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Abstract

The current fight against Vitamin A deficiency has focused on promoting biofortified staples that are rich in beta carotene, such as Orange Fleshed Sweetpotato (OFSP). These efforts usually entail providing quality planting materials to vulnerable households accompanied by sensitization about the benefits of OFSP. Most such interventions heavily subsidize the planting materials, with subsidies ranging from 50-100%. The subsidies are often premised on the hope that farmers will eventually absorb the full cost of the planting materials once they experience the benefits of consuming OFSP. This study uses data from 481 farmers drawn from different regions that benefited from a sweetpotato project, and the ANOVA and descriptive statistics, to examine farmers' willingness to pay (WTP) for OFSP planting materials. It specifically compares the WTP for quality planting materials of OFSP and non-OFSP varieties and assesses differences in WTP by region and agroecology. It finds a higher WTP for clean planting materials of a non-OFSP variety than for all OFSP varieties studied. It also finds that WTP differs by region and agroecology. The study concludes that there is higher demand for quality planting materials of some of the non-OFSP varieties of sweetpotato than for OFSP varieties, and that WTP for differs by intervention area. These findings imply that farmers' demand for clean planting materials of non-OFSP varieties is higher than for the OFSP varieties. They suggest the need for sweetpotato breeding to continue considering some of the attributes that make local varieties popular, e.g., taste and dry matter content, in their breeding programs.

Key words: Biofortified crops, quality planting materials, smallholder sweetpotato farmers, willingness to pay, Tanzania

1. Introduction

Micronutrient malnutrition, especially vitamin A deficiency (VAD), is major problem affecting developing countries of Sub-Saharan Africa (West and Darnton-Hill, 200; 1FAO, 2012). VAD is especially intense among the poorer populations who can't afford the artificial food supplements and whose options for food diversification are limited (Bouis, 1999). Biofortification, a food-based approach to combating VAD can contribute to the fight against VAD (Bouis et al., 2011). One of vitamin A-rich biofortified staple that can greatly contribute to the fight against VAD is the orange-fleshed sweetpotato (OFSP). The OFSP is rich in beta carotene, a precursor for vitamin A (Nestel et al., 2006). Proof-of-concept studies in Uganda, Mozambique, Kenya and Rwanda have found strong evidence that OFSP can provide adequate quantities of vitamin A needed to overcome VAD among vulnerable groups, namely children under 5 years and pregnant and lactating women (Harvestplus, 2012). In addition, Van Jaarsveld et al., (2005) found that consumption of moderate amounts of boiled OFSP by children, at least three times a week, significantly improved their vitamin A levels in the blood.

One of the major constraints to farmers' adoption of OFSP has been the lack of access to quality planting materials (or vines). Majority of sweetpotato farmers therefore depend on own sweetpotato vines or those borrowed from close social networks (Okello et al., 2015). Such vines tend to be of poor quality and are of the types that are not rich in vitamin A. The International Potato Center (CIP), jointly with the public and private sector partners, has therefore spearheaded efforts to promote farmers' access to quality sweetpotato planting materials, including those that are rich in vitamin A between 2009 and 2013 in Tanzania. The joint partnership involved CIP, the government of Tanzania and some non-governmental organizations. The partnership aimed at promoting farmers' access to quality planting materials at 50-100% subsidy. The planting materials promoted were of the OFSP and non-OFSP white-fleshed sweetpotato (WFSP) varieties. The white varieties promoted by the project were disease and pest free unlike the dominant traditional varieties, but contained no beta-carotene (Stathers et al., 2005). The project also sensitized farmers on the nutritional value of consuming OFSP (Sindi et al., 2012) and the need to use quality planting materials. Farmers were then provided with clean materials of both OFSP and non-OFSP to plant for two seasons prior to the study. It is estimated that more than 10,000 farmers benefited from this intervention (Okello et al., 2015).

