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ECONOMIC IMPORTANCE OF CASSAVA AS A CARIBBEAN ALTERNATIVE IN ANIMAL FEEDS AND SELECTION OF SUITABLE CULTIVARS FOR THIS PURPOSE (A Jamaican Experience)

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ABSTRACT

During 1987-88, ten varieties of cassava were tested for yields at eleven different sites in Jamaica having different elevations, rainfall and soil types. From two to nine varieties were tested at each site, in a total of thirty-one plots. Planting was at the rate of 5,500 sticks per acre, about double the customary rate.

Average yield with all plots weighted equally was 12.6 tons per acre, about double the national average. The most outstanding varieties were Blue Bud, a sweet variety which averaged 15 tons/acre, and Smalling, a bitter variety which averaged 13 tons/acre. Other promising varieties requiring further testing are Bobby Hanson, E.P., and CO-30.

The results clearly demonstrated the significant increases in yields associated with denser planting rates. There was some indication that yields decreased above 1,900 ft. elevation. No trends with respect to soil texture or average rainfall (by sites) was identified. Costs were J$2,965 with manual land preparation and J$2,490 with mechanical land preparation per acre.

At 1987-88 prices, and using a conservative estimate of 10 tons/acre yields, a farm gate price of J$0.15 per pound is required to cover production costs.

INTRODUCTION

Cassava is one of the crops which has received priority attention from the Government of Jamaica (GOJ) in its efforts to increase import substitution of both food and feed crops. In keeping with this priority, the Inter-American Institute for Cooperation on Agriculture (IICA) has worked in collaboration with the Ministry of Agriculture, with individual farmers and through independent studies in an effort to determine the best cassava varieties for Jamaican soil and climatic conditions, the best alternatives for processing the crop, and the economic viability of cassava as a food and/or feed crop under different price and market conditions.

This publication reports the results of observation tests carried out during 1987 and 1988 at fourteen locations across Jamaica. Additionally, as it is the final report of the IICA/Jamaica series on cassava, it excludes excerpts from the previous publications and in the summary and conclusions brings together the results of its six years of work with cassava in Jamaica, in an integrated form.

Advantages of Cassava

In Jamaica, cassava has always been considered a poor man's crop. This

is true for several reasons. First, the cost of production per acre is among the lowest of all the crops grown on the island. Second, it is capable of producing on soils so poor that they would otherwise be left fallow and grow in weeds. Third, while it responds favourably to moisture, it is capable of producing a good crop under moisture conditions which would be considered a drought for most crops. Fourth, it can be "stored" in the ground for as much as twelve (12) months after reaching maturity. Thus families without access to cooled storage facilities can dig up what is required each week or ten days, and the rest of the crop remains safe in the ground until it is needed. While the quality of the sweet cassava varieties used for human consumption as a tuber may diminish slightly over time, the bitter varieties used for making starch and bammy experience no deterioration. This is also true when it is made into dried chips and used as an ingredient in livestock feeds. Fifth, since the sweet and bitter varieties are difficult to distinguish, there is less danger of praedial larceny -- an important consideration in some areas. The praedial thieves are fearful that they may be stealing a bitter variety, which can cause food poisoning if not properly treated before use. Sixth, low costs per unit of production offer the potential of import substitution for starchy foods and feeds. Finally, due to the relatively low level of purchased inputs and the fairly simple production techniques required, it has much to recommend it for small farmers in developing countries.

Historical Background

Cassava has been important in Jamaica since pre-Hispanic times. When Columbus arrived in Jamaica in 1494, cassava was the main crop being cultivated by the Arawak Indians. It was evidently adapted to the soils and climate of the country.

Despite this long history of cultivation on the Island, cassava has not occupied a very prominent position among Jamaican crops, either in the colonial or post-colonial eras. In contrast, cassava is considered a staple crop in many Central and South American countries, and especially in Columbia, Mexico and Brazil, both as a human food and (to a lesser degree) as livestock feed. On the African continent, cassava is treated as one of the basic crops in many countries, and is prepared and used in a variety of ways both for human consumption and for livestock feed.

