IICA

ECONOMIC ASSESSMENT OF DIFFERENT TECHNOLOGICAL PACKAGES IN YELLOW YAM PRODUCTION

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DIFFERENT TECHNOLOGICAL PACKAGES IN

YELLOW YAM PRODUCTION

by

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SUMMARY

The accessibility of economic information such as profit levels for distinct production processes, encourages producers to ratify or reject new technologies as they become better informed. Given the vacuum of economic information about yam production, compounded by confined and sporadic technological information, this study peruses a benefit-cost analysis of yam technologies in Jamaica.

The research assesses economically five (5) technological packages for yellow yam production namely the traditional standard (Ts), the mini-sett standard (Ms), and three (3) modifications done by the farmers and derived from the mini-sett standard, MB_1 (setts), MB_2 (setts, mounds, stakes), and MB_3 (setts, mounds, grass mulch). The study is confined to the production system itself --yams. It relinquishes other activities of the farm as an entire economic or business unit, from a farming system perspective.

The study presents a general portrait of five diverse technological packages, and for each account income and cost of production schedules (listing all labour and material costs). Each system was analyzed for 0.45 hectare of land. Saleable output was analogous to all modified technological packages (MB's). It was estimated at eight (8) short tons, on the premise that the yield would be approximately one (1) short ton below the mini-sett standard (Ms) and also one (1) short ton above the yield of the traditional standard (Ts).

The inquiry reveals that the modified MB_3 earned the highest benefit-cost ratio. Yet, the mini-sett standard (Ms) was confirmed to be more profitable, generating the highest net income. While the modified systems --MB_1, MB_2 with the mini-sett standard, proved more profitable and exhibited greater secondary benefits compared to the traditional standard system (Ts), the analysis of farmers' returns to labour revealed the mini-sett standard (Ms) system as most labour efficient --earning the highest returns to farmers labour, besides return per man day.

From the technological and economic data collected and analyzed, the introduction and modification of the mini-sett technology seem viable for increasing both yam production and productivity.

Indeed, the transfer and adoption of The Mini-sett Technology could be subsequently hastened if the information on production and its economics is heightened, pursued and disseminated among farmers, co-operatives, farmers' organizations, agriculturalists, financial sector, etc. The information analyzed exhibits that with the application of The Mini-sett Technology on yams, the prospects for improving its competitiveness are economically feasible.

INTRODUCTION

Jamaica is compelled to become more efficient and competitive as the country consolidates its economic policies; predominantly free-market and private led, congruous with liberalized economies and freer global trade. For Jamaica's agricultural sector to react assertively to an expanded economic scenario, the design and introduction of technologies ought to be continual. Accordingly, the technology issue does not need to be emphasized.

Traditionally, Yellow yams (*Dioscorea cayenensis)* are an important staple food in Jamaica's diet, and are predominantly produced by small farmers. Over the last four years, yams have become a significant nontraditional export crop (***Strachan, 1995***). To strengthen the country's competitiveness in yam on the fresh produce export market and sustain this trend, farmers and exporters must ensure that production and productivity levels are improved; in required volumes and quality.

A decisive factor in advancing yellow yam production encompasses efficiency of available production techniques. The objective is to evaluate the mini-sett technique for improving yam production, as an optional new technological package apart from the traditional method. [1]

As is the case with most agricultural technologies, queries are typically raised alluding to the winners and losers from its adoption. Is the nature of the technology bounded by size? Is it applicable to farms irrespective of size and thus available to all? Are the economics such that its adoption will be viable only on large farms, and thus its broad base application delimited? These are some of the questions that ought to be addressed when introducing a new technological package such as The Mini-sett Yam Technology. In Jamaica this technology has been introduced to the farming community, and the farmers themselves have adopted and modified the original technological package (***Chin Sue, Fielding, and Reyes-Pacheco, 1995***).

[1] The mini-sett technology was developed in Nigeria and introduced to Jamaica in 1985 with the aim of improving yam production. It had the potential to improve traditional production systems through the introduction of soil conservation measures and cultural practices that are less labour intensive. (Chin Sue, 1991).

This paper scrutinizes different yam production technologies implemented by farmers from an economic perspective. It is presumed that by contrasting them economically, producers will be incited by the results. An ample introduction and adoption of The Mini-sett Yam Technology will significantly transform traditional yam production in Jamaica.