The high subsidy and the fact most sweetpotato farmers usually exchange vines for free have led to questions regarding whether farmers would be willing to pay for quality planting materials (that is, vines that are free from diseases and pests) if the current subsidies were removed, and how much they would be willing to pay. This study uses data from a carefully designed field experiment that controlled for quality of planting materials to compare farmers' willingness to pay for quality vines of OFSP and those of non-OFSP by region and agroecology of the intervention area. The study uses Analysis of variance (ANOVA) technique and descriptive statistics to compare farmers' willingness to pay for quality planting materials of OFSP with that

of non-OFSP and to assess differences in WTP for both OFSP and non-OFSP by intervention region and agroecology. The data used was collected from among sweetpotato farmers who participated in the project.

This study differs from previous ones which normally focused on the willingness to pay for OFSP roots (Nestel et al., 2006; Masumba et al., 2007; Tumwegamire et al., 2007; Meenakshi et al., 2010; Naico and Lusk, 2010) by focusing on sweetpotato planting materials. The only exception is Labarta's (2009) who examined the willingness to pay for OFSP planting materials in Mozambique using an auction. It also differs Labarta (ibid) study because it utilizes a field experiment that allowed farmers to plant quality vines of both the biofortified OFSP and non-biofortified white fleshed varieties of similar quality, thus enabling the them to have real rather than hypothetical experience of the varieties prior to bidding for different varieties.

The rest of this paper is organized as follows. Section 2 discusses the study methods and also presents the analytical framework. Section 3 discusses the empirical methods. Section 4 presents and discusses the results while Section 6 concludes and draws some policy implications.

2. Study methods

This study is based on the Lanchaster's consumer theory which is a refinement of the traditional approach to the theory of consumer behavior. The Lancaster theory posits that consumers value goods due to their attributes rather than the good *per se* (Lanchaster, 1966). Specifically, the Lancasterian demand theory argues that consumers derive utility from the characteristics or properties of a good rather than the good being the direct object of utility. This implies that a good by itself does not give utility to the consumer; rather, its attributes in terms of characteristics and features do. In general, a good will possess more than one attribute, and attributes may be shared by more than one good.

There are two methods assessing consumer evaluation of new food products namely, revealed and stated preference methods, respectively. The most commonly used stated preference method is the contingent valuation (CV). This study therefore used the CV method, owing to its flexibility and the ease of implementing it (Carson et al., 2001). We further used the open-ended (OE) method of eliciting WTP bids following past studies (Frykblom and Shogren, 2000; Reaves, Kramer and Holmes, 1999; Bohara et al., 1998; Loomis et al., 1997; Boyle et al., 1996).

Description of the experiment and the WTP elicitation scenario

In collecting the WTP data for this study, the respondent was asked a series of questions related to effects of sweetpotato pest (weevil) and diseases (virus). The questions exposed the respondent to the symptoms of major sweetpotato pests and diseases, especially the sweetpotato weevil and sweetpotato viral diseases, respectively. The respondent was then shown samples and pictures of a virus-infected sweetpotato plant and asked whether he/she had experienced similar symptoms in his/her plot(s). The cause of such symptoms were discussed and explained. Next, the respondent was informed that the project vines used in this study, and which comprised both OFSP and WFSP varieties, were of higher quality because they had been cleaned of the virus diseases. Then, the respondent was shown a picture of cleaned vines of better quality and also informed that such quality vines had higher yield than those found locally among the sweetpotato farmers in the same area.

The respondent was then informed that some of the cleaned vines had ability to provide vitamin A (that is, are biofortified) and had orange flesh color while others, which had white flesh color, did not. The varieties that could provide vitamin A were introduced and marked as Kabode, Jewel, and Ejumula, while those that could not were introduced and marked as New Polista and New Ukerewe. Additional information on sweetpotato pests and diseases and the orange-fleshed sweetpotato (including the benefits) was provided through radio broadcasts and market information boards located in the local markets in the study region. Information provided through radio broadcast and market information boards targeted both project and non-project participants (i.e., all the respondents) alike. Additional information on sweetpotato production was provided specifically to project participants through the decentralized vine multipliers and hence is expected to have reached farmers that had contact with (or received/purchased clean/quality vines from) these multipliers.

Prior to the study, the project participants were offered free clean/quality vines of OFSP and WFSP varieties and asked to plant and utilize (eat and/or market) the roots. The farmers planted the better quality vines for two seasons. The planting and utilization sweetpotato enabled the project participants to "evaluate/experience" the performance of quality OFSP vines in terms of taste, dry matter, and resistance to the sweetpotato weevil and virus diseases relative to the cleaned WFSP.

