itself to mechanisation.

The Four Path Series of soil tend to dry out rapidly and this together with compaction interferes with germination and emergence of the seedlings. If the production of tomatoes and peppers (sweet and hot) are to be done on this soil, the seeds should be sown in a nursery and the young seedlings transplanted onto the beds or ridges. Direct

seeding can be done for watermelons, cucumbers and carrots.

Details of the time of sowing, spacing, seed rate, etc. of the different vegetables are given in Table XIII.

4.5 Fertilizer Treatments

4.5.1 Morass Peat

Fruit Vegetables - tomatoes, egg plant, sweet peppers etc.

P_2O_5 - 180 kg/ha
K_2O - 260 kg/ha

Leaf Vegetables - cabbage, lettuce (head)

P_2O_5 - 200 kg/ha
K_2O - 250 kg/ha

Leaf lettuce application should be N-20, P-100 and K-125 kg/ha.

Beans

P_2O_5 - 67 kg/ha
K_2O - 120 kg/ha

Vines

P_2O_5 - 90 kg/ha
K_2O - 150 kg/ha

Application of the fertilisers should be made by broadcasting to the surface of the soil about (1) week prior to seeding. Based on the soil analyses, the only micro-nutrient which appears to be needed is copper. On the Peat being cultivated for the first time an application of 8 kg/ha of Cu/ha should be made at the same time as the application of the other fertilizers.

Table XIII

TIME OF SOWING, SPACING, SEEDRATE AND PERIOD OF MATURITY OF SELECTED VEGETABLES.

Crop	Varieties	Time of Sowing	Spacing	Seed Rate (kg/ha)		Period of Matu (Days after sow
				Direct Seeding	Transplanting	
Cabbage	K.K. Cross Y.R. Summer Roundup	Mid Nov-end Dec Mid March-Mid Apr.	Between rows 60-75 cm. Between plant -45 cm.	1.12-1.40	0.28-0.40	85-120
Lettuce	Great Lakes	Nov.- Mid Dec.	Bet. rows-60 cm " plants-30 cm	1.68-2.25	0.28-0.40	50-80
	Minetto Mignonette	Nov.-Dec. Mid Mar.-Mid Apr. Mid June-July	Bet. rows 45cm Bet. plants 20cm			
Tomatoes	Floradade Tropic Manapal Roma VF Manalucie	Mid Nov-end Dec. Mid Mar.-Mid Apr.	Bet. rows-75 cm Bet. plants 60-75cm	0.84-1.12	0.28-0.56	85-120
gg Plant	Black Beauty Long Purple	Mid Nov.-Mid Jan Mid Mar.-Mid. Apr.	Bet. rows 75-90cm Bet. plants 60-75cm	1.12-1.40	0.28-0.40	90-140
ot Pepper	Scotch Bonnet	Mid Nov.-Mid Jan	Bet. rows 75-90cm Bet. plants 75cm	1.12-2.0	0.28-0.40	130-160

4.5.2 Four Paths Clay Loam

Fruit Vegetables - tomatoes, peppers

502 kg of 6-18-27 fertilizers (30N-90P0135K) or 45N-135P-90K

Vines - cucumbers, melons

628 kg of 7-14-14 fertilizer or 377 kg of a 12:24:12 fertilizer (equivalent to 44-45 N, 88-90 P.)

Carrots

N - 60 kg/ha
P_2O_5 - 90 kg/ha
K_2O - 120 kg/ha

Application of fertilizers must be made one (1) week before seeding or transplanting and incorporated into the soil or placed in the "holes" or furrows.

4.6 Weed Control

The weed control measures recommended are those which have been used quite successfully in the first season. However, there are a number of other chemicals which can be used as a substitute for manual control and/or for some of the chemicals now being recommended. Some of these are listed in the First Report.

Cabbage, Lettuce	(a) Pre-emergence application of Datchal 75W at 11.2 kg/ha (b) Manual at 3-4 weeks
Tomatoes, Peppers, Egg Plant	Manual control at 3 weeks and again at 6-8 weeks.

(a) Pre-emergence application of Dacthal 75W at 11.2 kg/ha
(b) Manual control at 3-4 weeks

Cucumbers, Watermelons — Manual control at 2-3 weeks and at 5-6 weeks

Carrots
(a) Pre-emergence application of Dacthal 75W at 11.2 kg/ha or Kerosene oil.
(b) Manual at 4-6 weeks

4.7 Pest and Disease Control

Information on the control of pests and diseases has already been documented and need not be repeated here. This can be referred to in the Report entitled "Vegetable Production (BRUMDEC) Review and Proposed Short-Term Adaptive Production Oriented Research Programme" and the Second Quarterly Report. Valuable information is also contained in the Vegetable Growers Handbook published by the Ministry of Agriculture. What needs to be emphasized is that control of pests and diseases in vegetables must be done routinely as a preventative measure. Before commencing production, steps must be taken to ensure that the equipment and pesticides are in place to carry out operations on time and on a regular basis.

4.8 Harvesting and Handling

This topic cannot be dealt with to any extent in this report. However, a few general guidelines are worthy of mention. Very often great care is taken in the production of vegetables in the field but the same equal care is not taken when harvesting, handling and transporting the vegetables. The result is that substantial loss occurs both in quantity and quality of the produce. It needs always to be borne in mind that vegetables are highly

perishable. Care must be taken to ensure that the harvesting is done at the correct stage of maturity and that a minimum of damage occurs during this stage. It is also desirable that the harvesting particularly in the case of leafy green vegetables, e.g. cabbage, lettuce should be done in the early part of the day. After harvesting the produce must be transported from the field to the area of proper storage or to the markets as quickly as possible. Suitable type containers must be used in the movement of produce from the field. Diseased produce should not be mixed with sound ones. There are also some advantages in separating our different levels of maturity or ripeness and in placing products of greatly varying sizes in separate containers.