It is asserted that as variable costs are lower and yields are higher net returns can be increased if the mini-sett technique or its modifications are employed; resulting in greater efficiency when correlated to the traditional system. According to James and Stoneberg (1976) yield is the commonest and perhaps the most useful technical yardstick of crop efficiency. It is a measure that farmers know and understand well, hence, discussions and relationships comprising fertilizers, cultural practices, pests and diseases concerning yield can be beneficial. Correspondingly if the profitability of distinct technological packages is promoted, producers are more prone to make rational economic decisions about which of the techniques is more economically efficient.

Given the short period and limited scope of having exposed The Mini-sett Yam Technology among yam producers, the income and costs related to them are preliminary as they are still being generated (***Mahfood, 1993***). Certainly the mini-sett technology is based on sound technological principles for the production of yams. Less is known concerning its economic feasibility, which is a key element for its adoption among small farmers, but also its sustainability.

Objective

The purpose of this research paper is to appraise economically the predominant technological packages of yellow yam in Jamaica:

i) the traditional method (Ts)

ii) the mini-sett standard (Ms)

and modifications using

iii) setts (MB_1)

iv) setts, mounds, stakes (MB_2)

v) setts, mounds and grass mulch (MB_3).

It is foreseen that this inquiry would assist producers with information about profitability levels, a comparative analysis, and the factors that influence yam production.

Methodology

The foremost source of information for this study was secondary materials used to generate production costs, yields and income for the cited systems of yam production. Nonetheless, it was validated and complemented with a survey of fifty (50) farmers in total from seven (7) yam-growing parishes of Jamaica.

Complementary information was gathered in interviews with farmers and qualified informants on yields obtained and the levels of variable inputs used. The costs and returns received were calculated at current market prices.

The volume of saleable production for the modified systems was estimated at eight (8) short tons** based on the assumption that it would be approximately one (1) short ton above the yield of the traditional system --Ts and one (1) short ton below the yield of the mini-sett technology --Ms.

Limitations

Notwithstanding yam yields from a given land area vary greatly not only as a function of the level of variable inputs applied, but also as it relates among other factors to:

i) soil type,

ii) species or variety of yam planted,

iii) climatic conditions, and

iv) farmers practices.

** *1 short ton = 2,000 lb = 0.9072 tonne*

The method of economic analysis used is partial, for it was confined to the economics of yam production by itself. Indeed, it omitted the total on-farm system, and off-farm income, which play a role in farmers' decision-making about the adoption, modification, or non-application of new agricultural innovations.

Additionally, there were only five (5) distinct yam production systems analyzed as the most prevalent ones; and as a mono-crop farming system, in contrast to a multi-crop system, which perhaps would provide a most suitable account of small farmers' cultivating mode.

Costs and benefits were identified and priced at their market value. Different items were examined when accounting for costs such as land, labour, machinery, and contingencies. Value increases due to improved quality and yield and/or reductions in costs through mechanization and shrinkages in losses were excluded when determining and analyzing benefits. Also, those benefits created outside the production system itself were not incorporated in this study, which are secondary and include improvement in levels of living standards, environmental upgrading among other indirect benefits. However, they can surely enhance the application of the technological packages in question.

DESCRIPTION OF THE SYSTEMS

The technological packages for yam production considered in this study are: a) traditional standard, b) the mini-sett standard, and modifications using c) only setts, d) setts, mounds and stakes and e) setts, mounds and grass mulch.

Each system uses one acre (0.45 hectare) of land and a particular combination of available resources. The variety of yam grown is yellow yam, *Dioscorea cayenensis* and all activities are done manually --mechanization was not contemplated.

1. The Traditional Standard (T_s)

For the land area under cultivation it was estimated 2,177 kg. (4,799 lb) of untreated planting material planted in 1,000 individual hills. The hills are staked, the average height of stakes being 9 feet (2.6 meters). General weeding is done three (3) times during the growing season and one application of 6 cwt.*** (305 kg.) of NPK and sulphate of ammonia. Table 1 presents a complete cost of production and expected returns for this system.