In order to collect the willingness to pay bids, each respondent was first asked to remember the information he/she has been given and consider his/her experience of planting and utilizing the sweetpotato vines from the project. Ultimately, the respondent was asked how much money she/he would be willing to pay for a bundle of 100 vines each measuring 30cm of both the OFSP and WFSP varieties. Bid values were recorded in Tanzania shillings (Tshs). Some farmers were not willing to pay anything for quality OFSP and WFSP vines and were assigned a willingness to pay value of zero.

Additional information was collected using a pre-designed and pre-tested questionnaire. The information collected included farmer attitudes and perceptions towards sweetpotato, demographic characteristics (including gender, education and age), household income, and food consumption frequency.

Comparison of willingness to pay for biofortified and non-biofortified sweetpotato varieties: the analysis of variance (ANOVA)

The comparison of the producers' mean willingness to pay for non-biofortified and biofortified varieties, were analyzed using the analysis of variance (ANOVA) technique. It was used to test whether or not the means of several groups are equal by generating the t-test for groups. This method is considered useful especially when analyzing several groups since doing multiple two-sample t-tests would result in an increased chance of committing a type I error. The ANOVA was implemented on SPSS software.

The hypothesis tested using the ANOVA method was:

$H_0: \mu_B = \mu_{NB}$

$H_1: H_0$ is false ;

where μ_B and μ_{NB} respectively represent the mean willingness to pay for biofortified (OFSP) and non-biofortified (non-OFSP) varieties.

One-way between group analysis of variance (ANOVA) was conducted to compare mean willingness to pay for the biofortified orange fleshed sweetpotato (Jewel, Ejumula and Kabode) and mean willingness to pay for non-biofortified sweetpotato varieties (New Polista and New Ukerewe). In addition, ANOVA was used to compare mean willingness to pay for quality planting materials across the project intervention regions and agro-ecological zones. The study focused on three OFSP varieties namely, Kabode, Jewel, and Ejumula, two non-OFSP varieties, i.e., New Polista and New Ukerewe. The non-OFSP varieties were derived from the local landraces through laboratory "cleaning" the disease-infected varieties and then re-introducing them in the communities, hence the name "New". The model specification can be found Mwiti et al (2015).

3. Data and sampling procedures

This study used data collected from sweetpotato farmers in January and February 2013 in four regions of Tanzania namely, Mara, Mwanza, Shinyanga, and Kagera. Multi-stage sampling

technique was used to select farmers. First, the four regions which benefited from the project sensitization campaigns on the benefits of planting and consuming OFSP and of using clean/quality planting materials were purposively selected. Next, fourteen districts from these regions were also purposively chosen based on the areas where the project was actually implemented. The specific districts targeted for this study are shown in Figure 1. As shown also in the figure, the project reached beneficiary households with vines using 2 strategies namely through decentralized vine multiplier (DVM) and through mass distribution of the vines (MD). The former involved an individual farmer redeeming a voucher for subsidized vine, which was later redeemed for 200 cuttings of quality planting materials. The subsidy in the DVM model was about 50% of the price. The MD, on the other hand, targeted many farmers and issued vines for free (i.e., 100% subsidy).

In each of selected districts, a list of all the administrative Wards was the drawn and Wards randomly sampled from the list. Similarly, for each ward, a list of all villages was compiled and a random sample of villages drawn. Lastly, in each of the sampled village, separate lists of households that participated in the project and those that did not was compiled, and a random sample drawn from each list using probability proportional to size sampling technique. Data was then collected from each farm household through personal interviews using pretested questionnaires. In total 481 project participants and 251 non project participants were interviewed. The analysis in this paper is based only on the 481 households that participated in the project and who therefore benefited from project activities and hence were selected to participate in the willingness to pay study.

