Niger Agric. J. 30 (1999): 108 – 114

RATE OF RETURN ON IMPROVED SWEET POTATO PRODUCTION IN THE FOREST ZONE OF NIGERIA

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(Accepted April, 1999)

ABSTRACT

Sweet potato *(Ipomea batatas L)* has been proved to be a major root crop in Nigeria, like Uganda and Papua New Guinea. This study was carried out over a four year period 1991-1994 to determine the rate of return on the elite varieties developed and being disseminated from The National Root Crops Research Institute (NRCRI) to the resource poor farmers. The internal rate of return model used in this study takes full cognisance of the time value of money.

Results showed that the gross revenue increased as the unit price per kilogram of sweet potato increased. Varicty TIS 8164 emerged the highest yielder although it was statistically the same with variety TIS 870087 ($P \leq 0.01$).

The Internal Rate of Return (IRR) is estimated to be more than 100%, very much greater than the opportunity cost of capital. It is recommended that effort be made by research on product and market development as well as measures to solve the short storage life and perishability of the root tubers.

INTRODUCTION

Sweet potato (Ipomea batatas L.) lank is major crop in the world. It is very high yielding, nutritive and tolerate ecological differences (Hahn, 1977). In Nigeria and other parts of Africa, it is a staple food for the populace. In Papua New Guinea, it ranks first while in Uganda it is second to cassava as carbohydrate source (Kimber, 1972). Sweet potato ranks third in the value of production and fifth in contributing to calories in developing countries (Horton, 1988).

Nigerian produces an estimate of 0.26-0.48 million tonnes per year on 20,000-38,000 hectares and this accounts for 0.2% of world output (Horton, 1988; Ibid. CIP, 1991). Nwokocha (1992)

updated this figure to 45,000 ha contributing about 0.24% of world production.

The general problem of sweet potato as summarised by Haynes (1970) and Horton (1988) include the short shortage life and perishability of tubers, the epidermiology of pests especially during harvesting. Others include unstable price usually associated with the problem of seasonality in both supply and demand and maintaining dry season nursery for next season's cropping.

Efforts have been made to combat the above constraints. Such efforts have resulted in developing improved potato varieties by some Research Organisations namely the International Potato Centre (CIP) Lima, Peru, the International Institute of Tropical Agriculture (IITA), Ibadan, and the National Root Crops Research Institute, Umudike, both in Nigeria. Improved lines from IITA have been recorded as averaging 25.2 tha^{-1} from variety TIS 8437 (IITA, 1977) while at NRCRI average yield of 41.48 tha^{-1} was obtained from TIS 870087 (NRCRI, 1991). CIP obtained an average yield of 47.84tha^{-1} in variety VSP.5 (CIP, 1991).

Sweet potato has been shown to have economic potentials in both rainforest and derived guinea savannah zones of Nigeria (Eluagu et at 1986, Asumugha et al, 1992). Under Umudike condition, yield of sweet potato has been proved not to be statistically different under conventional (ridged) and reduced (unridged or harrowed) systems (Asumugha et at, 1992). The crop has a growth cycle of 4 months, and therefore can be grown 2-3 times in a year with supplementary irrigation through vines. Despite these potentials, farmers in Nigeria do not seem to have totally embraced this crop. This paper therefore tries to examine the economic performance of the new sweet potato varieties over a four-year work 1991-1994, by determining the Internal Rate of Return of the elite varieties developed and being disseminated. The specific objectives of the study are:

1. To carry out a detailed performance analysis of sweet potato production business over 4-year period.
2. to appraise the feasibility and viability of this enterprise by measuring the internal rate of return.

METHODOLOGY

This study was conducted under rain fed conditions in four growing seasons, 1991-1994. The location was research farm

of the National Root Crops Research Institute, Umudike (rainforest zone). The improved sweet potato varieties with wide ecological adaptations used are TIS 870087, TIS 8164 and TIS 8504, and AK/83/7. The Farm sizes were 0.10 ha in 1991; 0.10ha in 1992, 0.15ha in 1993, and 0.50 in 1994. These varieties were planted using the recommended technological package. The plot size was 6mx5m. The vines were planted in a slanting position (45^{0}) with at least two nodes in the soil and at 0.3m apart and 1m between ridges. Planting was done in May as recommended. Hand weeding was done 6 weeks after planting (Nwinyi and Ene, 1987). This was enough for the cover to suppress weeds. Mixed NPK fertilizer at the rate of 45:15:70 N,P, and K was applied at 6 weeks after planting as top dressing. Harvesting of sweet potato tubers was carried out at 16 weeks after planting as recommended using digging forks. Unit farmgate price was used for valuation.

Theoretical framework:

The Internal rate of Return (IRR) model was used to evaluate the data of this study. Here my model follows the pattern of Gittinger (1982), Jones (1982) as earlier used by Brown (1979).

The model equation is:

$$\sum_{t=1}^{T} Bt/(1+1)^{t} - \sum_{t=1}^{T} Ct/(1+1)^{t} + K = 0$$

where:

Bt = the benefit resulting from the enterprise in year t

Ct = the operational and maintenance cost in year t

T = year (1991 is year 1)

I = the unknown annual interest rate (discount) which will equate the flow of costs incurred in the initial year of the enterprise.

K = Capital outlay incurred in the initial year of the enterprises.