2. The Mini-sett Standard (M_s)

A complete cost of production and expected returns for this system is presented in Table 2. This system utilizes mounds, the application of plastic mulch, and very little weeding except for the furrows. The planting material is 4 oz. (112 g.) treated yam setts. Stakes are eliminated from this system as vines are allowed to spread out and run along the mounds. Approximately 660 lbs. (300 kg.) of fertilizer is used (***Chin, 1993 & Chin Sue, 1991***).

3. Modification (Setts) MB_1

This system employs all the activities of the traditional system --Ts; except that treated tuber pieces --setts are used for planting material instead of heads. It incurs all the costs, and uses all the variable inputs as in the traditional system. Table 3 exhibits the cost of production and expected returns for this system

*** *1 cwt. = hundred weight = 112 lbs*

(***Mahfood, 1993***).

4. Modification (Setts, Mounds, Stakes) MB_2

This system is almost like the mini-sett standard (--Ms) where mounds are used instead of hills, and treated setts instead of heads. The quantity of fertilizer used is less. Although mounds are used, the vines are staked as in the traditional standard (--Ts). The cost of production and expected returns for this system are shown in Table 4 (***Mahfood, 1993***).

5. Modification (Setts, Mounds, Grass Mulch) MB_3

The only difference between this system and the mini-sett standard --Ms is the use of grass mulch instead of plastic mulch. Table 5 displays the cost of production and expected returns (***Mahfood, 1993***).

BENEFIT AND COST ANALYSIS DISCUSSION

For each of the techniques applied, costs and benefits were derived and analyzed to measure their economic performance and highlight the one with the most acceptable return. It is presumed that given the economic profitability derived from the application of a given technological package, it will favour its adoption by farmers and prevent inefficient and wasteful expenditures.

The method used for comparing benefits to be derived from a given production technique with the costs of carrying it out, is known as the benefit-cost ratio. According to Murcia (1985), the measure is a rationale criterion for contrasting the economic profitability of an enterprise while giving one enterprise's comparative advantage over the other. Gittinger (1982), proposes that for a project and/or enterprise to be considered acceptable, the value should be greater than or equal to one when using the ratio.

Computation of the ratio considers total costs and total income. It is calculated as follows:

$$\text{Benefit Cost Ratio} = \frac{\text{Total Income}}{\text{Total Cost}}$$

Table 6 displays the results of the benefit cost analysis of all five (5) yam production systems under study.

An important cost involved while producing yams is labour, as a result, computation of the return to farmers' labour was undertaken. This is computed as follows:

i) Gross income (price x yield) - materials (price inputs) - transportation = Returns to farmer's capital and labour - opportunity cost and working capital = return to farmer's labour

ii) $$\frac{\text{Returns to farmer's labour}}{\text{Number of man days}} = \text{Return per man-day worked}$$

Table 7 gives a detailed representation of the returns to farmers labour for each system.

The summary of the ratios (Table 6) shows that the modified MB_3 earned the highest benefit-cost ratio of 2.17 and the standard traditional (Ts), the lowest at 1.29. Based on this concept of analysis, the modified MB_3 is considered the most acceptable over the other techniques, which are also acceptable since all ratios are above one.

A detailed analysis of the information presented in Table 6 indicates that the mini-sett standard (M_s) gives the highest yield and net returns irrespective of recording the highest total cost of production. It can be argued that both the mini-sett standard (M_s) and the modified MB_3 are similar except for the difference in the types of mulch used, so yields should be equal. If the estimated yield of the modified MB_3 is increased to that of the mini-sett standard (M_s) this system could very likely be more acceptable since net returns would then be higher. Yet, the question of acceptability would depend on the farmers, as many have suggested that the use of grass mulch encourages slugs. It is possible that the time and cost of acquiring and applying slug baits would be equal to the difference between the net return of both systems. The modified MB_1 and MB_2 suggest greater degrees of acceptability when compared to the traditional standard (T_s) earning higher benefit-cost ratios, due to the lower total cost and higher net returns. Exhibits A-D show how the different costs of carrying out each production technique affect the benefits derived from these production systems.

If the farmer's goal is to maximize returns, the ideal production system should fulfil the minimal requirements of covering all operating expenses while providing the best remuneration to the farmer. As a result, collating returns to farmers' labour is important as well. Table 7 discloses that the mini-sett standard (M_s) earned the highest returns to labour, and the highest returns per man-day worked, while it employs the same amount of productive man days (52) as the modified MB_3 system.