Figure 1: **A map showing study areas**

4. Results and discussion

Comparison of willingness to pay for vines of OFSP and non-OFSP varieties

The results of the comparison of WTP for planting materials of OFSP and non-OFSP planting materials are shown in Table 1. It shows that, among the OFSP varieties, the respondents were willing to pay Tsh 140 and Tsh 141 more for a bundle of 100 (30-cm) vines of Kabode than for similar quantity of vines of Ejumula and Jewel, respectively. These results suggest that, among the OFSP varieties, there is higher demand for Kabode vines. Indeed, paired t-tests of the differences in mean WTP between Kabode vines and the vines of Ejumula and Jewel are highly statistically significant at 1% level. This finding could be attributed to the good attributes of Kabode roots, especially in terms of taste, dry matter content and resistance to diseases. Okello et al (2013), for instance, found that farmers rate Kabode much highly in terms of these attributes than the other varieties.

Table 1: Comparison of willingness to pay for different sweetpotato varieties

Variety	Mean WTP (TShs)	Std Dev
Kabode	1097	1041
Jewel	956	1070
Ejumula	957	1055
New Polista	1221	1213
New Ukerewe	1088	1223

Results further show that mean WTP for quality vines of New Polista varieties is higher than for the vines of all the OFSP varieties while WTP for New Ukerewe vines is higher than for the vines of Jewel and Ejumula. Further, farmers are willing to pay more for New Polista than for New Ukerewe. The results therefore indicate that New Polista dominates the three OFSP and local varieties in terms of WTP. Pairwise comparison of the mean WTP shows that farmers are willing to pay Tsh 133 and Tsh 124 more for New Polista than for New Ukerewe and Kabode, respectively. These differences are statistically significant at 1% level of significance. A paired t-test of difference in mean WTP between Kabode and New Ukerewe is however not statistically significant. In addition, the results of the paired t-tests of differences in means also indicate that mean willingness to pay for vines of New Ukerewe variety is higher than for those of Jewel and Ejumula vines, and that the differences are statistically significant at 1% level.

Comparison of mean willingness to pay for quality planting materials by region

The results of the test of differences in means presented in Table 2 indicate that farmers in Mara are willing to pay significantly more money for Kabode vines than those in Mwanza (p= 0.039) and Shinyanga (p=0.012). Specifically, farmers in Mara are willing to pay Tsh. 350 more than Mwanza and Tsh. 510 more than Shinyanga. Results also show that Mara farmers are also willing to pay significantly higher (that is, Tsh.456.) for Jewel vines than those in Shinyanga (p=0.017). However, there is no statistically significant difference in willingness to pay for Ejumula vines across the study regions. In the case of New Polista, the results indicate that there is statistically significant difference in willingness to pay in the four regions. Specifically, sweetpotato growers in Mara are willing to pay, on average, Tsh.520, Tsh. 492 and Tsh. 902 extra for New Polista vines than those in Mwanza, Shinyanga and Kagera, respectively.

Table 2: Comparison of mean willingness to pay (Tanzanian shillings – Tshs.) for a bundle of 100 vines of 30cm each of quality planting materials, by region (n=450): Results of analysis of variance (ANOVA)

Dependent Variable			Mean Difference (I-J)	Std. Error	P-value
WTP for Kabode	Mara	Mwanza	349.97*	128.04	.039
		Shinyanga	510.34*	163.77	.012
		Kagera	555.42	247.59	.152
	Mwanza	Mara	-349.97*	128.04	.039
		Shinyanga	160.36	150.93	1.000
		Kagera	205.45	239.29	1.000
	Shinyanga	Mara	-510.34*	163.77	.012
		Mwanza	-160.36	150.93	1.000
		Kagera	45.09	260.17	1.000
WTP for Jewel	Mara	Mwanza	284.73	118.08	.098
		Shinyanga	456.45*	151.62	.017
		Kagera	590.04	228.33	.060
	Mwanza	Mara	-284.73	118.08	.098
		Shinyanga	171.72	139.83	1.000
		Kagera	305.31	220.68	1.000
	Shinyanga	Mara	-456.45*	151.62	.017
		Mwanza	-171.72	139.83	1.000
		Kagera	133.59	240.31	1.000
WTP for Ejumula	Mara	Mwanza	185.69	118.35	.704
		Shinyanga	332.45	151.24	.171
		Kagera	507.00	225.09	.149
	Mwanza	Mara	-185.69	118.35	.704
		Shinyanga	146.76	139.47	1.000
		Kagera	321.31	217.36	.840
	Shinyanga	Mara	-332.45	151.24	.171
		Mwanza	-146.76	139.47	1.000
		Kagera	174.55	236.88	1.
WTP for New Polista	Mara	Mwanza	520.12*	134.60	.001
		Shinyanga	491.86*	171.19	.026

