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POTENTIAL OF CASSAVA UTILIZED AS A WINDBREAK AND CASH CROP WITH CAVENDISH BANANA RECEIVING VARYING LEVELS OF NEMATICIDES AND FERTILIZERS

C. Ramcharan & G. Morris

ABSTRACT

Local brown stick cassava (Manihot esculenta Crantz) provided adequate windbreak effect and gave good yields when grown with Cavendish Banana in a modified inter-crop system. Cassava cuttings were planted at an equidistance of 1.22m between pairs of banana plants that were spaced 1.8m apart. Best yields were obtained from cassava growing between banana receiving either poultry manure (5.5 kg/mat) or cattle manure (4 kg/mat). Manure and 10.10.10 treated bananas had the next best influence on cassava root production followed by Ammonium sulphate (4.2 kgms/mat). Of the nematicide treatments on banana Mocap 10%G (112 g/mat/6 months) had the best effect on cassava yields. Most other nematicide treatments and Diazinon 2E drenches did not significantly increase yields of cassava over control. In its seven months of growth, cassava crop required a total of 33 man hours/.11 ha and yielded an average of 8,000 kg/ha with a net return of $3,302/ha. Since production costs were shared between cassava and banana the cost of producing each was relatively low as opposed to separate production systems.

INTRODUCTION

According to a 1978 Agriculture census there were 8,542 ha of agricultural land in St. Croix, U.S.V.I. 87% of this was in pastures and uncultivated lands, with the remaining acres cultivated mainly with a mixture of fruits and vegetables (Appendix 1). Such a relatively small acreage available for food crops makes intercropping the agricultural system that will utilize the land to the fullest and give farmers the highest returns.

Cassava, a ubiquitous root crop, grows well in most soils of St. Croix (5). Bananas are grown mainly as a minor backyard crop but the mostly flat, dry, and windy conditions of St. Croix (1) make this a risky crop for large scale cultivation. The low nutrient status (7) and high incidence of nematodes of most local soils (3) also limit the growth of the banana plant. There are many reports of cassava grown as an intercrop (2,4) and several tree and food crops have been intercropped with bananas (6).

This experiment was initiated in March 1980 to evaluate the feasibility of growing local brown stick cassava in a modified intercrop system with Cavendish Banana (Musa sp. AAA) treated with nematicide and fertilizer combinations.

MATERIALS AND METHODS

Cavendish Banana plants, as bull heads were planted on March 26, 1980 at a plant spacing of 1.8m and row spacing of 3.0m.

A split plot design was used for this experiment with main plots nematicide treatments and subplots fertilizers. Each main plot contained 8 plants so that there were 8 plots and 64 plants in each of 3 replicates. A total area of 1,071 m^2 or .11 ha was used. Diazinon although not a commonly used nematicide was included as a soil drench to test its nematicide properties.

Nematicides used were Furadan (Carbofuran) 5% G at 20 and 40 g/plant; Mocap (Ethoprop) 10% G at 56 and 112 g/plant; Dasanit (Fensulfothion) 15% at 70 g/plant; Diazinon 2E at 2 and 6 Tbsp/gal/plant and a control with no soil treatment. Furadan was applied at planting and at 4 month intervals. Mocap and Dasanit at planting and at 6 month intervals. Diazinon was drenched at 2 month intervals.

Fertilizers used were: 728 g 10.10.30/plant, 280 g 21.0.0/plant; 560 g 21.0.0/plant; 560 g 10.10.10/plant; 1120 g 10.10.10/plant; 5.5 kg poultry manure/planting hole; 4 kg cattle manure/planting hole; 840 g 10.20.10/plant. Fertilizers were applied around banana plants in an increasing circular band every 2 months; manures were applied at planting only.

On April 26, 1982 local brown stick cassava stem cuttings 20 cm long were interplanted with bananas. Sticks were placed on the windward side of banana rows with one 20 cm stick between 2 banana plants at an equidistance of 1.22 m and inserted at a 45° angle with upper end away from banana row (Fig. 1). Drip irrigation system consisted of 1/2" polyethylene main lines and 1/4 inch laterals with 2 emitters (1.5 gal/min at 15 psi) each 1 foot on either side of banana plant. Watering was controlled automatically with an irrometer tensiometer adjusted to maintain soil matrix potential at 35 centibars. Water was supplied from a rain water cistern.

Cassava roots were harvested on November 26, 1980, weighed and graded in the field.