The internal rate of return (IRR) is the rate of interest which equates the present value of the flow of costs with the present value of the flow of returns at a given point in time. It provide a more realistic estimate of the actual return than the benefit-cost ratio since the time shape of the cost stream may differ from the time shape of the benefit stream (Jones, 1982). The World Bank uses it to gauge the project if finances (Brown, 1979). The formula method of computing discounting factors is as shown:

Discount factor

$(DF) = (1)^{n}/1 + r$ or $(1-r)^{-n}$

Where:

n = number of years (time periods)

r = rate of interest for the time period in decimals.

RESULTS AND DISCUSSION:

Table 1 shows the farm sizes, yields and gross revenue for this work for the various years (1991-1994). It is observed that gross revenue increased as the unit price per kilogram of tuber increased over the years.

Table 1: Production Parameters

Year	Farm Size	Yield		Farmgate Price	Gross Revenue
	(ha)	(t)	(tha^{-1})	(#/kg)	(#)
1991	0.10	1.59	15.97	1.00	15,970
1992	0.10	1.74	17.39	2.00	34,780
1993	0.15	1.44	14.47	3.00	43,410
1994	0.50	9.59	19.17	4.00	76,680

Data in Table 2 show the mean root tuber output in tonnes per hectare of the four varieties used in 1994. TIS 8164 (dark pinkish and more of oval shape) was the highest yielder. This variety and TIS 870087 (light pinkish and cylindrical to oval shape) are significantly the same and remained highly significantly superior ($P \leq 0.01$) in total, marketable and unmarketable tuber yield to varieties TIS 8504 and AK/83/7 which the themselves are statistically the same ($P \leq 0.01$).

Table 2: Mean Root Tuber Output for the 4 Sweet potato Varieties in 1994 (t/ha)

Varieties	Marketable	Unmarketable	Total
TIS 870087	25.58[a]	1.67[a]	27.25[a]
TIS 8164	26.38[a]	1.75[a]	28.13[a]
TIS 8504	10.59[b]	1.33[b]	11.92[b]
AK/83/7	8.15[b]	1.23[b]	9.38[b]

Means bearing same letter are not significantly different by DNMRT ($P \leq 0.01$).

*TIS = Tropical Ipomea Species

Farm Business Performance:
Table 3 presents the streams of costs and benefits of the sweet potato. This assess the productivity of the resources committed in this enterprise from 1991 to 1994 using the input-output ratios. Here the annual Gross Revenue increased from #15,970 in 1991 to #76,680 in 1994 per hectare cultivated. Net income to the enterprise varied between #7,192.80 to #46,832.20.

Table 3: Farm Business Performance Analysis for Sweet Potato Enterprise 1991-1994.

Item	Value (#)			
	1991	1992	1993	1994
Production benefit (tha^{-1}) (Marketable and unmarketable tubers)	15,970	34,780	43,410	76,680
Operating Inputs (Sweet Potato Vines, Fertilizer)	1,118.6	1,204.4	5,486	5,432.4
Labour cost (Planting till Harvesting)	1,720.5	1,000.0	3,274.8	8,100.0
Tractor Service (land Preparation) – clearing, ploughig harrowing and ridging)	1,000.0	950.0	1,000.0	1,000.0
Capital cost depreciateu for (Matchet, Hoe, Kitchen knife, digging fork, plastic bowl)	1,017.0	1,017.0	1,017.0	1,017.0
Land charge	800.0	1,250	1720.0	5,000
Interest charges on capital (Circulating + Investment)	1,081.1	1,030.0	2,490.6	4,315.4
Management cost	2,103	2,583	3,783	4,983
Total cost (TFC + TVC)	8,777.2	9,034.5	18,780.8	29,847.8
Net Return to Risk	7,192.8	25,745.5	24,629.2	46,832.2

Internal Rate of Return
Here the values of the cost and benefit streams were standardized to provide a proper basis for comparison. Therefore the values were reduced to their present worth in 1994 by discounting (Table 4). This uses an iterative technique for calculating the IRR. Our computation shows that the Internal Rate of Return (IRR) is about 120%. This represents the interest rate received for the enterprise consisting of payments (negative values) and income (positive values) that accrue at regular intervals.

This result shows that the sweet potato enterprise is viable since the internal rate of return is very much higher than the opportunity cost of capital which is the bank-lending rate of 19% in 1994. It showed that the enterprise will recover all the costs (investment, operational and maintenance costs) and make a surplus of more than 100% for the use of the money. The IRR here represents a "break-even" rate of discount. At this rate, the benefit-cost ratio is as close as possible to one, the net present value (NPV) is as close as possible to zero, and the sum of the positive net benefits is almost equal to the sum of the negative net benefit. Jones (1982) reported a rate of return of 65-195% in agriculture.

Table 4: Viability Appraisal of Sweet Potato Enterprise R at 121%

Year	Discount Factor	Cost (#)	Present Value of Cost (#)	Revenue (#)	Present Value of Revenue (#)
1	8.1967^{-03}	8,777.2	71.9443	15,970	130.9016
2	6.7186^{-05}	9,034.5	0.6070	34,780	2.3367
3	5.5071^{-07}	18,780.8	0.0103	43,410	0.0239
4	4.5140^{-09}	29,847.8	1.3473^{-04}	76,680	3.4613^{-04}
			72.5644		133.2626

NPV = #60.6982 (Closing up to zero)

CONCLUSION

Based on the above result, it is reasonable to infer that the improved sweet potato enterprise is a worthwhile investment. The rate of return has been very high, estimated to be more than 100%. Efforts should further be made by research on product and market development for sweet potato as well as measures to solve the short storage life and perishability of the root tubers.

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