		Kagera	902.37*	255.56	.003
	Mwanza	Mara	-520.12*	134.60	.001
		Shinyanga	-28.26	157.53	1.000
		Kagera	382.25	246.62	.731
	Shinyanga	Mara	-491.86*	171.19	.026
		Mwanza	28.26	157.53	1.000
		Kagera	410.51	268.35	.761
WTP for New Ukerewe	Mara	Mwanza	388.09*	133.83	.023
		Shinyanga	617.54*	171.02	.002
		Kagera	766.55*	254.53	.016
	Mwanza	Mara	-388.09*	133.83	.023
		Shinyanga	229.44	157.71	.879
		Kagera	378.46	245.79	.746
	Shinyanga	Mara	-617.54*	171.02	.002
		Mwanza	-229.44	157.71	.879
		Kagera	149.02	267.86	1.000

Source: Survey result (2014)* Indicates significance at 5% level

Results further show that farmers in Mara region are willing to pay statistically significantly higher amount of money for New Ukerewe vines than those in the other three regions. They are willing to pay an extra Tsh.388 for New Ukerewe vines than those in Mwanza, Tsh. 617 more than in those in Shinyanga and Tsh.767 more than farmers in Kagera.

Comparison of willingness to pay for quality planting materials of sweetpotato varieties by agro- ecological zones

Table 3 presents the difference in mean willingness to pay for the five sweetpotato varieties across the agro-ecological zones. Sweetpotato growers living lower altitudes, i.e., 1000 to 12000 meters above sea level, and receiving 600 to 1200 millimeters of rainfall are willing to pay the highest amounts of money for New Polista, followed by Kabode, then New Ukerewe, Jewel and lowest Ejumula. In altitude of 1200 to1300m above sea level with 600 to1000 millimeters of rainfall, sweetpotato growers are willing to pay highest for New Polista, and lowest for for Jewel. Results also show that New Polista had the highest willingness to pay among farmers in the 1500 to 1800 meters above sea level receiving rainfall amount of 1400 to 1600 millimeters zone as well as in the zone 1100 to 1300 meters above sea level and receiving 600 to 1000 millimeters of rainfall. The only agro-ecological zone where New Polista did not lead in WTP is that with1200 to 1600 with 600 to 800 millimeters of rainfall. In this zone, Kabode had the highest willingness to pay followed by New Polista, then New Ukerewe, while Jewel had the lowest willingness to pay. These results indicate that there are differences in willingness to pay for quality sweetpotato planting materials across the various agro ecological zones.

Table 3. Comparison of mean willingness to pay (in Tanzanian shillings) for a bundle of 100 vine cuttings of 30cm each of quality planting materials, by agro ecological zones

Agro-ecological zone	N	WTP Kabode	WTP Jewel	WTP Ejumula	WTP New Polista	WTP New Ukerewe
Attitude1000-1200 rainfall 600-1200	152	1309.80 (1251.05)	1068.75 (1081.05)	964.14 (1048.45)	1373.03 (1254.3)	1258.22 (1302.11)
Attitude1200-1300 rainfall 600 -1000	206	1009.76 (1067.07)	902.68 (1063.49)	971.36 (1053.92)	1133.74 (1166.5)	963.35 (1070.2)
Attitude1500-1800 rainfall 1400-1600	50	1342 (1435.71)	1158 (1279.84)	1158 (1267.83)	1577.55 (1622.79)	1498 (1697)
Attitude1100-1300 rainfall 600-1000	24	522.92 (526.26)	516.67 (601.93)	745.83 (1088.67)	904.04 (697.85)	625.04 (583.24)
Attitude1200-1600 rainfall 600-800	19	1047.84 (895.94)	732.05 (838.25)	805.74 (819.72)	878.95 (833.05)	805.26 (804.48)

Source: Survey results (2014); Numbers in parentheses are the Standard Deviations.