4.9 Cost of Production and Returns

It is appreciated that the production of vegetables and for that matter, any crop cannot be a feasible one unless the market is available and economic returns can be obtained. Tables XIV to XVIII give the estimated cost of production of selected vegetables and their returns. In computing the calculations, the yields have been estimated in all cases at less than fifty (50) per cent of that obtained in the small plot trials.

It should be noted that labour costs ranged from 33 to 40 per cent of the total cost of production. This is not unusual since vegetable production is labour intensive particularly when done on a small scale. However, in large scale commercial production such operations as preparation of drains, seeding and application of fertilizers can be mechanized.

It would appear from casual observations that the prices of chemicals e.g. pesticides, fertilizers, etc. seem to be higher in Jamaica when compared with some other countries in the Caribbean. The availability of inputs at reasonable prices is vitally necessary if agriculture is to become an attractive economic venture.

TABLE XIV

PEPPERS - ESTIMATED COST OF PRODUCTION AND RETURNS

PER ACRE

OPERATIONS	LABOUR COSTS (A)	MATERIAL COSTS (B)	MACHINE COSTS	TOTAL COST (J$)
1. Land Preparation				
Ploughing (one)			45.00	
Harrowing (two)			50.00	
Levelling			40.00	
Making Drains	200.00			
2. Sowing				
Seeding - 18 man days	288.00			
Seeds - 1½lb		150.00		
Thinning, supplying - 4 man days	64.00			
				502.00
3. Weed Control				
Weeding - 15 man days	240.00			240.00
4. Pest and Disease Control				
Spraying - 4 man days	64.00			
Fungicides - 20lbs		160.00		
Insecticides - 12lbs		144.00		
				368.00
5. Fertilizing				
Labour - 2 man days	32.00			
Fertilizers		160.00		
				192.00
6. Harvesting & Transportation				
Reaping - 12 man days	192.00			
Grading & Packing - 6 man days	96.00			

TABLE XIV cont'd

OPERATIONS	LABOUR COSTS (A)	MATERIAL COSTS (B)	MACHINE COSTS	TOTAL COST (J$)
Containers		80.00		
Transportation Cost - 1 cts/lb			100.00	
				468.00
7. Other Charges				
Contingencies - 10% of A				117.60
Depreciation - 5% of B				34.70
Land Charges/Crop				50.00
Interest - 12% Year				112.20
Return to Risk & Management - 30%				561.00
TOTAL	1176.00	694.00	235.00	2980.50
Percentage of Total	40.8	23.3	7.9	

Anticipated Yields (lbs) - 10,000
Cost of Production (lbs) - 0.30 cts
Gross Revenue @
0.40 cts/lb - $ 4,000.00
Cost of Production - $ 2,980.50
Net Revenue -J$ 1,019.50

TABLE XV

TOMATOES - ESTIMATED COST OF PRODUCTION AND RETURNS

(PER ACRE)

OPERATIONS	LABOUR COST (A)	MATERIAL COST (B)	MACHINE COST (C)	TOTAL COST (J$)
1. Land Preparation				
Ploughing (one)			45.00	
Harrowing (two)			50.00	
Levelling			40.00	
Making Drains	200.00			
				335.00
2. Sowing				
Labour - 16 man days	256.00			
Seeds - 1 lb		70.00		
Thinning, Supplying - 4 man days	64.00			
				390.00
3. Staking				
7,000 stakes @ 0.50 cts/100		350.00		
Staking + Tying - 4 man days	96.00			
				446.00
4. Weed Control				
Labour - 15 man days	240.00			240.00
5. Pest and Disease Control				
Labour - 5 man days	80.00			
Fungicide - 25 lbs		200.00		
Insecticide - 15 lbs		180.00		
				460.00

TABLE XV cont'd

OPERATIONS	LABOUR COST (A)	MATERIAL COST (B)	MACHINE COST (C)	TOTAL COST (J$)
6. Fertilizing				
Labour - 2 man days	32.00			
Fertilizers		160.00		
				192.00
7. Harvesting & Transportation				
Reaping - 16 man days	256.00			
Grading & Packing -				
8 man days	128.00			
Containers		100.00		
Transportation Cost -				
1 cts/lb			160.00	
				644.00
8. Other Charges				
Contingencies - 10% of A				135.20
Depreciation - 5% of B				53.00
Land Charges - per crop				50.00
Interest 12% Year				147.90
Return to Risk and				
Management - 30%				723.60
TOTAL	1352.00	1060.00	295.00	3836.70
Percentage of Total	35.2	27.6	7.7	

Anticipated Yield (lbs) - 16,000

Cost of Production (lbs) - 0.24 cts

Gross Revenue

@ 0.30 cts/lb - $4,800.00

Total Cost - $3,836.70

Net Revenue $ 963.30

EGG PLANT - ESTIMATED COST OF PRODUCTION AND RETURNS

(PER ACRE)

OPERATIONS	LABOUR COSTS (A)	MATERIAL COSTS (B)	MACHINE COSTS	TOTAL COST (J$)
1. Land Preparation				
Ploughing (one)			45.00	
Harrowing (two)			50.00	
Levelling			40.00	
Making Drains	200.00			
				335.00
2. Sowing				
Seeding - 15 man days	180.00			
Seeds - 1¼ lbs		25.00		
Thinning, Supplying - 2 man days	32.00			
				237.00
3. Weed Control				
Weeding - 15 man days	240.00			240.00
4. Pest & Disease Control				
Spraying - 4 man days	64.00			
Insecticides		144.00		
Fungicides		80.00		
				288.00
5. Fertilizing				
Application - 2 man days	32.00			
Fertilizers		160.00		
				192.00
6. Harvesting & Transportation				
Reaping - 12 man days	192.00			
Grading & Packing - 4 man days	64.00			