METHODS

Variety and adaptability trials

In late 1985 it was agreed by the Ministry of Agriculture (MAG) and IICA that yields and costs per unit of production were key factors in determining the feasibility of increased domestic cassava production to be used as a substitute for imported starchy foods and feeds. It was further agreed that the critical factors to be studied were: yields and costs on production for the most promising varieties available, and the effect of their performance of different soil, elevation and climatic conditions which prevail in different areas of Jamaica. Effects of plant spacing were also included in the study. This would complement previous variety and intercropping work, and previous IICA studies made regarding the costs and economic viability of alternative methods for processing and marketing cassava. It was felt that these studies and analyses together with the previous studies would provide the information required by GOJ to make policy decisions regarding the future of the cassava crop/industry in Jamaica.

Thirteen cultivars were selected for testing, on the basis of superior

Table 1.

LOCATION AND CHARACTERISTICS OF TEST SITES

SELECTED FOR CASSAVA YIELD TESTING

Location	Soil Type	Elevation (ft.)	Rainfall (in./yr.)
St. Catherine			
Above Rocks	#50 Flint Rivers Loam	1,600	70-80"
Bodles	#217 Bodles Clay Loam	50'	40-50"
Guys Hill	#94 Carron Hall	2,000'	80-100"
Watermount	#32/34 Wirefence Diamond Clay Loam	2,150'	NA
St. Ann			
Lydford	#78 St. Ann Clay Loam	1,500'	80-90"
Clarendon			
James Hill	#207 Brysons Clay Loam	1,900	75-90"
Masons River	#198/199 Deep Deene Sandy Loam over Bog Hole Clay Loam	2,300'	80-90"
Manchester			
Grove Place	#73 Chudleigh Clay Loam	1,700'	70"
Marlborough	#78 St. Ann Clay Loam	2,100	60"
Mile Gully	#73 Chudley Clay Loam	1,600	70"
St. Elizabeth			
Lititz	#78 St. Ann Clay Loam ??	50'	35-50"
Santa Cruz	#70 Chudleigh Clay Loam	50'	70"
Southfield	#78 St. Ann Clay Loam	1,500'	45"

Table 2.

SITES AT WHICH EACH CULTIVAR WAS TO BE TESTED

Variety	Sites Where Variety Was To Be Tested
Basso 24	Lydford
Blue Bud	Above Rocks, Guys Hill, Bodles, Lydford, Grove Place, Watermount Marlborough, Lititz, Southfield
Bobby Hanson	Lititz
C-5	Masons River, James Hill
C-30	Lydford, Grove Place
CM 516	Bodles
CM 517	Bodles
CM 849	Bodles
E.P.	E.P. Lititz
Llanero	Masons River, Southfield
M. Coll 20	Masons River, James Hill, Southfield
Rockwood	Grove Place,, Marlborough, Lititz, Santa Cruz
Smalling	Guys Hill, Bodles, Lydford, James Hill, Grove Place, Marlborough, Lititz, Santa Cruz, Southfield

performance in previous trials and/or the number of acres of that variety currently being planted by farmers.

Cultivars and Their Characteristics

1. Blue Bud. This local variety has consistently produced well in the past under a wide variety of conditions; in the uplands and in the lowlands; in areas of lower rainfall and of higher rainfall. It is also rated as very palatable.

2. Bobby Hanson. Another local bitter variety, popular in St. Elizabeth and south Manchester.

3. C-30. This new variety had shown promise in previous trials.

4. E.P. A bitter variety which has been very popular in St. Elizabeth.

5. LLanero. An important sweet variety from Colombia, without much previous use in Jamaica.

6. Rockwood. An early maturing variety, it has been used on the uplands in St. Elizabeth and South Manchester.

7. Smalling. Another local variety, this has been planted extensively over the years in St. Elizabeth.

8-13. Basso 24; M. Coll 20; C-5; CM-15; CM 517; CM 849: These varieties were little known in Jamaica, but have produced good yields in other countries.

These cultivars were used to be tested in thirteen sites across Jamaica, representative of the variations in climate, soils and elevation in the cassava-producing areas of the country. Two or more cultivars were tested per site. It was also decided that the results would be more meaningful if all tests were done on farms, with the farmers using their normal cultural practices. An exception was made to this policy, however, with respect to density of planting; all plantings were to be done at the rate of 5,500 sticks per acre. Table 1 shows the soil types, elevation and average rainfall for each of the sites located. Table 2 shows for each variety the sites at which it was to be tested.