Comparison of mean willingness to pay for a bundle of 100 vines of 30cm each across varieties analysis of variance (ANOVA)

Table 4 presents the results of the Analysis of Variance (ANOVA) among sweetpotato vines of the five varieties. The between-group sum of squares for the model is 24.57 with 4 degrees of freedom, resulting in a mean square of 6.14. The F-statistic is 4.68 and is significant at less than 1% level (p-value=0.0009).These results indicate that the means of the five varieties of sweetpotato are significantly different at less than 1% level which, in turn, implies that the mean WTP for the five varieties is significantly different from each other. Overall, the results in Table 4 show that the mean willingness to pay for the clean planting materials is not equal across all the five sweetpotato varieties.

Table 4: Analysis of Variance (ANOVA) of five sweetpotato varieties (n=450)

	Sum of Squares	df	Mean Square	F	p-value
Between Groups	24.57	4	6.14	4.68	0.0009
Within Groups	2945.99	2245	1.31		
Total	2970.56	2249	1.32		

Source: Survey results (2014)
Note: Figures are in thousand Tanzanian shillings.

The ANOVA results do not, however, reveal where the differences in WTP are. In order to assess difference between varieties, Bonferroni multiple comparisons tests were to. These tests examine the differences between each pair of means, taking each variety as a reference point and comparing it with the rest. The results of the tests are presented in Table 5. As shown, with Kabode as the reference, the results indicate that the mean willingness to pay for Kabode vines is higher than mean willingness to pay for Jewel, Ejumula and New Ukerewe, but lower than the mean willingness to pay for New Polista. However, none of these mean differences in WTP is statistically significant. Comparison of mean willingness to pay for Jewel vines with those of the other varieties shows that it has lower mean willingness to pay than Kabode, Ejumula, New Polista and New Ukerewe vines. However, the only difference in WTP that is statistically significant is that with New Polista (p-value =0.002). These findings indicate that Jewel vines have the lowest willingness to pay among the sweetpotato varieties considered in this study.

Similarly, results indicate that the mean WTP for Ejumula vines is higher than that of Jewel vines, but lower than those of the vines of the other varieties. At the same time the table shows that only the difference with New Polista is statistically significant (p-value =0.004).

Table 5: Multiple comparisons (Bonferroni) of Mean willingness to pay for Kabode, Jewel, Ejumula, New Polista and New Ukerewe sweetpotato vines (n=450)

(I) Variety	(J) Variety	Mean Difference (I-J)	Std. Error	P-value	95% Confidence Interval	
					Lower Bound	Upper Bound
Kabode	Jewel	166.11	76.37	0.297	-48.47	380.69
	Ejumula	152.44	76.37	0.460	-62.14	367.03
	New Polista	-116.22	76.37	1.000	-330.80	98.36
	New Ukerewe	25.89	76.37	1.000	-188.69	240.47
Jewel	Kabode	-166.11	76.37	0.297	-380.69	48.47
	Ejumula	-13.67	76.37	1.000	-228.25	200.92
	New Polista	-282.33*	76.37	0.002	-496.92	-67.75
	New Ukerewe	-140.22	76.37	0.665	-354.80	74.36
Ejumula	Kabode	-152.44	76.37	0.460	-367.03	62.14
	Jewel	13.67	76.37	1.000	-200.92	228.25
	New Polista	-268.67*	76.37	0.004	-483.25	-54.08
	New Ukerewe	-126.56	76.37	0.976	-341.14	88.03
New Polista	Kabode	116.22	76.37	1	-98.36	330.80
	Jewel	282.33*	76.37	0.002	67.75	496.92
	Ejumula	268.67*	76.37	0.004	54.08	483.25
	New ukerewe	142.11	76.37	0.629	-72.47	356.69
New Ukerewe	Kabode	-25.89	76.37	1	-240.47	188.69
	Jewel	140.22	76.37	0.665	-74.36	354.8
	Ejumula	126.56	76.37	0.976	-88.03	341.14
	New Polista	-142.11	76.37	0.629	-356.69	72.47

Source: Survey results (2014)

* The mean difference is significant at the 5% level.

