

## **Consumer versus Farmer Preference for Sweetpotato Product Attributes in Papua New Guinea**

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### **ABSTRACT**

Sweetpotato is the main staple food in Papua New Guinea, with an estimated per capita consumption per annum of nearly 300 kilograms in the Highlands where the bulk of production occurs. In recent years, the demand for sweetpotato in the coastal cities, especially Lae and Port Moresby, has increased substantially due to urbanisation, economic growth and the mining boom. Many smallholder farmers are taking advantage of this marketing opportunity. However, to meet market demand, farmers must better understand what the consumer wants. This research reports on the results obtained from a consumer survey conducted in Port Moresby and a farm survey conducted in the Jiwaka province aimed at understanding and comparing consumers' and farmers' preferences for sweetpotato. The main findings are that (1) in Port Moresby, rice is the most preferred staple food, followed by sweetpotato and cooking bananas; (2) both consumers and farmers have a strong preference for sweetpotato varieties and associated attributes; (3) these preferences vary between and within regions and over time; (4) there is a gap between what the consumer wants and what the farmer prefers and supplies to the market; and (5) both consumers and farmers could not identify clearly what varieties are being supplied at the market. These results suggest there is a need for variety identification and the provision of such information to both consumers and farmers to facilitate trade and improve marketing efficiency.

### **INTRODUCTION**

Sweetpotato is the most important crop in Papua New Guinea (PNG), accounting for 43% of all food energy. It is grown throughout the country with an annual production estimated to be around 3 million t. Of which, 75% is produced in the PNG highlands. About 60 to 75% of highland sweetpotato is used for household consumption and 25 to 40% is used as pig feed (Bourke and Vlassak, 2004). As the most important food crop, the national average consumption of sweetpotato is 260 kg/person/year, but there are regional differences. The annual per capita consumption of sweetpotato in the rural area is 299 kg, while in the urban area it is only 42 kg/person/year (Gibson, 2001). By comparison, rice consumption is 66 kg/person/year in the urban area and 24 kg/person/year in the rural area, with a national average of 31 kg/person/year. Transport issues, availability of other staple foods (e.g., rice, bananas, taro, sago, yam, cassava), and socio-demographic differences may have contributed to the differences in the level of consumption between the two areas (Gibson, 2001).

Sweetpotato has become an essential cash crop for smallholder farmers in recent years, driven by the need to generate income in a cash economy, and the growing demand from the expanding urban and non-farm sectors. The amount that is sold to the market was estimated to be around 2% of total production, approximately 60,000 tonnes a year in 2005 (Spriggs, 2005). This proportion may have increased to around 5-10% in the past few years as a result of the mining boom. There is market opportunity for smallholder farmers in the PNG highlands to take advantage of this increasing market demand to improve their livelihoods. However, market access is hampered by inadequate marketing infrastructure, poor postharvest management, and a lack of supply chain coordination, as well as a lack of market information on consumer demand.

To improve economic returns, smallholder sweetpotato farmers will need to be better organised, work collaboratively in groups, change their current postharvest and marketing practices, and overcome the distrust and ignorance that has hampered efforts to introduce desired changes. Furthermore, there is a need to understand buyers' preferences for sweetpotato in different market segments. The objective of this study was to assist smallholder sweetpotato farmers in the PNG highlands in understanding consumer preference and in identifying market opportunities.

## **MATERIALS AND METHODS**

This study is based on a farm survey conducted in the PNG highlands in December 2012 and a consumer survey conducted in Port Moresby in April 2013.

### **Farm Survey**

The farm survey was conducted with five farmer groups in Jiwaka province to account for regional differences in socio-economic and demographic factors (see Table 1, left hand side panel). Overall, 186 respondents were interviewed. The survey covered a number of topics, including:

- Socio-demographics of the farm households—age, gender, education and the role in sweetpotato production and marketing of household members.
- Production activities and decision-making—landholdings and tenure, garden size, and production shares of sweetpotato and other crops.
- Varietal choice—varieties of sweetpotato grown and marketed, and their characteristics.
- Postharvest practices—regarding curing, packaging and storage of sweetpotato.
- Product utilisation and marketing—shares of sweetpotato grown/used for home consumption, animal feed and marketing and market outlets and pros and cons of different selling methods.
- Finance—income sources, assets, expenditure and access to credit.
- Access to training and extension—group membership, training received and future training needs.
- Self-assessment of wellbeing—degree and source of happiness, and areas of dissatisfaction and areas for improvement.