Economic analyses often embody external benefits --those accounted outside the production system itself. Among those secondary benefits recognized under the mini-sett and modified systems are:

i) Yams produced under these systems using treated setts are seemingly of better quality in appearance as most are straight, when compared with those produced under traditional standard (***Williamson, 1996***).

ii) Environmentally, the mini-sett standard (M_s) and the modified MB_3 systems are more friendly as the uses of stakes are eliminated from these techniques.

iii) The mounds constructed, as part of these systems, provide an effective soil conservation technique, as less soil erosion is evident when practiced on the hillsides.

CONCLUSION

The economic analysis of production systems enables the producer to gain an insight into his farming business. The farmer should use this information to improve production or productivity, as a consequence of some specific use of inputs. As a result, planning in the economic context that is aimed at improving production, profits, and earnings besides comparing enterprise advantages is important. This report was foreseen to highlight those considerations for five (5) yellow yam production systems, under which benefits (profit, yield, income) can be maximized and costs (labour, non-labour) minimized.

This, however, is not a simple task as each farmer has a different set of objectives, despite a common understanding that every producer is to gain the best remuneration from his production system. Indeed, a farmer exposed to a new technology may resort to his cropping systems method (or some part of it) as other interests occur. Or similarly personal preferences, for example, time spent on a technique, appearance, nature of the technology, and incidence that risk and uncertainty may forestall possible outcomes. Their analytical processes used for decision-making suggest that farmers will systematically select and judge the effects of a technological innovation or production system beyond its economic merits --quality improvement and income increases.

The application and modification of the mini-sett technology is feasible, and from the technological and economic data gathered and analyzed, it is encouraging for increasing yam production and productivity. Given the newness and limited scope of farmers exposed to The Mini-sett Yam Technology, the data and socio-economic analysis, its benefits and cost, are only just being realized; which is a key element for its adoption, but also for its sustainability.

While there are unanswered questions as to the costs and benefits of the different technological packages or variations of The Mini-sett Yam Technology, the findings from this research paper seem to validate the conclusion that The Mini-sett Technology is more profitable than the traditional method for yam production. Nevertheless, in spite of the economic feasibility, its sustainability among small traditional yam farmers remains a major focus as it has to be envisioned within their small farming system framework. Yet, it is expected that as the system is further refined and becomes available to a wider clientele of yam producers, its costs are likely to fall, its yields to grow and thus induce greater profits, encouraging wider adoption.

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ANNEX

Table 1.

COST OF PRODUCTION & EXPECTED RETURNS USING THE TRADITIONAL METHOD (Ts).
(ONE ACRE --0.45 HECTARE)

Crop: Yellow Yam

COST OF PRODUCTION			JAS/ACRE		
	UNIT	NO. OF UNITS	COST PER UNIT	TOTAL	
TOTAL LABOUR INPUTS					$33,350
Land clearing (manual)	Man days	10	100.00	1,000.00	
Forking	Man days	2	250.00	500.00	
Dig hills (open & mould)	Man days	20	250.00	5,000.00	
Drop and plant heads	Man days	5	250.00	1.250.00	
Staking & Tying	Man days	6	250.00	1,500.00	
Cut & clean trenches	Man days	10	250.00	2,500.00	
Weeding (3 times)	Man days	30	250.00	7,500.00	
Fertilizing	Man days	2	250.00	500.00	
Twining	Man days	4	250.00	1,000.00	
Harvesting	Lbs.	14,000	0.90	12,600.00	
TRANSPORTATION	Lbs.	14,000	0.60	8,400.00	8,400
MATERIALS					57,680
Head (transportation inclusive)	Lbs.	4,800	10.00	48,000.0	
Fertilizer NPK 7-14-14	Cwt.	4	500.00	2,000.00	
Sulphate of Ammonia	Cwt.	2	340.00	680.00	
Stakes	Stakes	1,000	7.00	7,000.00	
SUMMARY					
Opportunity Cost of Capital @ 30% p.a.					29,829
Total Cost (Cost of Production and Opportunity Cost)					129,259
Saleable production/acre					14,000lbs
Total cost per Lb.					$9.23
RETURNS					
Income from one acre of yam: 14,000 lbs. @ $12/lb.					168,000
Gross Income/acre					168,000
Net Income					38,741
Benefit Cost Ratio					1.29

Table 2.

