Comparative Organoleptic and Gross Margin Analysis of Taro and Sweet Potato in Samoa

Nandakumar Desai[11], Taniela Siose[12], and Mohammed Kader[13]

Abstract: Production and marketing data for taro (*Colocasia esculenta*) and sweet potato (*Ipomea batatas)* grown using manual labor in Samoa was analysed. Results indicate sweet potato is 1958 M.hr (equivalent to WST15,398) relative to taro which is 480 M.hr (WST8,170) labour and capital intensive. This structured labour and capital use gross margin, returns per M.hr and B:C ratio recorded relatively higher values for sweet potato than for taro. Higher percentage of carbohydrate, moisture, protein and fat in sweet potato organoleptic profile indicate its possible use in weeny food preparation.

Keywords: *Organoleptic, Gross Margin Analysis, Returns per Labour*

Introduction

Under Pacific island situations root and tuber crops like taro, cassava, sweet potatoes and yams are considered the main source of carbohydrates and they also have high nutritional value (FAO 2010). In countries like Samoa aroids (mainly taro) was the main source of carbohydrates before the outbreak of Taro Leaf Blight (TLB) in 1993. The outbreak totally destroyed not only Samoa's main food crop but also its main export earnings as well.

Under these circumstances, the resiliency of Pacific Island small holder agriculture comes from integrated farming system (IFAD 2012). In this regard, certain well accepted traditional crops, especially root crops, have become important sources of household income, without undermining the viability of cropping/farming systems. Hence, combining root crops with cash crops, such as cocoa and vanilla, have also been important components of integrated farming systems in the region. Such a system allows improving the productivity of traditional root crop production. It is known that intensive mono-culture may result in the loss of productivity associated with labor and other productive resources.

Crop diversification could be considered technical interventions in tropical root crop production. Sweet potato, in particular, is a short-term crop of minor importance to Samoa but has the potential of being a substitute food crop in low fertility, saline and drought conditions. The orange coloured sweet potato is rich in vitamin A and high in nutritional value. It is mostly preferred by non-Samoan communities but has received very little attention from Samoans.

In order to address crop diversification, economic aspects of production must be evaluated. The Pacific Island Countries have produced farm management manuals that show gross margins and budgets for various crops and livestock activities. These manuals are useful planning tools if they are regularly and accurately updated. However, they fail to provide adequate information for estimating returns from traditional smallholder production.

A better form of analysis would give a much higher value to traditional crops and cropping systems, and a higher priority in agricultural policy. Hence, this study aims at cross-evaluating the performance of taro and sweet potatoes by considering gross margins and organoleptic analysis. The outcome of this study would improve decision making capacities of smallholders, in

[11]Lecturer, School of Agriculture and Food Technology, USP (Samoa).
[12]Student of School of Agriculture and Food Technology, USP (Samoa)
[13]Senior Lecturer, School of Agriculture and Food Technology, USP (Samoa).

evaluating constraints on increasing household incomes and in identifying activities and technologies that could help manage these constraints.

Methodology: Data on taro (Samoa 2) was collected from published literature and sweet potato (IB/PR/03) from our own experimental study at the University of the South Pacific, School of Agriculture and Food Technology (Samoa) in 2016. This includes information about expenditure incurred on land preparation by using labour and planting material used for taro and sweet potato crop. Crop-wise other expenditure related to fertilizer use, labour engaged for weeding, harvesting and preparing the produce for marketing were recorded separately.

To draw meaningful conclusion, the generated data was subjected to gross margin and organoleptic analysis. Crop production cycle for taro and sweet potato was restricted to eight and five months, respectively. The planting geometry of 1MX1M for taro and 0.4MX0.7M sweet potato were followed. The realized ha^{-1} yield level from taro and sweet potato was 14 and 15 tons, respectively. To arrive at gross margin and returns per man hours (M.hr), the per ton sale price for taro and sweet potato were considered WST800 and WST2000 and per M.hr wage rate was considered WST4.

Results and Discussion: The experimental results obtained in studying the comparative economics of taro and sweet potato are presented in Table-1. The per ha crop production costs of WST 8170 (taro) and WST15,398 for sweet potato were incurred. The crop-wise and activity-wise breakdown indicated that, in order to establish 1ha of taro, 200 M.hr were used. For sweet potato, 1122 M.hr were used and the corresponding expenditure amounted to WST 800 and WST4488. The expenses incurred towards planting material had registered WST 5000 for taro and WST 8000 for sweet potato.

To meet nutrients requirements, the 250kg and 230kg of complex fertilizer was used whose, respective ha^{-1} cost values were observed at WST 1250 and WST 1150. To control weeds in taro and sweet potato in one hectare field 200 M.hr and 528 M.hr were consumed and the corresponding expenses for this M.hr worked to WST 800 and WST 528. For ha^{-1} taro and sweet potato crop WST 320 and WST 1232 incurred as harvesting cost.

The higher amount of gross margin of WST 14,602 for sweet potato was realized as compared to WST 2,530 for taro. On the other hand in spite of higher quantum of use of M.hr the returns to per M.hr for sweet potato was observed to be WST 7.46 while, for taro it was WST 5.27. Similarly the Benefit Cost Ratio (B:C) analysis had indicated lower ratio of 1.37 and higher ratio of 1.97 for taro crop and sweet potato respectively.