### **Consumer Survey**

The consumer survey was conducted in nine locations in Port Moresby to account for the ethnic and socioeconomic backgrounds of respondents and safety issues for enumerators. The survey sites were identified by extension officers from the FPDA Port Moresby office (see Table 1, right hand side panel) and respondents from each site were identified on a voluntary basis. A total of 356 respondents were interviewed by 10 enumerators. A semi-structured questionnaire was developed and pre-tested. The survey form was divided into four sections:

- Section A—consumption patterns and preferences for sweetpotato and other staple food crops.
- Section B—information regarding varietal preferences and preferred quality attributes.
- Section C—information regarding buying decisions and issues related to sweetpotato marketing such as availability, quality, product information, and pricing schemes.
- Section D—socio-demographic information of the respondents and their households.

## **RESULTS AND DISCUSSION**

In this section, we focus on consumers' and farmers' varietal choice and associated product attributes.

### **Consumer Survey**

Key results from the consumer survey are summarised below.

1. **Most preferred food staples.** In Port Moresby, rice was the most preferred staple food, followed by sweetpotato and cooking bananas. 55% of the respondents chose rice and 40% chose sweetpotato as their most preferred staple food (Table 2). 46% of the respondents chose sweetpotato and 22% chose rice to be their second most preferred staple food. The main reason for choosing rice was its availability while for sweetpotato it is taste/preference. For changes in sweetpotato consumption, 23% of respondents indicated that they are eating more, while 29% are eating less and 48% are eating about the same, compared to a year ago (Table 3). The main reasons for eating more was a change in taste/preference for health reasons and an increase in family size, and the main reasons for eating less were affordability and different taste/preference of children who prefer rice and potato.
2. **Variety preferences.** In Port Moresby, *Wanmun* and *Wahgi Besta* appeared to be the most preferred sweetpotato varieties (out of 8 most mentioned varieties during the survey). They were preferred by 40% and 39% of respondents, respectively (Table 4). The main reasons for choosing *Wanmun* and *Wahgi Besta* were similar in that they are both of “good taste” (sweet; creamy; good taste/flavour/aroma) and of “good quality” (colour of skin/long shelf life/ strong/ firm flesh/ does not sprout quickly/good appearance). A previous study found that *Kerot* to be by far the most preferred variety in the Lae market followed by *Wahgi Besta*, and then a number of varieties (*Trimun*, *Korowest*, *Wanmun* and *Gimane*) that were equally preferred (Omot et al., 2010). During the course of research, we observed that different varieties were planted in different regions, and consumers and farmers alike tended to prefer varieties grown in their villages, suggesting a clear link between varietal choice and region. For example, Eastern Highlands tends to grow *Gimane* while Jiwaka tends to grow *Wahgi Besta* and *Wanmun* and Western Highlands tends to grow *Korowest* and *Rachael*. These are the “commercial” varieties commonly found on the market. Among the consumer survey respondents in Port Moresby, 21% were from Chimbu, 18% from Southern Highlands, 10% from Eastern Highlands, 9% from Jiwaka and 42% from all other provinces.
3. **Quality attributes.** When respondents were asked what they considered as good quality sweetpotato, 76% of respondents indicated “good appearance – no pest/insect damage”, 44% indicated “sweet taste”, 33% indicated “uniform shape and size”, and 31% indicated “fresh and clean” (Table 5, left hand side panel). Sweetpotato was considered of poor quality when it had “pest/insect damage”, “poor taste” and “poor shape” (Table 5, right hand side panel). In general, the majority of respondents considered the quality of sweetpotato in the market to be very good (21) , good (70%) and poor (9%). 40% of respondents consider that the quality had improved while 29% considered quality had deteriorated over time. 70% of respondents noticed quality that was variable throughout the year. When respondents were asked how they think quality can be improved, improving “transport”, “handling”, “grading/sorting”, “packaging”, and “storage” were all mentioned.
4. **Preferred physical characteristics.** Specific physical characteristics that consumers looked for when shopping were: highland grown, medium-size, elongated shape, yellow/cream-coloured fresh, firm, dry and smooth textured, red skin, unwashed, fully matured, and non-sprouted (Table 6).
5. **Buying decisions.** Respondents showed a strong preference for the sweetpotato they buy. 89% said that the decision was made before they go to the market. In terms of availability, 62% of the respondents said it was easy to find what they want. If what they want was not available in the market, 60% said they would buy other variety while 38% said they would buy other staples.
6. **Product information.** When respondents were asked what information they asked of vendors, the answers were: variety by 53% of respondents, place of origin of production (37%), price (19%), fresh colour (17%), and harvest date (15%).

## Farm Survey

Key results from the farm survey are summarised below.

