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Some nutritional experiments with aeroids at Central Experiment Station — L. Cross and L. Wilson

Introduction

The importance of local foodcrops have increased in recent years throughout the Caribbean area. Increased production can be accomplished in one of two ways — increasing the areage under the crop and increas= the yield per acre. Little is known about the nutritional requirements of foodcrops in the tropics. Deficiency symptoms have been recorded for a few of these crops namely, pigeon peas (Nichols 1964), sweet potatoes and tannia, **Xanthosoma saggitifolium** (Spence and Ahmad 1966). From a production stand point, however greater emphasis must be placed on the optimum levels of balanced nutrients required by the plant for maximum growth and yield. In an attempt to find out the response of rootcrops to nitrogen, phosphorus and potash a series of studies on tannia, **Xanthosoma saggitifolium**, dasheen, **Colocasia esculenta** var **glo= bulifera** and eddoes **Colocasia eculenta** were begun in 1960 at Central Experiment Sation of the Ministry of Agriculture. A brief account of what was attempted and the results obtained to date are reported in this paper.

Methods

A 2^3 factorial design was laid out for each of the three crops. Each ex= periment thus consisted of eight treatments replicated four times. The following rates of fertilizers were applied — 100 lbs/acre N, 50 lbs/ac. P_2O_5, 50 lbs/ac. K_2 0 unlike the practice in Trinidad of growing dasheen in streams or close to stream of running water, all three crops were plant= ed a "commercial type" planting i.e. with adequate drainage on properly prepared land. The soil type was Cunupia Clay. Dasheen and eddoes were planted at a spacing of 3ft. by 2ft. while tannia was planted at a spacing of 4ft by 4ft. The fertilizers were applied about one month after planting in one application.

Results

The final yields expresed in lb per acre over a period of five (5) years for tannia and seven (7) years for eddoes and dasheen are shown in Tables 1, 2 and 3 respectively.

TABLE 1

YIELD OF TANNIA FROM 1962—1966

Treatments	1962	1963	1964	1965	1966	Total
C	17,552	8,217	14,757	11,529	8,497	60,552
N	18,418	8,211	16,828	12,469	9,597	65,523
P	18,156	7,560	14,015	11,420	9,944	61,095
NP	18,540	9,096	18,442	10,685	11,002	67,765
K	16,983	8,492	16,426	10,726	9,921	62,548
NK	16,973	8,984	17,822	15,030	9,463	68,272
PK	18,785	8,156	16,181	11,706	9,073	63,901
NPK	17,688	8,211	17,985	12,530	9,332	65,746
Total	143,095	66,927	132,456	96,095	76,829	515,402

ANALYSIS OF VARIANGE

Source	DF	SS	MS	F	F. observed 5%	F. observed 1%
Blocks	4	563636779	140,909,195	141.40 **	2.71	4.07
Treatments	7	11758478	1,679,783	1,69 n.s.	2,36	3.36
Error	28	27903585	996,557			
Total	39	603298842				

TABLE 2

YIELD OF EDDOES FROM 1960—1966

Treatments	1960	1961	1962	1963	1964	1965	1966	Total
C	15,079	40,501	19,380	7,921	19,738	9,205	13,169	124,993
N	20,221	43,473	22,497	11,957	26,210	12,835	19,316	156,509
P	17,272	42,611	21,827	9,598	21,226	9,812	14,242	136,588
NP	18,451	38,207	22,031	13,965	24,426	10,538	17,190	144,808
K	17,090	35,985	22,912	10,287	22,191	10,289	12,972	131,726
NK	18,981	37,733	21,296	12,625	26,060	9,910	18,943	145,548
PK	16,818	37,650	23,385	11,042	25,899	11,456	16,127	142,377
NPK	17,922	45,448	21,003	14,833	27,755	9,662	22,228	158,901
Total	141,834	321,608	174,331	92,278	193,505	83,707	134,187	1,141,450

ANALYSIS OF VARIANCE

Source	D.F.	SS	MS	F	F Observed	
Blocks	6	4,847,823,125	807,970,521	225.67	2.32	3.26
Treatments	7	135,877,177	19,125,311	5.34 **	2.24	3.10
Error	42	150,675,266	3,580,316			
Total	55	5,132,073,566				

TABLE 3

DASHEEN

TRS	1960	1961	1962	1963	1964	1965	1966	Total
C	8,024	17,081	11,187	14,607	14,619	6,643	12,879	85,040
N	6,474	19,094	12,954	15,360	14,555	7,126	12,506	88,069
P	9,520	22,640	13,440	15,756	15,436	7,496	10,626	94,914
NP	8,568	18,772	13,128	15,348	16,795	8,272	19,226	100,109
K	9,874	21,629	14,804	15,454..	15,939	7,377	16,203	101,280
NK	9,058	19,315	16,345	14,999	16,427	7,527	13,309	96,980
PK	10,618	16,079	14,315	14,829	18,426	8,111	10,999	93,377
NPK	8,704	18,461	16,171	17,291	20,788	7,999	11,870	101,284
	70,840	153,071	112,344	123,644	132,985	60,551	107,618	761,053

ANALYSIS OF VARIANCE

Source	D.F.	S.S.	M.S.	F	F.observed 5%	F.observed 1%
Blocks	6	818,502,739	136,417,125	46.14**	2.32	3.26
Treatments	7	36,956,088	5,279,441	1.79n.s.	2.24	3.10
Error	42	124,210,101	2,957,383			
Total	55	979,668.928				

The differences between years is highly siginficant. Variation in rainfall and in rainfall pattern could account for this. Treatment differences are not significant except in the case of nitrogen applied to eddoes.

