International Scholars Journals

International Journal of Agricultural Sciences ISSN: 2167-0447 Vol. 6 (11), pp. 1183-1199, November, 2016. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Eliciting farmers' willingness to pay and adopt improved seed varieties in semi-arid counties of Machakos, Makueni and Tharaka-Nithi in Eastern Kenya

Moni AN[1], Mulwa RM[2], Lutta M[3]

[1]Department of Agricultural Economics, Faculty of Agriculture, University of Nairobi, P.O. Box 29053-00625, Nairobi, Kenya.
[2]Centre for Advanced Studies in Environmental Law and Policy, University of Nairobi, P.O. Box 30197, Nairobi, Kenya.
[3]Kenya Agricultural Research Institute, P.O. Box 57811-00200, Nairobi, Kenya.

Received 16 August, 2016; Revised 30 September, 2016; Accepted 02 October, 2016 and Published 10 November, 2016

This study examines the farmers' willingness to pay and adopt improved seed technologies in three semi-arid Counties of Eastern Kenya namely Machakos, Makueni and Tharaka-Nithi. The study used cross-sectional data gathered from a household survey of 252 households in the three Counties. Multi-stage sampling procedure was used in identifying the target respondents. Descriptive statistics and Contingent Valuation Method were employed to address the problem at hand. From the willingness to adopt results, many farmers indicated that they were willing to take up new technologies. With regards to this, there has to be a conscious policy decision by the government to promote uptake of these technologies through different channels such as extension, media and other appropriate channels. The uptake of technology is also subject to the cost of that technology. From the willingness to pay results, it is clear that farmers will be willing to pay for new technologies up to a certain price. Thus, there is need to have consultation between the government (both national and county) and the seed suppliers on the supply prices. If such prices are without the reach of many farmers, then schemes such as subsidies could be introduced on certain targeted technologies, so as to improve their uptake. A number of farmers said some technologies like dolichos had no demand in the markets. Therefore, the government and other stakeholders should find a ready market for most of these crops so as to encourage more production by the farmers.

Key words: Willingness to adopt, willingness to pay, contingent valuation method, improved seed varieties, semi-arid counties.

INTRODUCTION

In many African countries, agriculture is seen as the bastion of their economies (CAADP, 2010). It contributes over 30 percent of their Gross Domestic Product (GDP) and 60 percent of all employments. About 70 to 80 percent of the total population in these countries lives in the rural areas and depends mainly on agriculture for their livelihood (ibid). However, over 70 percent of the rural population in these continents are said to be living in extreme poverty and are undernourished. Therefore, agriculture is not only key to economic growth and development but also critical in reducing hunger and poverty prevalent in the rural areas.

In Kenyan, the economy is predominantly dependent on agriculture. The sector directly and indirectly contributes 26 percent and 25 percent of the country's GDP, respectively. It employs over 40 percent of the total popu-

Corresponding author. E-mail: alfred_moni@yahoo.co.uk

lation and over 70 percent of the rural people (ASDS, 2010). However, food insecurity and poverty remain a major challenge in the country. Over 43 percent of the Kenyan population is food insecure and about 46 percent (many of whom live in the rural areas) live below absolute poverty.

Therefore, the country has a deficit in the production of several key food stuffs. Production of the main food crops has generally been below the country's consumption requirements (ASDS, 2010). Shortfalls in domestic production thus increase risks of food insecurity for the millions of net buyers of food in the country--a group that includes most smallholder farmers. Drought, poor or failed cropping practices are the main causes of food insecurity for many households in the country. There has been a weather-driven cyclical nature of food insecurity in many parts of the country especially in the arid and semi-arid areas (ASALS) likeTharaka-Nithi, Machakos and Makueni counties. The extended periods of drought erodes livelihood opportunities and community resilience in these areas, leading to undesirable farming and coping strategies that damage the environment and impair household nutritional status through prolonged food insecurity (ASDS, 2010).