TABLE XVI cont'd

OPERATIONS	LABOUR COSTS (A)	MATERIAL COSTS (B)	MACHINE COSTS	TOTAL COST (J$)
Containers		150.00		
Transportation			100.00	
				506.00
7. Other Charges				
Contingencies - 10% of A				100.40
Depreciation - 5% of B				28.00
Land Charges/Crop				50.00
Interest - 12% Year				94.00
Return to Risk & Management - 30%				469.00
TOTAL	1004.00	559.00	235.00	2539.40
Percentage of Total	39.5	22.0	9.3	

Anticipated Yield (lbs) - 10,000

Cost of Production (lbs) - 0.25 cts

Gross Revenue @

0.40 cts/lb - $4,000.00

Cost of Production - $2,539.40

Net Revenue $1,460.60

TABLE XVII

CABBAGE - ESTIMATED COST OF PRODUCTION AND RETURNS

(PER ACRE)

OPERATIONS	LABOUR COSTS (A)	MATERIAL COSTS (B)	MACHINE COSTS	TOTAL COST (J$)
1. Land Preparation				
Ploughing (one)			45.00	
Harrowing (two)			50.00	
Levelling			40.00	
Making Drains	200.00			
				335.00
2. Sowing				
Seeding - 16 man days	256.00			
Seeds - 1¼ lbs		75.00		
Thinning, Supplying - 4 man days	64.00			
				395.00
3. Weed Control				
Spraying	8.00			
Dacthal - 10 lbs		65.00		
Weeding - 4 man days	64.00			
				137.00
4. Pest & Disease Control				
Spraying - 5 man days	80.00			
Fungicides - 10 lbs		80.00		
Insecticides - 15 lbs		180.00		
				340.00
5. Fertilizing				
Application - 2 man days	32.00			
Fertilizers		166.59		

TABLE XVII cont'd

OPERATIONS	LABOUR COSTS (A)	MATERIAL COSTS (B)	MACHINE COSTS	TOTAL COST (J$)
6. Harvesting & Transportation				
Reaping, cleaning & packing				
- 10 man days	160.00			
Containers		120.00		
Transportation - 1 ct/lb		150.00		
				410.00
7. Other Charges				
Contingencies - 10% of A				86.40
Depreciation - 5% of B				41.83
Land Charges/Crop				50.00
Interest - 12% Year				102.04
Return to Risk &				
Management - 30%				510.18
TOTAL	864.00	863.59	135.00	2606.04
Percentage of Total	33.2	32.1	5.2	

Anticipated Yields (lbs) - 15,000

Cost of Production (lbs) - 0.17 cts

Gross Revenue @

0.30 cts/lb - $3,600.00

Cost of Production - $2,606.04

Net Revenue $ 993.96

TABLE XVIII

CUCUMBERS - ESTIMATED COST OF PRODUCTION AND RETURNS

(PER ACRE)

OPERATIONS	LABOUR COSTS (A)	MATERIAL COSTS (B)	MACHINE COSTS	TOTAL COST (J$)
1. Land Preparation				
Ploughing (one)			45.00	
Harrowing (two)			50.00	
Levelling			40.00	
Making Drains	200.00			
				335.00
2. Sowing				
Seeding - 2 man days	32.00			
Seeds - 2 lbs		60.00		
Thinning, Supplying - 4 man days	64.00			
				156.00
3. Weed Control				
Weeding - 10 man days	160.00			
4. Pest and Disease				
Spraying - 6 man days	96.00			
Fungicides - 20 lbs		160.00		
Insecticides - 6 lbs		72.00		
				328.00
5. Fertilizing				
Application - 2 man days	32.00			
Fertilizers		86.00		
				118.00
6. Harvesting & Transportation				
Harvesting, Grading & packing - 15 man days	240.00			
Containers		120.00		
Transportation - 1 ct/lb			150.00	
				510.00

TABLE XVIII cont'd

OPERATIONS	LABOUR COSTS (A)	MATERIAL COSTS	MACHINE COSTS	TOTAL COST (J$)
7. Other Charges				
Contingencies - 10% of A				82.40
Depreciation - 5% of B				24.90
Land Charges/Crop				50.00
Interest - 12% Year				79.32
Return to Risk & Management - 30%				400.00
TOTAL	824.00	498.00	285.00	2243.62
Percentage of Total	36.7	22.2	12.7	

Anticipated Yield (lbs) - 15,000

Cost of Production (lbs) - 0.15 cts

Gross Revenue @ 25 cts/lb	-$3,750.00
Cost of Production	-$2,243.62
Net Revenue	$1,506.38

5. AREAS FOR FUTURE RESEARCH

So far only one season's work has been completed and the Second Season's work is unlikely to yield much additional information because of the setback. Much therefore remains to be done particularly on the Peat. It would be desirable for any future research work to be restricted to those crops for which commercial production is to be attempted. At this point in time only broad guidelines can be given as to the areas for future research.

5.1 Varietal Studies with Onions and Garlic

Onions and garlic have been specifically mentioned because of the market potential for these crops. In the case of Onions, it is suggested that these trials should be done both in the Fall and Spring using the varieties recommended for these two seasons. Preference should be given to the varieties with good storage qualities. The Ministry of Agriculture/Jamaica has already done some work on the selection of varieties for the different seasons and on their storage qualities. This information should be used as the basis for any future studies.

It would appear that any change of success in the growing of Garlic would depend on the availability of planting material of varieties adopted to the low-land tropics. As soon as the varieties are available, trials should be carried out with them during the cooler months of the year (November - February).

5.2 Other Varietal Studies

The studies carried out so far on crops and varieties were influenced by the availability of planting material. Other varieties which are considered superior in terms of yields and quality to those already tested should be evaluated with a view to replacing those now being recommended.

5.3 Fertilizer Studies

Fertilizer studies have been completed on only one crop e.g. cabbage. Whilst the fertilizers now being recommended are likely to produce satisfactory yields, studies should be initiated with other vegetables to determine the optimum treatments.