- 1. Varietal choice.** According to Roullier et al. (2013), more than 1000 sweetpotato varieties are grown by smallholders in Papua New Guinea, the second largest genetic diversity centre for sweetpotato. In our survey, 36 varieties were clearly identified by farmers. However, we were unable to verify whether they are indeed different varieties genetically. Survey results found that 83% of the farmers grew > three sweetpotato varieties with the maximum number of varieties grown by a farmer being six. The most preferred varieties were *Wahgi Besta* (74% of farmers), *Sugar* (14%) and *Rachael* (8%) (Table 7). The survey identified regional differences between groups: the most preferred variety for groups 1, 2 and 3 was *Wahgi Besta* *Sugar* by group 4 and *Wahgi Besta* and *Sugar* were equally preferred by Group 5. While there was no difference in the number of varieties grown within a group, there was significant difference in the average number of varieties grown between groups (Chi-square = 11.723, p-value = 0.0195).
- 2. Perceived varietal attributes.** Respondents' perceptions of desirable and undesirable traits of varieties are given in Table 8. Good eating quality, yield performance, market price, early maturing, and resistance to pests and diseases were some of the most common reasons for selecting those varieties. Some morphological attributes were also mentioned, including colours of the skin and the flesh. 39% and 32% of respondents indicated that these varieties are easy to handle and travel well to long-distance markets, respectively. More than 80% of respondents indicated that sweetpotato were grown for both home consumption and marketing. Only 18% and 5% of the farmers said that they produced *Wahgi Besta* and *Sugar*, respectively specifically for the market confirming that most farmers did not grow sweetpotato for the market only and instead they sell what they are growing – an indication of production/supply orientation, as opposed to customer/market orientation. It may be coincidental that Jiwaka is growing *Wanmun* and *Wahgi Besta* which are the preferred varieties by consumers in Port Moresby. Omot et al. (2010) also looked at farmers' perceptions of consumer preference for sweetpotato variety, physical characteristics, and eating quality, and how farmers responded to them. They found that sweetpotato suppliers from the highlands were not fully aware of consumers' preferences, but because they thought they did, they could not, and did not, respond adequately to consumer demand. It would appear that the majority of farmers rarely visited the market (most likely once or twice a year) and this could be one reason why they are able unable to fully understand what the consumer wants, particularly as when they did go to the market, they simply brought whatever they had grown.

## CONCLUSIONS

Based on the results from the farm and consumer surveys and previous research, it is clear that farmers' and consumers' preferences for sweetpotato are much more variable within and among populations, regions, and over time. This means that it is difficult for farmers and marketers to select the varieties that meet consumer demand and market requirements. However, the physical characteristics preferred by the consumer can be used as a guide for variety selection and future breeding programs. In general terms, farmers are not customer or market-oriented as they grow the varieties that are common in their areas mainly because they suit the agro-climatic conditions for production, not because of consumer demand. In rare cases where the varieties are grown for the market, they are chosen because they travel well to long distance markets, especially Port Moresby, despite these varieties taking 7-8 months to mature (for example, *Korowest*), as opposed to 4 months (for example, *Gimane* and *Wahgi Besta*).

Misconceptions of consumer preferences can result in inefficiency in the supply chain and misallocation of resources because when the “wrong” varieties are being marketed, they mostly likely obtain low prices and product wastage. Education of farmers regarding consumer preferences, and providing consumers with product information on product standards, labelling or advertising will help improve marketing efficiency.

## ACKNOWLEDGEMENTS

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### Tables

Table 1. Respondent groups for farm and consumer surveys.

Farm Survey (Jiwaka Province)		Consumer Survey (Port Moresby)	
Location/Group *	No. of respondents	Location	No. of respondents
Kukpa and Kudjip (1)	77	Gabutu	25
Minj (2)	49	Erima	55
Banz (3)	24	Gordon Ridge /5 Mile	44
Kindeng (4)	17	Morata 2	58
Wahgi Flat (5)	19	Segani/Ranugari/4 mile	84
		Bomana	43
		Others (Boroko/Taurama/Central)	47
Number of respondents	186	Total number of respondents	356

\*1 Voice for Change; 2 South Wahgi Organic Farmers Association; 3 Konza Organic Farmers Association; 4 Village extension worker (VEW) group; 5 Kondapina Flood Farmers Association.

Table 2. Most preferred food staples.

Item	Order of preference (% of respondents)		
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>
Sweetpotato	40	46	12
Potato	1	8	25
Tao	0	2	3
Yam	0	0.3	1
Banana	3	20	42
Cassava	0	1	3
Rice	55	22	11
Sago	0	1	1
Others	0.3	1	2

Table 3. Changes in sweetpotato consumption.