RESULTS AND DISCUSSION

Because of particular random design of fertilizer treatments applied to banana plants, their effects on cassava yield could not be statistically analyzed. However, the following observations (Table 1) were made.

Yields of cassava roots appeared to be highest from plants intercropped between bananas treated with cattle and poultry manures. Yields were

B- Banana

C- Cassava

Drip Irrigation Lines

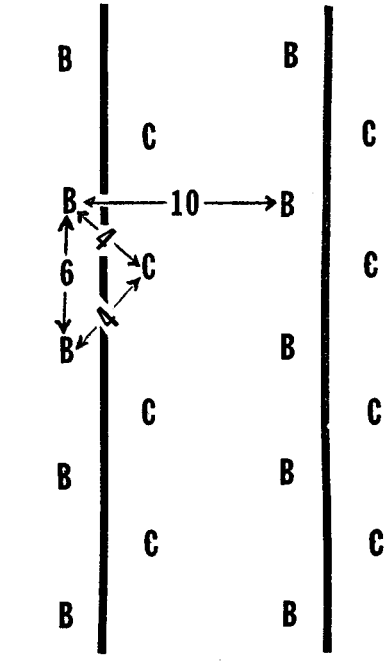

Fig. 1 Modified Intercrop System of Banana/Cassava with Drip Irrigation

Table 1.--Effects of Selected Fertilizer Treatments of Local White Stick Cassava Intercropped with Giant Cavendish Cassava

Treatment[1/]	No. plants harvested	Yield	Yield/ plant	Est. Yield
		(kg)	(kg)	(T/ha)
Cattle manure 4kg + poultry manure 5.5kg	8	38.4	4.8	9.2
21.0.0 4.2 kg	8	32.6	4.1	7.8
10.10.10 2.8 kg + cattle manure 4kg	8	32.7	4.1	7.8
10.10.10 5.6kg + cattle manure 4kg	8	27.6	3.6	6.6
21.0.0 1.42kg + cattle manure 4kg	8	27.4	3.4	6.5
10.10.10 8.2kg	8	25.4	3.2	6.1

1/ Rates applied per 2 banana plants/year.

intermediate from those between bananas receiving either Ammonium Sulphate (4.2 kg) or 10.10.10 (2.8 kg) and cattle manure. Cassava intercrop appeared to be lowest yielding where bananas were treated with either 10.10.10 (5.6 kg) and cattle manure or a combination of Ammonium Sulphate (1.42 kg) and cattle manure.

Nematicide treatment of bananas did not significantly increase yields of cassava roots over non-treated banana plants (Table 2). However in plots receiving Mocap 10% G at 112 g/banana plant cassava yields appeared highest while yields were lowest in those treated with Dasanit 15% g at 70 g/plant.

There have been few reports of positive responses of cassava to inorganic fertilizer treatments with good yields being obtained on a wide range of soil types and soil fertility. However, like most other root crops, cassava will produce better on soils amended with organic matter and local soils have been shown to be low in organic matter content (7). The incorporation of cattle and poultry manure in the planting holes of banana plants seemed to have a beneficial effect on the intercropped cassava while the inorganic fertilizer treatments particularly at higher rates did not produce as good yields. Manures, particularly poultry manure and high rates of Ammonium Sulphate fertilizer also seemed to have a similar effect on root yields. The apparent ineffectiveness of 10.10.10 fertilizer could have been due to its relative insolubility as compared to Ammonium Sulphate.

There are no reports on the effects of soil-applied nematicides used either directly or indirectly on cassava. In this trial the application of nematicides did not improve yield of intercropped cassava but Dasanit 15% G appeared to lower the amount of roots harvested. The apparent increased yield of the high Mocap 10% G treatment was indirect. Several banana plants had to be replaced in these plots, so that cassava plants grew more vigorously and yielded more.

Cassava has been successfully intercropped with maize, bean, sweet potato and a variety of other vegetables and fruits (2,4). In most intercropping systems cassava has been grown mainly as a cash crop. With banana, cassava can provide not only a valuable food and cash intercrop during the first year but create a favorable micro-environment and serve as a good windbreak for young banana plants. Periodic pruning of plants was a relatively easy operation and provided suitable cassava planting material.

The system used in this experiment (Fig. 1) at first appeared to overcrowd banana plants but periodic pruning alleviated this problem. The intercrop pattern also allowed for adequate inter-row mechanical weed cultivation and facilitated application of nematicides and fertilizers.