5.4 Micro-Nutrient Studies

High yields have been obtained with all the vegetables on the Peat with Cu being the only micro-nutrient applied. Symptoms of which were suspected to be Boron deficiency were observed on the leafy vegetables, e.g. cauliflower and cabbage. It would be desirable to establish whether any of those micro-nutrients are essential in the large scale production of vegetables. Research elsewhere has indicated that micro-nutrients are necessary for successful production of vegetables.

5.5 Time of Planting Studies

The results obtained indicates that the ideal season for growing vegetables would be the period November - March. However, to provide greater flexibility to BRUMDEC, it would be desirable that vegetable production be done during the other months of the year. Investigations should be done with those vegetables for which markets are available to establish the package of practices which must be followed for their successful production during the different seasons.

APPENDIX I

Cabbage Varietal Evaluation Trial - Four Paths Clay Loam - 204

Analysis of Variance

Source	df	ss	variance	F
Total	11	44.44	4.04	
Replications	2	1.89	0.95	
Varieties	3	34.90	11.59	8.83*
Errors	6	7.85	1.31	

*Significant at 5% level

Average Yields in Kilograms per hectare

Varieties	kg/ha
K.K. Cross	21,629
Y.R. Summer	21,333
Roundup	14,740
Danish Ball Head	13,259

L.S.D. between variety totals at 5% level - 5084 kg/ha
" " " " 1% " - 7702 kg/ha

APPENDIX II

Cabbage Varietal Evaluation Trial - Morass Peat Soil - 152

Analysis of Variance

Source	df	ss	variance	F
Total	14	384.04		
Replications	2	3.09	1.55	
Varieties	4	360.29	90.07	34.91**
Errors	8	20.66	2.58	

** Significant at the 1% level

Average Yields in Kilograms per hectare

Variety	kg/ha
K.K. Cross	46,293
Y.R. Summer	36,593
Roundup	24,148
Danish Ball Head	20,148
Early Jersey Wakefield	17,403

L.S.D. between variety totals at 5% level - 6711 kg/ha
" " " " " 1% " - 9756 kg/ha

APPENDIX III

Lettuce Varietal Trial

Analysis of Variance

Source	df	ss	variance	F
Total	8	26.14		
Varieties	2	21.73	10.87	15.10**
Replications	2	1.52	0.76	
Errors	4	2.89	0.72	

** Significant at 1% level

Average Yields in Kilograms per Hectare

Variety	kg/ha
Minetto	24,666
Great	23,111
Mignonette	16,600

L.S.D. between variety totals at 5% levels - 1393 kg/ha
" " " " " 1% " - 2076 kg/ha

APPENDIX IV

Tomato Varietal Evaluation Trial - Four Paths Clay Loam - 204

Analysis of Variance

Source	df	ss	variance	F
Total	20	47.15		
Replications	2	2.94	1.47	
Varieties	6	38.10	6.35	12.45**
Errors	12	6.11	0.51	

** Significant at 1% level

Average Yields in Kilograms

Variety	kg/ha
Floradade	35,489
Tropic	33,400
Roma VF	29,844
Manapal	28,378
Manalucie	28,156
Walter	27,178
Oxheart	26,067

APPENDIX V

Tomato Varietal Evaluation Trial - Morass Peat Soil - 152

Analysis of Variance

Source	df	ss	variance	F
Total	20	563.93		
Replications	2	2.16	1.08	
Varieties	6	82.88	0.404	
Errors	12	478.89	34.20	

F not significant at 5% level

Average Yields in Kilograms per Hectare

Variety	kg/ha
Floradade	75,039
Oxheart	72,121
Roma VF	71,938
Walter	64,419
Manapal	64,074
Tropic	63,863
Manalucie	59,555

APPENDIX VI

Tomato Fertilizer Trial on Four Paths Clay Loam

Analysis of Variance

Source	df	ss	Variance	F
Total	23	116.25		
Replications	2	3.52	1.76	
Treatments	7	93.00	13.29	9.43**
Errors	14	19.77	1.41	

**Significant at 1% level

Average Yields in Kilograms per hectare

Treatments			kg/ha
N	P	K	
45	135	90	25,111
60	90	135	25,333
45	90	90	14,777
45	135	135	13,555
60	135	135	13,555
60	90	90	14,000
45	90	135	13,333
60	135	90	11,333

L.S.D. between Fertilizer Treatment total at 5% level - 1488 kg
" " " " " at 1% " - 2067 kg

APPENDIX VII

Carrot Fertilizer Trial - Four Paths Clay Loam - 204

Analysis of Variance

Source	df	ss	Variance	F
Total	23	11.207		
Replications	2	0.207	0.104	
Fertilizer Treatments	7	7.530	1.076	4.34**
Errors	14	3.470	0.248	

** Significant at 1% level.

Average Yields in Kilograms per hectare

Treatments			kg/ha
N	P	K	
30	90	120	3549
30	135	120	5494
30	135	180	5246
30	90	180	5617
60	90	120	9598
60	135	120	7284
60	90	180	7347
60	135	180	7438

APPENDIX VIII

Rainfall Data

August to December, 1981

	August	September	October	November	December
1.	-	13.0	-	10.0	-
2.	-	-	-	-	-
3.	-	-	6.0	11.5	-
4.	1.0	-	-	11.0	-
5.	-	3.5	0.5	13.0	-
6.	-	4.5	28.0	2.0	-
7.	-	3.0	68.5	-	-
8.	-	3.0	3.0	-	-
9.	-	18.5	3.5	3.5	-
10.	1.5	1.5	1.5	1.5	-
11.	-	-	0.5	0.5	-
12.	0.5	-	2.5	2.5	-
13.	-	36.0	7.0	7.0	-
14.	27.5	-	0.5	0.5	-
15.	1.0	-	-	2.5	-
16.	-	-	-	-	-
17.	-	-	-	-	-
18.	-	-	14.0	-	-
19.	-	18.0	3.0	18.5	-
20.	20.0	7.0	6.5	-	-
21.	1.5	-	9.5	20.2	-
22.	-	-	5.5	20.1	-
23.	-	-	16.0	21.2	-
24.	10.5	-	2.5	19.9	-
25.	11.5	42.0	-	21.7	-
26.	28.0	6.0	11.0	19.6	-
27.	-	31.0	45.0	20.8	-