Apart from finding that edoes will respond favourably to nitrogen fertilizers, the results of these series of experiments gave no real understanding of the behaviour of these crops or how to increase their yield by fertilization under Trinidad conditions. In an attempt to study these results in greater detail it was decided in the last year (1966) to combine the measurement of final yield with an analysis of the concentration of nutrients in the soil and in the plant.

Chemical analysis

Composite samples both of the leaves and of the soil was taken in each plot or treatment at the following four times during the life restoring of the plant — at about one (1) month, three (3) months, four and a half ($4^1/_2$) months and five (5) month stages of growth.

The soil was analysed according to the following standard techniques:

The soil sample was air dried, ground and passed through a 2 mm sieve. The pH, O.M. N, P_2O_5, Mg, and Ca were then measured.

The pH. was measured by a pH meter and glass electrode using a 10/25 aqueous suspension of soil.

The O.M. was determined by oxidation with $H_2SO_4/K_2CN_2O_7$.

N was found by the Kjeldahl Technique

P_2O_5 was extracted with Truog's solution and estimated by the Ammonium Molybdate — Stannons Chloride Method.

Cations were extracted with Ammonium Acetate Solution. Potassium and Calcium were determined by Flame Photometry, and magnesium was determined by "Versenate" Titration.

The plant analysis were carried out in the following manner.

Using a cork borer, five samples were taken from the youngest opened leaf on ten plants in each plot. This procedure was done twice to obtain duplicate samples of leaf Laminae.

Tissue Analysis

Potassium, calcium, magnesium, phosphorus and sodium determination were done on aliquots prepared from oven dried, wet ashed, leaf borings.

Wet ashing was done in a nitric-sulphuric-perchloric acid mixture (Tenary's mixture) — (Jackson 1960).

Potasium & Sodium contents were determined by flame photometry.

Calcium & Magnesium contents were estimated by versenate titration (Jackson 1960).

Phosphorus was estimated spectrophotometrically by the molybdinum blue method (Dickman and Bray 1960).

Total Nitrogen determination were done by the Markham's semi-micro apdaptation of the Kjeldahl procedure. (Markham 1945).

The results of all these analyses were tabulated and plotted on graphs.

To date only preliminary observations have been made on the data obtained. Nevertheless the following general pattern emerged.

1. The demand for most nutrients was highest within the first 90—120 days of plant growth then decreasing, some times rapidly. Any program either for additional fertilizers or folios sampling techniques must, as a result, be done early in the growth or life history of the plant.

2. Nitrogen tends to increase the absorption of phosphorus.
3. The Potassium content of Cunupia clay appears to be adequate
4. Since no Mg or Ca was added to the soils then there should be little or no change over the growing period in pattern of soil content of Mg or Ca throughout the various treatments. In fact the pattern for soil Ca and Mg are almost identical in all 8 plots. Mg and Ca supply appear to be adequate.

A more detailed study of the data including the Nitrogen analysis which have so far not been put on graphs should give us a better understanding of the behavior of these rootcrops and their need for additional nutrients under the soil and climate conditions of these experiments.

It is also planned to continue the crop logging techniques with siutable modifications based on the knowledge gained from our present data.

APPENDIX I

EDDOES FERTILIZER TRIAL

	Date of Planting	—	15th/5th/66
Leaf			
	First sampling	—	37 days later
	Second sampling	—	82 days after planting
	Third sampling	—	137 days after planting
	Fourth sampling	—	141 days after planting
Soil			
	First sampling	—	33 days after planting
	Second sampling	—	85 days after planting
	Third sampling	—	167 days after planting
	Fourth sampling	—	170 days after planting
Time of Fertilizer application		—	45 days after planting
Dates of Harvesting		—	8th, 10th & 11th/11th/66
Scales			
	Time scale	—	1" = 20 days (throughout)
Phosphorus	(a) Leaf	—	1" = 0.2% of total Phosphorus
	(b) Soil	—	1" = 2 parts per million available P_2O_5
Potassium	(a) Leaf	—	1" = 0,5% of total Potassium
	(b) Soil	—	1" = 40 parts per million available K_2O
Magnesium	(a) Leaf	—	1" = 0,2% of total Magnesium
	(b) Soil	—	1" = 0.5 million equivalent % available Magnesium
Calcium	(a) Leaf	—	1" = 0.5% total Calcium
	(b) Soil	—	1" = 2 millions equivalent % available Calcium

APPENDIX II

DASHEEN FERTILIZER TRIAL

Date of Planting	—	20th/5th/66

Leaf

First sampling	—	37 days after planting
Second sampling	—	83 days after planting
Third sampling	—	138 days after planting
Fourth sampling	—	144 days after planting
Fith sampling	—	215 days after planting

Soil

First sampling	—	29 days after planting
Second sampling	—	81 days after planting
Third sampling	—	163 days after planting
Fourth sampling	—	215 days after planting
Fith sampling	—	253 days after planting
Time of Fertilizer application	—	40 days after planting
Dates of Harvesting	—	25th & 28th/1st/67

Scales

Time scale		—	1" = 30 days (throughout)
Phosphorus	(a) Leaf	—	1" = 0.1% total Phosphorus
	(b) Soil	—	1" = 1 parts per million available P_2O_5
Potassium	(a) Leaf	—	1" = 1% total Potassium
	(b) Soil	—	1" = 100 parts per million available K_2O
Magnesium	(a) Leaf	—	1" = 0.2% of total Magnesium
	(b) Soil	—	1" = 1 million equivalent % Magnesium
Calcium	(a) Leaf	—	1" = 0.5% of total Calcium
	(b) Soil	—	1" = 2 million equivalent % Calcium