COST OF PRODUCTION & EXPECTED RETURNS USING THE Mini-sett METHOD (Ms).
(ONE ACRE --0.45 HECTARE)

CROP: Yellow Yam

COST OF PRODUCTION				JA$/ACRE	
	UNIT	NO. OF UNITS	COST PER UNIT	TOTAL	
TOTAL LABOUR INPUTS					27,844
Land clearing	Man days	10	100.00	1,000.00	
Forking	Man days	2	250.00	500.00	
Fertilizing, ridging & preparing mounds	Man days	10	250.00	2,500.00	
Laying out plastic & planting	Man days	20	250.00	5,000.00	
Weeding	Man days	10	250.00	2, 500.00	
Harvesting	Lbs.	18,160	0.90	16,344.00	
TRANSPORTATION	Lbs.	18,160	0.60	10,896.00	10,896
MATERIALS					47,400
Setts	Lbs.	2,000	10.00	20,000.00	
Plastic mulch	Rolls	5	5,000.00	25,000.00	
Fertilizer	Bag (100 lbs.)	6	400.00	2,400.00	
SUMMARY					
Opportunity Cost of Capital @ 30% p.a.					25,842
Total Cost (Cost of Production and Opportunity Cost)					111,982
Saleable production/acre					18,160lbs.
Total Cost per Lb.					$6.16
RETURNS					
Income from 1 acre of yam: 18,160 lbs. @ $12/lb.					217,920
Salvage of plastic at one-half cost					12,500
Gross Income					230,420
Net Income					118,438
Benefit Cost Ratio					2.05

Table 3.

COST OF PRODUCTION & EXPECTED RETURNS USING MODIFICATION MB$_1$ (Setts).
(ONE ACRE --0.45 HECTARE)

CROP: Yellow Yam

COST OF PRODUCTION				**JA$/ACRE**	
	UNIT	**NO. OF UNITS**	**COST PER UNIT**	**TOTAL**	
TOTAL LABOUR INPUTS					$37,650
Land clearing	Man days	10	100.00	1,000.00	
Forking	Man days	2	250.00	500.00	
Dig hills (open & mold)	Man days	20	250.00	5,000.00	
Drop & plant setts	Man days	15	250.00	3,750.00	
Staking & tying	Man days	6	250.00	1,500.00	
Cut & clean trenches	Man days	10	250.00	2,500.00	
Weeding (3 times)	Man days	30	250.00	7,500.00	
Fertilize	Man days	2	250.00	500.00	
Twining	Man days	4	250.00	1,000.00	
Harvesting	Lbs.	16,000	0.90	14,400.00	
TRANSPORTATION	Lbs.	16,000	0.60	9,600.00	9,600
MATERIALS					29,680
Setts	Lbs.	2000	10.00	20,000.00	
Fertilizer NPK 7-14-14	Cwt.	4	500.00	2,000.00	
Sulphate of ammonia	Cwt.	2	340.00	680.00	
Stakes	Stakes	1000	7.00	7,000.00	
SUMMARY					
Opportunity cost of capital @ 30% p.a. for one year					23,079
Total Cost (Cost of Production and Opportunity Cost)					100,009
Saleable production/acre					*16,000/lbs
Cost of production/lb.					$6.25
RETURNS					
Income from one acre of yam: 16,000 lbs. @ $12/lb.					192,000
Gross Income					192,000
Net Income					91,991
Benefit Cost Ratio					1.91

*ESTIMATED

Table 4.

COST OF PRODUCTION & EXPECTED RETURNS USING MODIFICATION MB,.
(Setts, Mounds, Stakes)
(ONE ACRE --0.45 HECTARE)