APPENDIX VIII cont'd

	August	September	October	November	December
28.	-	1.0	8.5	19.9	-
29.	1.0	2.0	2.0	18.9	-
30.	-	-	4.5	17.6	-
31.	0.5	-	-	-	-
Total in mm	104.5	190.0	249.5	284.4	-
Total in ins.	4.11	7.48	9.82	11.20	-

APPENDIX IX

Rainfall Data

January to May, 1982

	January	February	March	April	May
1.	17.0	0.5	-	2.0	1.0
2.	0.5	-	7.0	0.5	-
3.	-	-	-	-	1.5
4.	-	-	-	-	7.0
5.	0.5	25.5	-	1.0	-
6.	-	0.5	-	-	-
7.	0.5	3.5	-	-	-
8.	-	-	-	-	5.5
9.	-	-	-	-	50.0
10.	-	0.5	1.5	-	20.0
11.	-	32.5	-	-	86.0
12.	-	1.5	-	-	-
13.	-	19.5	-	34.0	45.0
14.	-	1.0	-	68.5	23.0
15.	-	-	-	16.5	1.0
16.	-	-	-	10.0	13.5
17.	-	-	-	4.0	58.0
18.	-	-	-	0.5	99.0
19.	-	-	5.0	42.5	-
20.	-	-	-	6.0	-
21.	-	-	5.5	0.5	1.0
22.	-	-	-	-	2.0
23.	-	-	-	1.5	0.5
24.	3.0	-	-	11.0	16.0
25.	6.0	-	-	-	11.0
26.	-	-	4.0	-	12.5
27.	28.5	-	7.0	-	2.0

APPENDIX IX cont'd

	January	February	March	April	May
28.	18.5	-	-	12.0	2.0
29.	14.5	-	-	0.5	7.0
30.	-	-	-	10.8	2.0
31.	1.0	-	5.5	-	12.1
Total in mm	91.5	85.0	37.0	319.0	560.6
Total in ins.	3.60	3.35	1.46	12.56	22.07

APPENDIX X

Maximum and Minimum Temperatures

August to December

(°Celsius)

	August max/min		September max/min		October max/min		November max/min		December max/min
1.			32.8	19.8	34.7	21.8	31.3	20.8	
2.			32.0	20.0	33.8	21.4	31.1	20.0	
3.			32.9	20.0	34.4	22.2	30.9	20.9	
4.			31.9	20.6	33.2	21.3	30.0	21.9	
5.			33.0	21.1	33.8	21.0	27.0	22.9	
6.			33.1	20.9	34.0	21.6	29.0	23.9	
7.			33.6	20.5	32.0	20.7	31.7	21.5	
8.			33.8	20.7	32.2	21.3	31.1	22.1	
9.			33.9	22.3	33.9	21.1	33.0	21.9	
10.	34.1		29.7	21.2	32.5	22.0	32.5	22.0	
11.	33.9	21.7	34.6	22.3	32.0	20.9	32.0	20.9	
12.	34.9	20.8	33.6	20.0	32.0	21.7	32.0	21.7	
13.	32.3	20.6	33.4	20.0	32.0	20.8	32.0	20.8	
14.	24.4	22.1	33.2	21.0	32.6	20.2	32.6	20.2	
15.	30.5	20.3	33.2	22.3	31.4	20.8	31.2	20.8	
16.	31.7	21.4	33.2	21.8	30.7	19.8	31.1	21.0	
17.	21.9	21.9	34.0	21.8	33.1	21.0	31.0	21.9	
18.	32.5	21.8	33.6	21.0	34.3	20.8	31.3	21.5	
19.	33.5	21.1	34.3	23.4	33.0	20.7	32.0	21.0	
20.	33.9	21.1	33.7	22.0	33.6	22.0	32.0	20.2	
21.	33.1	21.0	33.6	21.9	29.1	22.1	32.0	20.2	
22.	32.8	21.4	34.6	21.4	31.6	23.0	30.0	20.1	
23.	33.5	21.9	34.2	21.2	32.3	21.1	29.9	21.2	
24.	32.6	20.8	35.8	22.8	33.1	20.0	28.8	19.9	
25.	31.0	20.1	34.6	20.3	33.1	20.9	32.0	21.7	
26.	24.0	22.2	32.7	20.3	34.0	21.1	32.0	19.6	
27.	32.2	24.9	32.6	21.0	31.7	20.9	31.5	20.8	
28.	34.1	22.7	32.2	20.8	31.0	19.9	31.5	19.9	
29.	31.3	21.8	33.2	21.2	31.0	20.9	32.0	18.8	
30.	33.5	20.4	33.6	21.9	29.2	22.0	32.0	17.6	
31.	33.5	20.1	-	-	30.0	20.1	-	-	
	706.2	450.1	1000.1	635.5	1005.3	655.1	936.0	627.7	Total
	32.1	21.4	32.3	21.3	32.4	21.1	31.2	20.9	Mean

Source: Ministry of Agriculture
Rice Research Station, Elim, St. Elizabeth

APPENDIX XI

Maximum and Minimum Temperatures
January to May, 1982
(°Celsius)