Comparison of farmers' WTP for quality planting materials of biofortified and non-biofortified sweetpotato varieties

Table 6 displays the mean amounts of money in Tanzanian Shillings (Tshs.) the study respondents were willing to pay for the two different sweetpotato vines based on the flesh color, that is, for the biofortified (OFSP) and non-biofortified (non-OFSP) sweetpotato varieties. The mean willingness to pay for the clean planting materials of the OFSP varieties combined is Tshs. 993 while the mean willingness to pay for the vines of non-orange fleshed sweetpotato varieties combined (NON-OFSP) is Tshs. 1145.The results therefore show that sweetpotato growers are

willing to pay Tshs.151 more for quality planting materials of the NON-OFSP than OFSP varieties.

Table 1: Summary statistics of willingness to pay of OFSP vines and non-OFSP vines (n=450)

Variety Type	Mean	Std. Dev.	Freq.
OFSP	993.26	1094.34	1350
NONOFSP	1144.61	1222.09	900
Total	1053.8	1149.28	2250

Source: Survey results (2014)
Note: Figures are in thousand Tanzanian Shillings (TShs).

Table 7 presents the findings of Analysis of Variance (ANOVA) between OFSP and non-OFSP varieties. As shown, the total sum of squares (TSS) is 2971. The corresponding F-statistic is 9.4, with a p-value of 0.002. These findings indicate that the mean willingness to pay for quality planting materials of non-biofortified (non-OFSP) is statistically significantly different from that of the biofortified (i.e., OFSP) vines at the 1% level.

Table 7: Analysis of Variance (ANOVA) between OFSP and non-OFSP (n=450)

	Sum of Squares	df	Mean Square	F	P-value
Between Groups	12.37	1	12.37	9.40	0.002
Within Groups	2958.19	2248	1.32		
Total	2970.56	2249	1.32		

Source: Survey results (2014)
Note: Figures are in thousand Tanzanian shillings.

These results therefore corroborate the earlier finding that demand for clean planting materials of the local varieties is higher. They also corroborate past findings of Combris et al., (2007) which suggested that consumers value taste and other related sensory varietal attributes of a food product more that nutritional quality of a product. These findings specifically support their argument that "taste beats quality".

5. Summary, conclusions and implications

This study used data collected from 481 sweetpotato growing households to assess the willingness by smallholder farmers to pay for quality sweetpotato planting materials of OFSP and non-OFSP varieties and regional and agroecological differences in WTP. The quality materials were previously cleaned for the major diseases (especially viruses) that affect sweetpotato yields. The study is based on a carefully designed field experiment conducted in Tanzania that generated the WTP data for quality planting materials of three OFSP and two WFSP varieties. The data were analyzed using analysis of variance (ANOVA) technique which tests whether or not the means of several groups are equal by generating the t-test for groups.

The study finds that consumers are willing to pay more money for some, but not all, non-OFSP varieties. Specifically, WTP for clean planting materials of New Polista (a non-OFSP variety) was highest, followed by Kabode (an OFSP variety) and then New Ukerewe, Ejumula and lowest for Jewel. The study also finds diffrences in willingness to pay by region and agroecological zones of the project interventions. Results of the analyis of variance corroborate these findings.

This study therefore concludes that sweetpotato growers are willingness to pay more for quality planting materials of non-OFSP varieties than that of OFSP varieties. It also concludes that WTP for quality planting materials of biofortified OFSP and non-OFSP differs by region, and agro ecological zones varieties. It also concludes that farmers are willing to pay more for quality planting materials of non-biofortified varieties, especially New Polista, than for the biofortified OFSP varieties. The findings corroborate those of other studies which found that taste is preferred to quality.

Together, these findings suggest that even though OFSP varieties offer nutritional benefits, farmers still strongly prefer the white-fleshed sweetpotato varieties, especially once they are cleaned from the diseases that affect their yields. The findings imply that breeders need to pay attention to the attributes consumers value in the white-fleshed sweetpotato varieties as they pursue the enrichment of sweetpotato with beta carotene.

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