From the above, it was inferred that, the sweet potato was observed to be labour and capital intensive and indicated higher amount of gross margin and returns to per M.hr and B:C ratio. In addition from the establishment date of sweet potato crop the gross margin was obtained by completing crop cycle in just five months.

In contract, in order to realize gross margin from taro crop, one needs to wait till eight month of crop cycle. With this lag time associated with the taro crop cycle had indicated little scope for repeated land use. On the contrary with the sweet potato's short duration crop cycle provided an opportunity in improving the per annum intensity of land use. Further, the short crop cycle sweet potato suggested on the scope of developing on-farm planting materials. We can say that the short crop cycle of sweet potato created more opportunity to regenerate soil fertility by growing

leguminous cover crop during the long fallow period for better sustainability. Sweet potato provide an indication on the creation of higher quantum of on farm employment opportunities. Its cost of production extents to WST8000. However, under labour scarce situations, taro crop cultivation observed to be economically more feasible.

The per hectare costs and returns analysis results for taro and sweet potato are presented in Table 2 and depicted in Figures 1 & 2 respectively. In the total cost of production, the maximum share relating to planting material and other costs were registered to be 61.2 percent for taro and 52.0 percent for sweet potato. The establishment cost item share was relatively high (29.2%) for sweet potato and it was low for (9.8%) taro. Under maintenance cost item the share of expenditure incurred towards fertilizer indicated higher of 15.3 percent for taro and relatively least of 7.5 percent for sweet potato. Similar trend was observed for weeding whose percentages were 9.8 and 3.4 for taro and sweet potato respectively. Whereas, the harvesting and cleaning component showed higher of 8.0 percent for sweet potato and least of 3.9 percent for taro.

The information on the per hectare sweet potato production costs percentage increase or decrease over taro production costs indicated an increased percentages for the items like establish cost (461%), harvesting and cleaning cost (285%) and total cost (88.5%). While, decreased percentages for the items under maintenance cost such as fertilizer (8.0%) and weeding (34.0%) were observed.

On the other hand corresponding to the per hectare returns from sweet potato production in terms of percentage increase or decrease over returns from taro production had registered 447.2 percent and 167.9 percent increased gross margin and gross return respectively. In addition sweet potato had recorded 41.6 percent of increased return from per M.hr over taro.

From the per hectare costs and returns analysis it was concluded that, the items such as establishment, planting material and other costs, harvesting and cleaning were responsible for the relative increased costs.

The reasons for relative increase in these costs were due to land preparation methods, planting geometry and harvesting and cleaning of higher quantum in sweet potato cultivation. Of these increased percentages, planting material cost that accounted 52.0% of total cost. This could be minimized by producing own planting material during the long fallow period even in the backyard of farmer's house. However, due to the long period crop cycle of taro and the nature of planting material (sucker, runner and taro tops), provides opportunities for on-farm planting material production; as it could use only different planting time.

Organoleptic Analysis: The nutrition profile of taro tubers contrastingly indicated higher percentages of dry matter and ash. Sweet potato indicate higher percentages for carbohydrate followed by moisture, protein and fat. The finding indicated the possibility of its usage in infant weeny food preparation. On the other hand, the sweet potato composition results indicated it's suitability in the production of chips.

Nutrient Mining: Nutrient uptake data show that taro is a very exhaustive crop compared to sweet potato. Taro uptake 50.3 kg N, 11.6 kg P and 68.1 kg K/ha/season while sweet potato uptake 16.8 kg N, 9.1 kg P and 26.7 kg K (Fig 3). Thus, cultivation of taro is not sustainable for soil fertility management if the same amount of nutrient are not added to the soil.

Conclusion: Sweet potato is a short-term crop of minor importance to Samoan people but has a great potential as a substitute food crop, especially in low fertility, saline and drought conditions. In addition, it could be considered as a technical intervention to transform root crops farming into more sustainable systems. The gross margin analysis along with generation of farm employment opportunities indicate possibility of increasing productivity of sweet potato cropping systems. Thus, increased policy interventions are needed to popularize sweet potatoes and farmers need to cultivate this crop instead of solely depending on taro for food security.

References:

Centre for Tropical Agriculture (2011). Pacific: Agriculture trade policy debates and developments. Stable URL: http://agritrade.cta.int

Fred Opio Ekongoha and Jegasothy, (1999). Managing a Small-scale Plantation. Proceeding of a Training Workshop, USP Extension Center, Port Vila, Vanautu, September 11-15.

Food and Agricultural Organization, (2010). Building Resilience to Climate Change; Root Crops and Fisheries Production, Food and Agricultural Organization, Italy.

International Fund for Agricultural Development, (2012). Review of the IFAD's Sub-Regional Strategic Opportunities and Program in the Pacific, Italy.