	January max/min		February max/min		March max/min		April max/min		May max/min		
1.	31.9	18.2	30.6	18.9	31.9	14.8	32.3	18.0	31.4	20.5	
2.	31.9	17.0	31.6	18.0	31.4	15.7	27.8	19.8	31.0	21.0	
3.	32.1	18.5	31.1	16.0	32.1	18.2	32.9	19.4	30.0	21.9	
4.	32.0	19.2	29.9	18.8	32.0	17.1	32.8	17.0	30.7	22.0	
5.	32.8	18.3	32.7	19.5	31.0	19.9	32.3	17.9	32.3	22.5	
6.	31.6	20.0	31.9	18.9	31.0	23.3	32.6	19.7	31.1	19.9	
7.	31.0	19.6	31.5	18.1	32.0	20.0	33.0	19.1	32.5	20.2	
8.	30.0	16.4	30.8	18.9	32.9	18.4	34.9	18.3	31.4	20.2	
9.	31.3	15.2	31.6	20.0	32.6	17.8	33.9	19.0	32.9	21.0	
10.	30.4	18.8	31.1	18.3	31.0	19.9	33.8	20.3	32.1	19.9	
11.	30.2	18.0	32.3	17.0	32.3	16.9	33.9	22.5	32.0	19.8	
12.	30.0	18.1	31.7	17.2	28.8	19.3	34.2	18.2	30.9	19.4	
13.	30.2	19.1	32.7	16.7	31.0	16.7	33.7	19.0	32.8	21.0	
14.	30.1	21.1	31.2	17.9	31.1	18.0	31.9	18.5	32.1	21.0	
15.	30.6	18.5	30.7	18.9	31.9	17.8	30.7	18.5	32.0	20.4	
16.	32.0	18.0	30.6	19.1	31.3	17.9	31.9	19.0	31.2	20.5	
17.	30.7	18.2	31.0	16.7	31.4	17.6	31.4	19.6	32.5	21.3	
18.	33.7	14.3	31.3	17.5	31.0	17.9	30.4	19.3	32.0	21.3	
19.	31.9	16.9	31.6	17.9	31.2	17.8	32.2	19.8	31.6	21.0	
20.	31.6	17.9	30.0	17.5	31.9	16.9	31.9	19.1	32.6	21.3	
21.	30.8	15.9	31.3	16.0	31.5	17.2	32.1	19.8	30.8	21.1	
22.	32.1	17.8	30.8	17.3	32.0	16.9	31.8	19.9	31.3	23.2	
23.	28.2	18.4	29.9	16.6	33.5	16.3	31.9	20.1	30.0	23.6	
24.	31.9	17.8	29.0	14.3	32.3	17.0	31.8	21.2	30.7	23.1	
25.	30.4	16.9	30.2	13.2	32.9	19.0	31.8	19.9	28.0	25.0	
26.	30.2	16.1	30.9	15.0	32.0	17.6	31.3	20.8	29.0	21.9	
27.	30.2	16.6	31.1	15.8	32.1	18.2	31.7	19.7	30.0	22.8	
28.	28.6	16.9	-	15.9	32.0	18.7	31.0	19.6	31.2	23.8	
29.	30.2	17.9	-	-	31.7	19.8	-	21.8	32.0	23.6	
30.	31.0	17.9	-	-	30.9	18.5	-	-	32.2	24.0	
31.	26.0	19.0	-	-	32.5	18.8	-	-	29.0	24.8	
	921.9	552.5	871.1	485.9	983.2	559.9	901.9	564.8	969.3	673.2	Total
	30.7	17.8	31.1	17.3	31.7	18.0	32.2	19.4	31.3	21.7	Mean

Source: Ministry of Agriculture, Rice Research Station, Elim, St. Elizabeth

AGRICULTURE IN JAMAICA

Collection of papers of the Office of IICA in Jamaica

1977 - 1978

No. I - 1 Fritz Andrew Sibbles, "Basic Agricultural Information on Jamaica Internal Document of Work", January 1977

No. I - 2 Yvonne Lake, "Agricultural Planning in Jamaica", June 1977

No. I - 3 Aston S. Wood, Ph.D., "Agricultural Education in Jamaica", September - October 1977

No. I - 4 Uli Locher, "The Marketing of Agricultural Produce in Jamaica", November 1977

No. I - 5 G. Barker, A. Wahab, L. A. Bell, "Agricultural Research in Jamaica", November 1977

No. I - 6 Irving Johnson, Marie Strachan, Joseph Johnson, "Land Settlement in Jamaica", December 1977

No. I - 7 Government of Jamaica, "Agricultural Government Policy Papers", February 1978

No. I - 8 Jose Emilio Araujo, "The Communal Enterprise", February 1980

No. I - 9 IICA and MOAJ, "Hillside Farming Technology - Intensive Short Course", Vols. I and II, March 1978

No. I - 10 Jose Emilio Araujo, "The Theory Behind the Community Enterprise - Seminar in Jamaica", March 1978

No. I - 11 Marie Strachan, "A National Programme for the Development of Hillside Farming in Jamaica", April 1978

No. I - 12 D. D. Henry, "Brief Overall Diagnosis of Hillside Farming in Jamaica", April 1978

No. I - 13 Neville Farquharson, "Production and Marketing of Yams in Allsides and Christiana", May 1978

No. I - 14 R. C. E. McDonald, A. H. Wahab, "Fertility Assessment of Newly Terraced Hillside Soils Using the Microplot Technique - the Allsides Case Study", 1978

No. I - 15 IICA - IDB, "Course in Preparation and Evaluation of Agricultural Projects", Vols. I and II, November 1977

No. I - 16 Neville Farquaharson, "Production and Marketing of Dasheen in Allsides and Christiana", June 1978

1978 - 1979

No. II - 1 O. Arboleda-Sepulveda (IICA-CIDIA), "Agricultural Documentation and Information Network in Jamaica", September 1978

No. II - 2 Victor Quiroga, "National Agricultural Information System", (NAIS-Jamaica) Project Profile, September 1978