CROP: Yellow Yam

COST OF PRODUCTION				**JA$/ACRE**	
	UNIT	**NO. OF UNITS**	**COST PER UNIT**	**TOTAL**	
TOTAL LABOUR INPUTS					**$32,150**
Land clearing	Man days	10	100.00	1,000.00	
Forking	Man days	2	250.00	500.00	
Fertilizing, ridging & preparing mounds	Man days	10	250.00	2,500.00	
Planting	Man days	15	250.00	3,750.00	
Staking & tying	Man days	6	250.00	1,500.00	
Weeding (3 times)	Man days	30	250.00	7,500.00	
Twining	Man days	4	250.00	1,000.00	
Harvesting	Lbs.	16,000	0.90	14,400 00	
TRANSPORTATION	Lbs.	16,000	0 60	9,600	9,600
MATERIALS					**29,400**
Setts	Lbs.	2,000	10 00	20,000.00	
Fertilizer	Bags (100 lbs.)	6	400.00	2,400.00	
Stakes	Stakes	1,000	7 00	7,000.00	
SUMMARY					
Opportunity cost of capital at 30% p.a.					**21,345**
Total Cost (Cost of Production and Opportunity Cost)					**92,495**
Saleable production/acre					*16,000lbs
Cost of Production/lb.					$5.78
RETURNS					
Income from one acre of yam. 16,000 lbs. @ $12 00 / lb.					192,000
Gross Income					192,000
Net Income					99,505
Benefit Cost Ratio					**2.07**

*ESTIMATED

Table 5

COST OF PRODUCTION & EXPECTED RETURNS USING MODIFICATION MB,
(Setts, Mounds, Grass Mulch)
(ONE ACRE --0.45 HECTARE)

CROP: Yellow Yam

COST OF PRODUCTION				**JA$/ACRE**	
	UNIT	**NO. OF UNITS**	**COST PER UNIT**	**TOTAL**	
TOTAL LABOUR INPUTS					$25,900
Land clearing	Man days	10	1,00.00	1,000.00	
Forking	Man days	2	250.00	500.00	
Fertilizing, ridging & preparing mounds	Man days	10	250.00	2,500.00	
Applying grass mulch & planting	Man days	20	250 00	5,000.00	
Weeding (3 times)	Man days	10	250.00	2,500 00	
Harvesting	Lbs.	16,000	0.90	14,400.00	
TRANSPORTATION	Lbs	16,000	0.60	**9,600.00**	**9,600**
MATERIALS					**32,400**
Setts	Lbs.	2,000.00	10 00	20,000.00	
Grass mulch	Acre	1.0	10,000.00	10,000 00	
Fertilizer	Bags (100 lbs.)	6	400.00	2,400.00	
SUMMARY					
Opportunity cost of capital at 30% p.a. for one year					**20,370**
Total Cost (Cost of Production and Opportunity Cost)					**88,270**
Saleable production/acre					*16,000 lbs
Total Cost of production/lb					$5.51
RETURNS					
Income from one acre of yam 16,000 lbs. @ $12 00 / lb.					192,000
Gross Income					192,000
Net Income					103,730
Benefit Cost Ratio					**2.17**

*ESTIMATED

Table 6

SUMMARY OF BENEFIT COST ANALYSIS (JAS)

	COST						BENEFIT		
PRODUCTION SYSTEM	BENEFIT COST RATIO	LABOUR ($)	MATERIAL	TRANS-PORTATION	OPPORTUNITY COST	TOTAL COST	YIELD (LBS.)	GROSS INCOME	NET INCOME
STANDARD TRADITIONAL (T_s)	1.29	33,350	57,680	8,400	29,829	129,259	14,000	168,000	38,741
STANDARD Mini-sett (M_s)	2.05	27,844	47,400	10,896	25,842	111,982	18,160	230,420	**118,438**
MODIFIED MB_1	1.91	37,650	29,680	9,600	23,079	100,009	*16,000	192,000	91,991
MODIFIED MB_2	2.07	32,150	29,400	9,600	21,345	92,495	*16,000	192,000	99,505
MODIFIED MB_3	2.17	25,900	32,400	9,600	20,370	88,270	*16,000	192,000	103,730

*ESTIMATED YIELD

Table 7

Returns to Farmers Labour per Production System (JAS)

PRODUCTION SYSTEM	NET INCOME	LABOUR COST	RETURN TO LABOUR	MAN DAYS	RETURN PER MAN DAY IN YAM PRODUCTION
STANDARD TRADITIONAL (T_s)	38,741	33,350	72,091	89	810.01
STANDARD Mini-sett (M_s)	118,438	27,844	146,282	52	2,813.11
MODIFIED MB_1	91,991	37,650	129,641	99	1,309.50
MODIFIED MB_3	99,505	32,150	131,655	77	1,709.80
MODIFIED MB_3	103,730	25,900	129,630	52	2,492.8[illegible]