Table 1 Enterprise Budgeting for Taro and Sweet Potato crop (ha^{-1})

Crop		Taro			Sweet Potato		
SL No	**Activity**	**Qty. (M. hr./ No./Kg)**	**Unit Cost/Price (WST)**	**Total Amount (WST)**	**Qty. (M.hr. / No./Kg)**	**Unit Cost/Price (WST)**	**Total Amount (WST)**
I	Gross return for	14 Tons	800	11,200	15 Tons	2,000	30,000
II	Establishment cost; Land preparation & planting	200 M.hr	4/M.hr	800	1122 M.hr.	4/M.hr.	4,488
III	Planting material & other costs	10,000 No.		5,000	35,700 No.		8,000
IV	Maintenance cost;						
	1. Fertilizer	250 Kg.	5/Kg	1,250	230 Kg.	5/Kg.	1,150
	2. Weeding	200 M.hr	4/M.hr	800	528 M.hr	4/M.hr	528
V	Harvesting & cleaning	80 M.hr	4/M.hr	320	308 M.hr	4/M.hr	1,232
VI	Total cost			8,170			15,398
VII	Gross margin			2,530			14,602
VIII	Returns to M.hr	480 M.hr		5.27	1958 M.hr		7.46
IX	B:C Ratio			1.37			1.97

Table – 2: Per Hectare Costs and Returns Analysis for Taro and Sweet Potato

Crop		Taro	Sweet Potato	
SL. No.	Activity	Total Amount ($)	Total Amount ($)	% Increase /Decrease over Taro
I	Establishment cost; Land preparation & planting	800 (09.79)	4,488 (29.15)	(+) 461.00
II	Planting material & other costs	5,000 (61.20)	8,000* (51.95)	(+) 060.00
III	Maintenance cost;			
	1. Fertilizer	1,250 (15.30)	1,150 (07.47)	(-) 008.00
	2. Weeding	800 (09.79)	528 (03.43)	(-) 034.00
IV	Harvesting & cleaning;	320 (03.92)	1,232 (08.00)	(+) 285.00
	Total cost	8,170 (100.00)	15,398 (100.00)	(+) 088.47
V	Gross return	11,200	30,000	(+) 167.86
VI	Gross margin	2,530	14,602	(+) 477.15
VII	Returns to M.hr	5.27	7.46	(+) 041.56

*On farm Sweet potato planting material production this cost may be eliminated

Figure 1: Distribution of costs of production of Taro

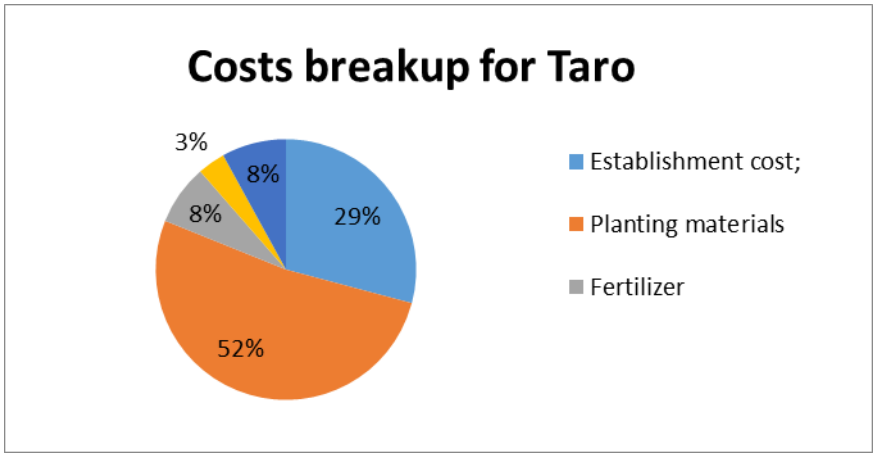

Figure 2: Distribution of costs of production of Sweet Potato

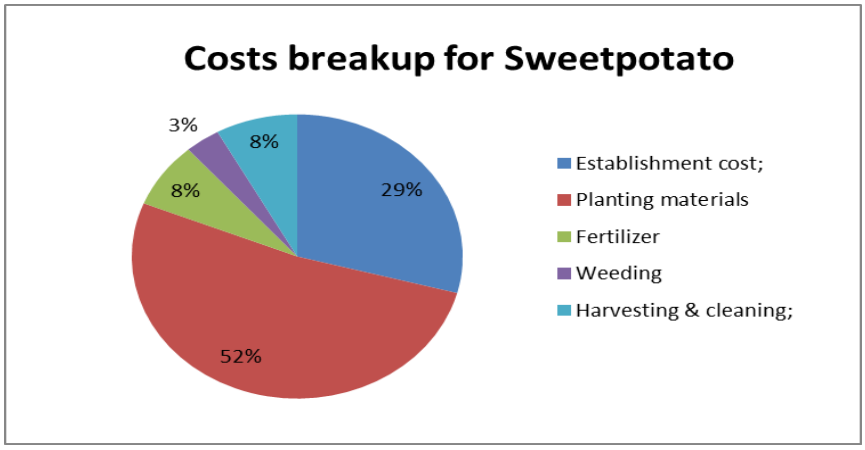

Figure 1 Nutrient Uptake by Sweet potato and Taro