No. II - 3 Joseph Johnson, "A Review on Land Reform in Jamaica for the Period 1972 - 1978", September 1978

No. II - 4 Neville Farquharson, "ABC of Vegetable Farming", A Draft High School Textbook, Vols. I, II, III and IV, February 1979

No. II - 5 Jerry La Gra, "Elements of an Agricultural Marketing Strategy for Jamaica", March 1979

No. II - 6 D. D. Henry, I. E. Johnson, "Agricultural Extension Service in Jamaica", March 1979

1979 - 1980

No. III - 1 H. R. Stennett, "Watersheds of Jamaica and Considerations for an Ordinal Scale of their Development", July 1979

No. III - 2 IICA-MAJ, "Hillside Farming in Jamaica", A Training Seminar, December 1978

No. III - 3 A. L. Wright, A. H. Wahab, H. Murray, "Performance of Six Varieties of Red Peas (Phaseolus vulgaris L.) on a Newly Terraced Ultisol in Jamaica", September 1979

No. III - 4 IICA/Jamaica Staff, "Agro-Socio-Economic Sample Survey of Allsides - Trelawny, Jamaica", September 1979

No. III - 5 IICA-MOAJ, "An Approach to Agricultural Settlement of Hilly Lands", October 1979

No. III - 6 IICA-MOAJ, "Tree Crops of Economic Importance to Hillside Farms in Jamaica", October 1979

No. III - 7 Canute McLean, "Production and Marketing of Peanuts", November 1979

1980

No. IV - 1 Joseph Johnson, "Production and Marketing of Red Peas in the Hilly Areas of Jamaica", January 1980

No. IV - 2 Lyn Snuffer, "Rural Women: An Annotated Caribbean Bibliography with special reference to Jamaica", January 1980

No. IV - 3 Vincent Campbell, Abdul Wahab, Howard Murray, "Response of Peanut (Arachis hypogaea L.) on a Newly Terraced Ultisol in Jamaica", January 1980

No. IV - 4 P. Aitken, A. Wahab, I. Johnson, A. Sahni, "Agro-Socio-Economic Survey - Pilot Hillside Agricultural Project 'PHILAGRIP' Southern Trelawny", February 1980

No. IV - 5 Glenys H. Barker, "Bibliography of Literature relating to Research and Development in the Agricultural Sector of Jamaica 1959 - 1979", March 1980

No. IV - 6 Milton R. Wedderburn, "Allsides Farmers' Pre-Cooperative A Socio-Economic Assessment", March 1980

No. IV - 7 Adele J. Wint, "The Role of Women in the Development Process", April 1980

No. IV - 8 Milton R. Wedderburn, "The Co-operative Input in the Development of the Pilot Hillside Agricultural Project (PHILAGRIP)", April 1980

No. IV - 9 MOJ/IICA/CARDI, Fruit Trees Seminar - "Research & Development of Fruit Trees", June 1980

No. IV - 10 Henry Lancelot, "Traditional Systems in Hillside Farming, Upper Trelawny, Jamaica", June 1980

No. IV - 11 IICA/Jamaica, "Pilot Hillside Agricultural Project", (PHILAGRIP), Project Document. Vols. I, II and III, June 1980

No. IV - 12 A. Wahab, I. Johnson, P. Aitken, H. Murray and H. Stennett, "Highlights of the Pilot Hillside Agricultural Project at Allsides", July 1980

No. IV - 13 I. Johnson, A. Wahab, P. Aitken, H. Payne, "Benchmark for a Project Profile for Developing a Peanut Industry in Jamaica", July 1980

No. IV - 14 P. Aitken, A. Wahab, I. Johnson, "The Allsides Post Peasant", August 1980

No. IV - 15 Norma Munguia, Percy Aitken, Abdul Wahab, Irving Johnson, "Salt Extraction by Solar Energy", A Mini-project, September 1980

No. IV - 16 Abdul H. Wahab, Percy Aitken-Soux, Irving E. Johnson and Howard Murray, "The Allsides Project in Jamaica - Developmental Potentials of Hillside Agriculture", September 1980

No. IV - 17 P. Aitken, A. Wahab, I. Johnson, A. Sahney and N. Munguia, "Rural Women Survey", Vols. I, II and III, October 1980

No. IV - 18 P. Aitken, I. E. Johnson, A. Wahab, "Assessment of Employment Among Small Hillside Farmers of Jamaica", November 1980

No. IV - 19 IICA/Jamaica "Pilot Hillside Agricultural Project", (PHILAGRIP), Final Project Document. October 1980.

No. IV - 20 P. Aitken, A. Wahab, I. E. Johnson, Bo-Myeong Woo, "IICA Evaluation of the First Phase FSB Allsides Project", (Internal Document of Work), November 1980

No. IV - 21 MINAG/IICA/CARDI - "Seminar on Multiple Cropping", December 1980

1981

No. V - 1 N. Munguia, P. Aitken, A. Wahab, I. Johnson, "Smoke Curing of Fish (as a household industry in Rural Jamaica)", January 1981

No. V - 2 P. Aitken, A. Wahab, I. Johnson, "Under-employment - It's Relation to the Agricultural Sector and Considerations for its Management", January 1981

No. V - 3 D. D. Henry, J. R. Gayle, "The Culture of Grafted Pimento (as spice crop for Allsides, Jamaica)", January 1981

No. V - 4 Abdul H. Wahab, Noel Singh, "Agricultural Research in Jamaica", February 1981

No. V - 5 P. Aitken-Soux, A. H. Wahab, I. E. Johnson, "Country Level Action Plan (CLAP)", May 1981

No. V - 6 P. Aitken-Soux, A. H. Wahab, I. E. Johnson, "Overview of Agricultural Development in Jamaica", May 1981

No. V - 7 Samuel Thompson, I. E. Johnson, P. Aitken-Soux, Abdul Wahab, "The Land Development & Utilization Act 1966", July 1981