Exhibit: A

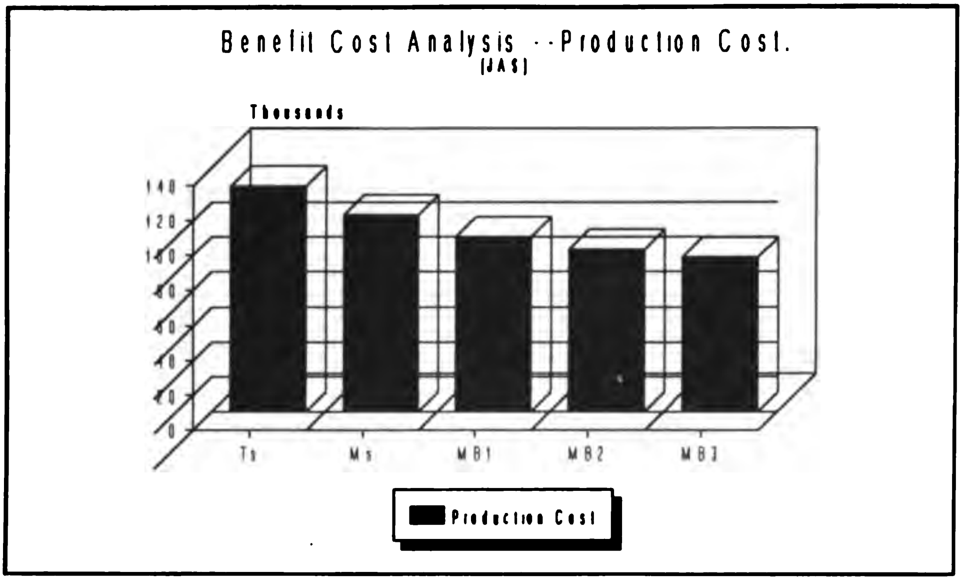


Exhibit: B

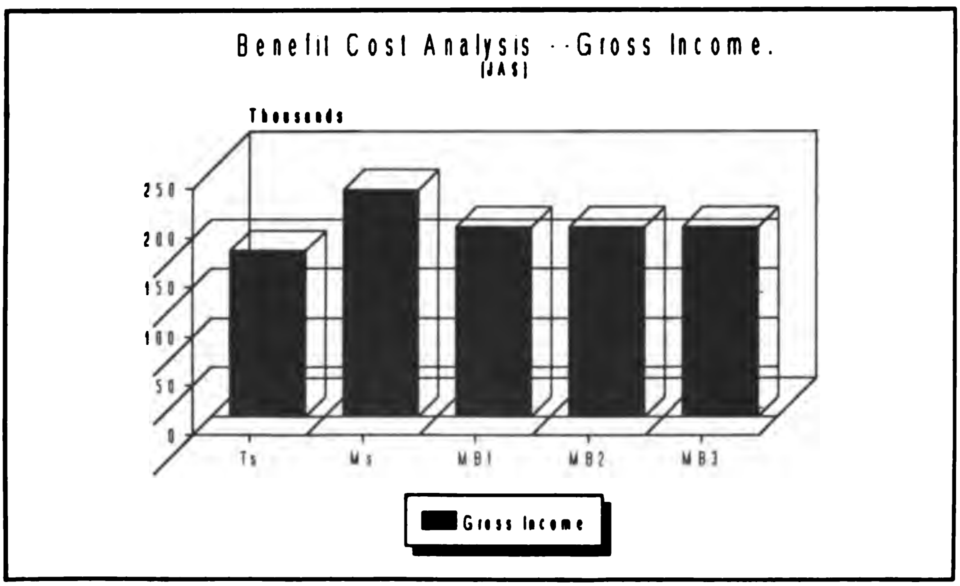


Exhibit: C

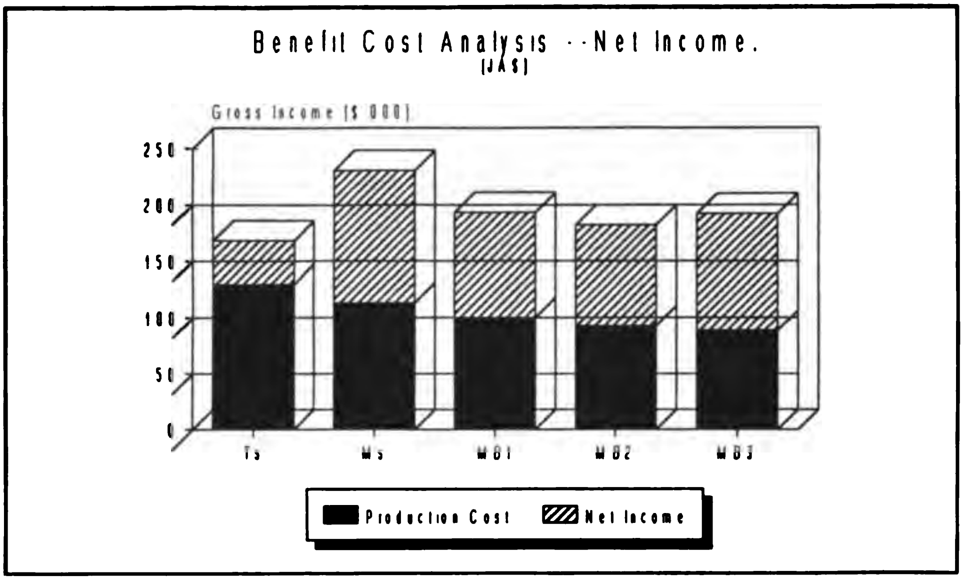
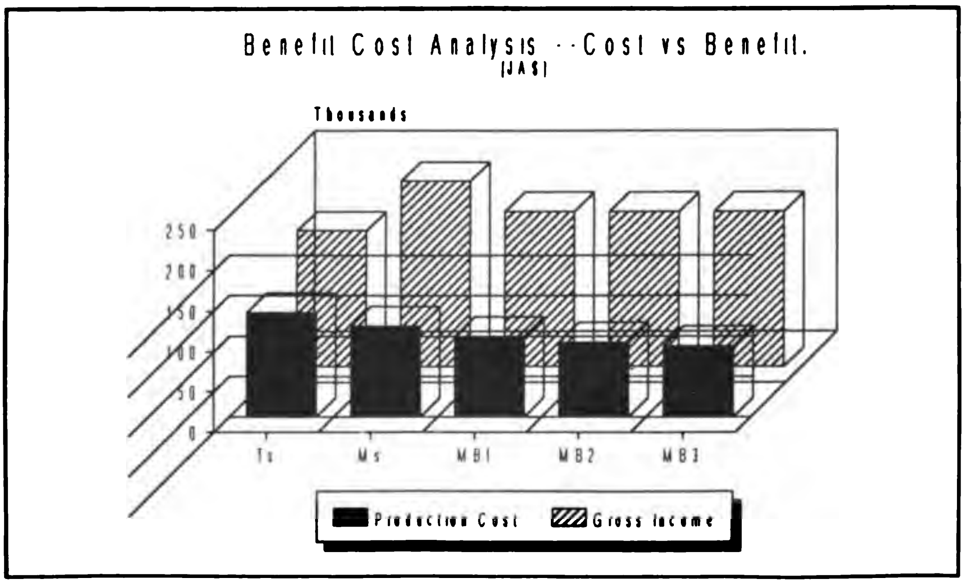


Exhibit: D



QUESTIONNAIRE

Cost of Production and Returns for One Acre (0.45 hectare) of Yellow Yam.

COST OF PRODUCTION

	UNITS	NO. OF UNITS	COSTS UNITS	TOTAL
TOTAL LABOUR INPUTS				
- Land clearing (manual				
- Forking				
- Fertilizing				
- Ridging/preparing mounds				
- Dig hills (open mound)				
- Drop and plant heads				
- Lay out plastic				
- Applying mulch (grass)				
- Staking and tying				
- Cut and clean trenches				
- Weeding				
- Twining				
- Harvesting				
- Transportation				
MATERIALS				
- Heads				
- Setts				
- Fertilizer - NPK 7-14-14				
- Sulphate Ammonia				
- Grass				
- Plastic				
- Stakes				
SALEABLE PRODUCTION/ACRE				

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