Nitrogen containing fertilizers such as cattle and poultry manures, and to some extent ammonium sulphate, not only gave good banana growth but also produced better cassava yields.

Table 2.--Effect of Nematicide Treatments on Yield of Local White Stick Cassava Intercropped with Giant Cavendish Banana

Treatment[1/]	No. plants harvested	Yield	Yield/ plant	Est. Yield[2/]
		(Kg)	(Kg)	(T/ha)
Mocap 10%G 56 g	24	100	4.16	8.0 abc
Mocap 10%G 112 g	24	128.2	5.34	10.2 a
Furadan 5%G 20 g	24	103.5	4.31	8.3 abc
Furadan 5%G 40 g	24	101.6	4.23	8.1 abc
Dasanit 15%G 70 g	24	88.4	3.7	7.1 c
Diazinon 2E 2Tbsp/Gal.	24	102.9	4.29	8.2 abc
Diazinon 2E 6Tbsp/Gal.	24	101.8	4.24	8.1 abc
Control	24	102.6	4.27	8.2 abc

1/ Mocap and Dasanit applied at planting and at 6 month intervals. Furadan applied at planting and 4 month intervals. Diazinon applied at 2 month intervals.

2/ Figures followed by same letter or group of letters are not significantly different at the 5% level.

Table 3.--Estimated Cost Returns per Hectare for Cassava Intercropped with Giant Cavendish Banana

Item	Yield	Unit	Cost/Unit U.S.$	Value U.S.$
		Kg		
Cassava	8,000		0.55	$ 4,400.00
Gross Receipt				4,400.00
Variable Costs	Input			
Planting material	1920	Sticks	0.01	19.20
Pruning	29	Hrs.	3.17	91.30
Weed control	130	"	3.17	410.83
Herbicide (Paraquat)	1.2	Pts.	2.50	3.00
Miticide (Dicofol)	2.4	"	3.50	8.40
Tractor	1.00	Ha	11.00	11.00
Labor	24	Hrs.	3.17	76.08
Irrigation labor	6	"	3.17	19.02
Operating capital	6.92	Doll.	7.00	48.44
Sub-total				$ 687.29
Harvest Cost				
Digging & Cutting	91	Hrs.	3.17	$ 289.10
Sub-total				$ 289.10
Total Variable Cost				$ 976.39
Income Above Var. Cost				$ 3,423.61
Fixed Costs				
Equipment	1.00	Ha.	20.64	20.64
Irrigation	1.00	"	82.49	82.49
Other	1.00	"	18.00	18.00
Total Fixed Costs				$ 121.13
Total Costs				$ 1,097.52
Net Returns				$ 3,302.48

Intercrop pattern was also well suited to drip irrigation, where single lines with emitters provided water to both crops at the same time. Dense canopy of banana leaves and cassava foliage would have obstructed efficient overhead irrigation. There appeared to be no competition for soil water, nutrients, or root room between the two crops and there were no pests common to both. Nematicide treatments to banana did not adversely affect yields or cooking quality of cassava roots.

The estimated cost and returns for cassava outlined in Table 3, also substantiate its dual purpose as a windbreak and cash crop. After the initial seven months of the banana crop cassava was harvested at approximately 8,000 kg per hectare. The average wholesale price was estimated at U.S.55¢ per kg. Thus gross income per hectare was calculated at U.S.$4,400.

A large portion of the variable cost during the production process was shared with the banana crop. Consequently, the cost of producing the cassava was relatively low. A reduction in variable costs resulted in greater returns per hectare. Further examination of Table 3 shows that although variable costs were U.S.$923.00, income above variable costs was calculated at U.S.$3,476 per hectare. Thus returns above variable cost were economically encouraging.

Cassava with banana could therefore be an economically viable enterprise when grown in such a modified intercrop system under local conditions. Cassava can be a valuable food and cash crop during the first 7 months of establishment of a banana field providing essential windbreak effect and creating a suitable micro-environment for the banana plants.

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APPENDIX 1

LAND USE ACREAGES OF TOTAL AGRICULTURAL LANDS ON ST. CROIX USVI[1/]

Land Use	Area
	(Ha)
Pastures	6,815
Woodlands	629
Harvested Crop Lands	604
Other	454
TOTAL	8,502

1/ From 1978 Census of Agriculture AC78-A-54 U.S. Dept. of Commerce Bureau of Census, Washington, D.C. 20402.