No. V - 8 Abdul Wahab, Percy Aitken-Soux, Irving Johnson, Bo-Myeong Woo, Howard Murray, Joseph Dehaney, "The Experiences of Jamaica in the Management of Agricultural Production on Hillsides", July 1981

No. V - 9 Dave Hutton, Abdul Wahab, Howard Murray, "Yield Response of Yellow Yam (Dioscorea Cayenensis) After Disinfesting Planting Material of Pratylenchus Coffeae", July 1981

No. V - 10 Elaine Montague-Gordon, Abdul H. Wahab, Joseph Dehaney and Audrey Wright, "Performance of Eleven Varieties of Dry Beans (Phaseolus vulgaris) Over Two Successive Seasons on the Hillsides of Jamaica", August 1981

No. V - 11 Dave G. Hutton, Abdul H. Wahab, "Position Paper on Root Crops in Jamaica", August 1981

No. V - 12 Percy Aitken-Soux, Abdul H. Wahab, Irving E. Johnson, "Technical Assistance for the English Speaking Caribbean (Considerations for an IICA Strategy)" (Internal Document of Work), September 1981

No. V - 13 Bo-Myeong Woo, Abdul H. Wahab, Joseph Dehaney, "Crop Production on Hillsides using non-Bench Terracing Alternative Measures for Soil Conservation (first year's results of the Olive River Soil Conservation studies)", September 1981

No. V - 14 Abdul H. Wahab, Percy Aitken-Soux, Irving E. Johnson, Bo-Myeong Woo, Howard Murray and Joseph Dehaney, "Agricultural Production on Hillsides - the Allsides Project Case Study", September 1981

No. V - 15 D. G. Hutton, A. H. Wahab and J. Dehaney, "Investigating Critical Levels of Dry Rotting of Yellow Yam (Dioscorea Cayenensis) Planting Material, the Benefits of Disinfesting the Heads of Pratylenchus Coffeae and of After-Planting Nematicide Treatments", September 1981

No. V - 16 D. G. Hutton, A. H. Wahab, H. Murray and J. Dehaney, "Critical Levels of Dry Rotting of Yellow Yam (Dioscorea Cayenensis) Planting Material and Yield Responses After Disinfesting Heads of Pratylenchus Coffeae and After Post-Plant Nematicide Applications", September 1981

No. V - 17 E. Ayer and J. Reyes, "Seminar on Mediterranean Fruit Fly", September 30, 1981

No. V - 18 Bo-Myeong Woo, "Erosion Control Works in Korea", October 1981

No. V - 19 Irving E. Johnson and Percy Aitken-Soux, "Country Level Action Plan (CLAP)" (Third Revision - Internal Document of Work), October 1981

No. V - 20 Humberto Pizarro, "Programme of Work to Establish Guidelines for the Effective Administration, Operation and Maintenance of the Irrigation and Drainage District in the BRUMDEC Project" November 1981

No. V - 21 Humberto Pizarro, "The Operation of the Drainage System in the Black River Upper Morass Project", November 1981

No. V - 22 Humberto Pizarro, "Recommendations for Land Use and Irrigation Needs in the BRUMDEC Project", November 1981

No. V - 23 Humberto Pizarro, "Organization, Operations and Maintenance of the Irrigation System in the BRUMDEC Project", November 1981

No. V - 24 Humberto Pizarro, "Basic Information for Planning Water Management in the BRUMDEC Project", November 1981

1982

No. VI - 1 Vivian Chin, "Rice Research and Production in the BRUMDEC Project State-of-the-Art Review, Identification of Constraints and Interim Recommendations and Budget for Establishing 405 Hectares (1,000 acres) of Rice on the Clay Soils at BRUMDEC", January 1982

No. VI - 2 Vivian Chin, "Programme of Work for the Short-Term Adaptive Production-Oriented Research on Rice in the BRUMDEC Project", January 1982

No. VI - 3 Claude Grand-Pierre, "Adaptive Research for Grain Production (BRUMDEC) - A Short-Term Programme", January 1982

No. VI - 4 Claude Grand-Pierre, "Experimental Procedures for Grain Crops Research in the BRUMDEC Project", January 1982

No. VI - 5 Charles Kennard, "Summary of the Proposed Programme of Work for Adaptive Production Oriented Research (Short-Term) in Vegetable Production in the BRUMDEC Project", January 1982

No. VI - 6 Charles Kennard, "Vegetable Production (BRUMDEC) - Review and Proposed Short-Term Adaptive Production Oriented Research Programme", January 1982

No. VI - 7 Bo-Myeong Woo, "Olive River Run-Off Plots - Description of the Experiment", January 1982

No. VI - 8 Vivian Chin, "Fertilizer Experiments in BRUMDEC (Second Quarterly Report)", January 1982

No. VI - 9 Claude Grand-Pierre, "Third Quarterly Report of the Short Term Production Oriented Sorghum Research Programme", January 1982

No. VI - 10 Bo-Myeong Woo, Ministry of Agriculture,"Crop Production on Hillsides Using Non-Bench Terracing Alternative Measures for Soil Conservation", February 1982

No. VI - 11 Philemon Hoilett, Ina Pyne, Calvin Gray, Renford Baker, and Michel Eldin, "Workshop on Agroclimatic Zoning - case study Kingston, Jamaica", April 1982

No. VI - 12 Charles Kennard, "Vegetable Production Programme - BRUMDEC Second Quarterly Report", Period December 19, 1981 - March 18, 1982, April 1982

No. VI - 13 Claude Grand-Pierre, "Final Report on Grain Experimental Work in BRUMDEC", (Contract I), May 1982

No. VI - 14 J. Y. Richmond, Ph.D., "Lab Safety Seminar - Animal Health - Conferences of Jonathan Richmond", June 1982

FECHA DE DEVOLUCION			
10 ENE	'[illegible]		