Spacing of Plants

Research results from other countries have indicated that it is possible to increase yields by increasing the number of sticks planted per acre. In these plots it was decided to increase the number of plants per acre by 100% to 150% to determine the effect on yields under the varying soil, rainfall and elevation conditions which prevail in Jamaica.

RESULTS

Implementation of Study Design

Of the thirteen sites selected and planted, yields on eleven were obtained. The plots at Bodles suffered from suatained flooding followed by a prolonged dry period, with the result that the plots were killed. This was in large part due to the use of low-lying land with inadequate surface drainage;

Table 3. RANKING OF VARIETIES BY YIELD/ACRE

Variety	Yield/Acre Tons	Number of Plots	Observations
1. Bobby Hanson	16	1	Blue bud and Smalling each yielded 16.5 tons per acre at this same site
2. E.P.	15.5	1	Blue bud yielded 16.5 and Smalling 16 T/acre at this same site
3. C-30	15.5	2	Outyielded Smalling by 2 T/acre at one site and by 1 T/acre at the other site
4. Blue bud	15	6	Highest yielding plot in 6 of the 7 sites where it was harvested
5. Rockwood	14.2	3	Averaged 0.8 T/acre less than Smalling on these 3 sites
6. Smalling	13	9	12 T/acre or more in 8 of 9 sites
7. M. Coll 20	10	3	Extremely variable; 18 T/acre at Southfield, but only 7 at James Hill and 5 at Masons River
8. Basso 24	10	1	Average all plots, this site 14 T./acre; Blue bud yielded 20
9. Llanero	9.3	3	Smallings averaged 11 T/acre at same 3 sites
10. C-5	6.5	2	Smallings averaged 9.5 T/acre at same 2 sites

Table 4. AVERAGE PLOT YIELDS BY SITES, ACCORDING TO ELEVATION

Site	Elevation	Yield T/acre
Masons River	2,300	5.75
Watermount	2,150	8
Marlborough	2,100	14
Guys Hill	2,000	11
James Hill	1,900	9.25
Grove Place	1,700	16.5
Above Rocks	1,600	12
Lydford	1,500	14
Southfield	1,500	14.5
Lititz	50	16.2
Santa Cruz	50	15.25
Average, 11 Sites		11.4

Table 5. YIELDS BY SITES ACCORDING TO AVERAGE ANNUAL RAINFALL

Site	Inches Rainfall Annual Ave.	Yield T/acre
Guys Hill	80-100	11.0
Lydford	80-90	14.0
Masons River	80-90	5.75
Watermount	80 (est.)	8.0
James Hill	75-90	9.25
Above Rocks	70-80	12.0
Grove Place	70	16.5
Santa Cruz	70	15.25
Marlborough	60	14.0
Southfield	45	14.5
Lititz	35-50	16.2

it is not believed to be a chronic problem of the Bodles area in general. At Mile Gully, cattle broke into the plot area and ate and trampled the crop, destroying it completely.

Varieties Tested

Of the thirteen varieties to be tested for yields, ten were harvested and yields recorded. Due to the small quantity of planting material available, the varieties CM 516, CM 517, and CM 849 were planted only at Bodles, and did not survive the floods and drought.

Yields by Varieties

The average yield for the 32 plots harvested, giving equal weight to each plot, was 12.6 tons per acre. Average yields and number of sites for each variety tested are shown below. (Under observations, comparisons are made between varieties grown at the same site, generally with either Blue Bud or Smalling, which were planted at the largest number of sites, and were consistently superior-yield varieties in the tests.)

Yields by Elevation of Sites

One of the factors which was examined in this test was the effect of elevation on yields. In Table 4, yields are given for the best sites, ranked according to elevation. Based on this limited number of observations, it appears that elevation may have an effect on yields in Jamaica. The two sites with the lowest average yields were located at the highest elevations among the sites used, 2,300 and 2,150 ft. elevation.

Yields and Average Rainfall

While records of on-site precipitation during the test period are unavailable, those for average precipitation at each site are available. Average rainfall varied from a low of 35-50 inches at Lititz to 80-100 inches at Guys Hill. In Table 5, yields are shown for each site, ranked according to average annual rainfall. Based on this limited number of observations, for a single growing cycle, there does not appear to be any noticeable correlation between precipitation and yields in Jamaica, within the range 35 to 100 inches of average rainfall per year.