Patterns (% of respondents)		Reasons for eating more (% of responses)		Reasons for eating less (% of responses)	
		Change in preferences (taste/health)	52	Affordability – expensive	53
About the same	48	Increase in HH size	44	Different preferences of children	33
Eating less	29	Availability - more supply in the market	42	Unavailability	29
Eating more	23	Affordability - more affordable	17	Low quality of sweetpotato in the market	23
		Others: (convenience/habit)	21	Decrease in HH size	21

Table 4. Varietal preferences.

Variety	% of respondent	Reasons for preferring these varieties (no. of responses)*							
		1	2	3	4	5	6	7	8
<i>Wanmun</i>	40	117	48	47	23	73	11	39	4
<i>Wahgi Besta</i>	39	110	41	36	14	77	12	57	15
<i>Karot</i>	8	25	8	5	4	11	4	7	0
<i>Trimun</i>	3	11	4	4	3	6	2	4	0
<i>Rachael</i>	3	9	5	5	1	7	3	5	1
<i>Korowest</i>	2	8	3	4	1	2	2	4	1
<i>Gimane</i>	1	3	1	1	1	0	0	2	0
<i>Marasondai</i>	1	3	1	1	1	2	0	1	1
Others	3	8	5	5	4	7	3	4	0

\* 1 Taste (sweet; creamy; taste/flavour/aroma); 2 Size and shape of roots (good shape/shape/elongated/straight); 3 Flesh characteristics (soft/moist/starchy/powdery/firm/not too watery); 4 Market availability; 5 Good quality (colour of skin/long shelf life/strong/firm flesh/does not sprout quickly/good appearance); 6 Easy to prepare (easy to peel/fast cooking/easy to cook); 7 Nutritional value (filling/hunger buster/strength/energy/last long); 8 Others – familiarity/habit (used to eat this variety).

Table 5. What consumers consider as good and poor quality sweetpotato.

Good quality sweetpotato		Poor quality sweetpotato	
Item	% of responses	Item	% of responses
Physical appearance <sup>1</sup>	76	Pest/insect damage	99
Taste (sweet)	44	Poor taste	60
Uniform shape and size	33	Poor shape <sup>3</sup>	42
Fresh and clean	31	Skin damage <sup>2</sup>	37
Strong tuber	12	Dried and withered roots	19
Maturity	7	Small size	12
Nutritional/dietary value	7	Others (coastal varieties)	8
Others	6		

<sup>1</sup> no pest/insect attack; <sup>2</sup> has spot/discoloration/bruised skin/cracked/wrinkled;

<sup>3</sup> crooked/rough skin/odd shapes/irregular shape/disfigured/not straight.

Table 6. Preferred physical characteristics of sweetpotato (in % of responses).

Flesh colour		Skin Colour		Taste	
Yellow	51	Red	34	Sweet	97
White	38	Brownish white	26	Powdery/Dry	92
Orange	14	Purple	21	Smooth	92
Purple	1	White	16	Firm	90
		Other	3	Soft	10
				Grainy	8
				Watery/Moist	8
Cleanliness		Maturity		Freshness	
Unwashed	76	Fully matured	67	Non-sprouted	88
Washed	24	Young	33	Sprouted	12
Size		Shape		Source	
Medium	77	Elongated	76	Highlands	99
Large	21	Round	24	Lowlands	1
Small	2				

Table 7. Varietal choice for sweetpotato in selected villages in Jiwaka province.

Item	Groups					All
	1	2	3	4	5	
No. of varieties grown	1-6	1-6	2-5	2-6	2-6	1-6
Most preferred varieties	(% of respondents)					
<i>Wahgi Besta</i>	83	98	63	12	42	74
<i>Rachael</i>	7		17	24	5	8
<i>Sugar</i>	4		17	59	42	14
Others	7	2	4	6	11	5

Table 8. Perceptions on attributes of sweetpotato varieties (% of respondents).

Attribute	Sweetpotato variety				Average
	<i>Wahgi Besta</i>	<i>Rachael</i>	<i>Sugar</i>	Other	
Good eating quality	99	100	100	78	99
Yield performance	91	86	76	56	88
Price on the market	85	79	68	67	83
Colour of the skin	83	57	72	67	80
Colour of the flesh	80	50	72	78	77
Early maturing	55	57	20	11	48
Easy to harvest and store	50	14	8	0	39
Resistant to pests/diseases	39	21	36	11	35
Travel well	37	21	16	11	32
Other	17	7	20	11	16