Yields and Soil Type

All plots except one were on loam or clay loam soils. The exception was Masons River, where the plots were on sandy loam underlaid with clay loam. Since the variation in soils was limited to loam and clay loam, and there was no clear pattern of superior yields for either of these two soil types, it is not possible to make any meaningful statement regarding the effect of soil texture on yields.

Spacing of Plants

All plots were planted at the rate of 5,500 sticks per acre, more than double the number traditionally planted. As several of the varieties included in the trial are extensively grown locally, and produced more than double their yields per acre than they do with traditional spacing, it appears that increasing the number of plants per acre is by itself an important

modification which might well be introduced in Jamaica's cassava technology. This conclusion is, however, tentative as it will only become clear over a period of several years whether this more intensive planting rate can be sustained without depleting the soil. Table 6 shows the yields for each variety in each site where it was planted.

Costs of Production

Production costs per acre are very similar throughout Jamaica. There is, however, a significant difference in total production costs, depending on whether the preparation of the land is done mechanically or by hand. Offsetting this lower cost for mechanical land preparation is the fact that it involves a cash cost for most small farmers, to hire the land preparation, whereas the remuneration for hand preparation is received by the farmer if he or members of his family do the work. Additionally, there will be a slight increase in harvesting costs and hence total costs as yields increase. Table 7 presents cost figures using manual land preparation, and using mechanical preparation.

SUMMARY

Yields; (1) Average yield, giving equal weighting to each varietal plot, was 12.6 tons per acre. This is about double the national average. If the three sites with consistently low yields are omitted, this average increases to 14.2 tons per acre. (2) Two varieties, both grown fairly extensively in Jamaica, were tested in 7 or more sites, and gave consistently high yields. These are Blue bud, a sweet variety, which averaged 15 tons per acre. They can be recommended for any location suitable for cassava production. (3) Three other varieties, Bobby Hanson (16 T/Acre), E.P. (15.5 T/Acre) and CO-30 (15.5 T/Acre), produced high yields, but were not tested at enough sites to justify their recommendation at this time. Further testing of these varieties is recommended. (4) Only two varieties, Llanero and C-5, averaged less than 10 T/Acre.

Planting Rate: It is clear from these trials that increased density of planting results in large increases in yield per acre. Planting 5,000 to 5,500 sticks per acre is recommended.

Elevation: While the results are fragmentary, it appears that there is a tendency for yields to decline at 1900 ft. elevation or higher. Caution should be taken in planting at these elevations.

Rainfall: No correlation was found between average rainfall and yields.

Soils: There was insufficient variation in soil texture between sites to detect differences in yields associated with different soil textures.

Costs of Production: At 1987-88 prices, production costs were J$2,965 per acre with manual land preparation and J$2,490 per acre with machine preparation.

Market Price: At 10 T/Acre yield and with 1987-88 price relationships, it is necessary to obtain a minimum of J$0.15 per lb. at the farm gate, to cover production costs. It will be noted that this yield is lower than the average obtained in experimental trials, even when those are performed on operating farms.

Table 6. ESTIMATED YIELDS OF VARIETIES, BY SITES

(Tons/Acre)

Sites	Yields Per Acre By Varieties									
	Basso 24	Blue bud	Bobby Hansn	C-5	E.P.	Llan-ero	Coll 20	Rock-wood	Small-ing	C-30
Above Rocks		12								
Guys Hill		10							12	
Watermount		8								
Lydford	10	20							12	14
James Hill				8		10	7		12	
Masons River				5		6	5		7	
Grove Place									16	17
Marlborough		18						12	12	
Lititz		16.5	18		15.5			16.5	16	
Santa Cruz								14	16.5	
Southfield		14				12	18		14	

Table 7. PRODUCTION COSTS PER ACRE

	Type of Soil Preparation	
	Manual (J$)	Mechanical (J$)
Land cleaning	250.00	125.00
Forking	700.00	350.00
Planting material; 5,000 sticks @ $10/100	500.00	500.00
Planting	250.00	250.00
Fertilizer; 6 cwt. @ J$65/cwt.	390.00	390.00
Applying fertilizer	25.00	25.00
Weeding (twice)	400.00	400.00
Pest control chemicals (est.)	100.00	100.00
Applying pest control chemicals	50.00	50.00
Reaping	300.00	300.00
Total cost per acre	J$ 2,965.00	2,490.00