In its attempts to address some of these issues, the Kenyan government in collaboration with other development partners have consolidated efforts to improve agricultural research and extension, technology dissemination and adoption. Currently, the agricultural research and extension services in the country comprises public and private agricultural research institutions, NGOs and other civil society players who are responsible for disseminating knowledge, new technologies like certified seeds, and other agricultural information geared towards improving agricultural productivity through adoption of ecologically resilient and innovative farming practices. The certified seeds for example are more adaptive to certain areas with adverse climatic conditions hence capable of yielding more in those areas compared with the local uncertified varieties. In general, the adoption of improved agricultural practices helps to enhance resilience in farming as well as livelihood support systems in the face of a changing climate.

Some of the national and international research institutions and seed companies in the country include the Kenya Agricultural Research Institute (KARI), International Maize and Wheat Improvement Centre (CIMMYT), International Crop Research Institute in Semi-Arid Tropics (ICRISAT), Seed co and *freshco* which are mandated to develop improved seed varieties suitable for specific areas. These improved seeds are aimed at increasing food production thus curbing the vicious cycle of food insecurity and poverty mainly prevalent in the ASALS. From March 2011, KARI has been undertaking a project geared towards enhancing farming resilience for improved food security among the households in these counties through provision of improved seed varieties in Tharaka-Nithi, Machakos and Makueni counties. However, the actual demand and supply status of these improved seed varieties in these three counties is not well understood. In addition it's also not clear how much farmers are willing to pay for the respective technologies and the amount of land they are willing to commit under the different technologies.

MATERIALS AND METHODS

The data used in this study was derived from a cross-sectional survey in three counties namely Tharaka-Nithi, Machakos and Makueni. A multi-stage sampling procedure was used whereby, from each district, the locations and farmer groups for the study were selected purposively based on the technologies of interest and Agro-Ecological Zone (AEZ) differences. The technologies of interest include; maize, beans, pigeon peas, cowpeas, green grams, millet, sorghum and dolichos lablab. In Machakos County, Kavumbu location in Mwala district (AEZ LM5) was selected. At AEZ LM4, Katangi location in Yatta district was selected. In Makueni County, Kivani location in Makueni district at LM4 was selected, while in Kathonzweni district, Thavu location at LM5 was selected. In Tharaka-NithiCounty, Ntugi location at LM5 was selected.

From the selected locations and groups, the respondents to be interviewed were selected randomly based on the required sample size. A representative sample size of about 250 households was targeted with about 80 households per crop in each county to be interviewed. In regard to this, 252 households were identified and interviewed during the survey period. Information on demand and supplies of the improved seeds, willingness to pay and willingness to adopt the seeds in each County was collected.

Descriptive statistics and Contingent Valuation Method were used to address the problem at hand. The total number of kgs of each seed variety bought by the farmers and the area under each variety was determined. This was then be used as a proxy of the actual demand for that particular seed type in that county against which supply requirements was assessed.

The Contingent Valuation Method (CVM) according to Carson *et al.,* (2001) attempts to elicit information about respondents' preferences for a good or service by asking them how much they are willing to pay or willing to accept for a good or service. There are many elicitation methods which could be used in contingent valuation. These include: the bidding game (Willis, 2002); direct open-ended elicitation (Fredrik and Peter, 2005), single and double-bounded dichotomous choice methods, and Payment card method (Ryan and Watson, 2009). In our case, we used the payment card which presents respon-

dents with a visual aid containing a large number of monetary amounts. This method: a) facilitates the valuation task, by providing respondents a context to their bids; b) avoids starting point bias; and c) reduces the number of outliers. For these reasons we chose the payment card method.

RESULTS AND DISCUSSION

DEMAND AND SEEDING RATES OF DIFFERENT CROPS

Table 1 below present information on the total number of kilograms of each seed variety bought and planted by the farmers per county. It also gives information on the total acres of land put under each seed variety as well as the seed rate per crop in each county.

The demand structure for the improved seed varieties in each county was determined by the total number of kilograms of the seeds purchased and planted by the households. In Machakos County, maize had the highest number of kgs planted and acres devoted to it, followed by beans, cow peas, green grams, pigeon peas, sorghum, dolichos and millet in that order.

In Makueni County, maize also topped in total kgs planted and area followed by beans, green grams, cow peas, pigeon peas, dolichos, sorghum and millet, respectively. Maize and beans in these two counties are highly demanded because maize is the staple crop while beans are mainly cooked together with the maize to make '*githeri*'. Millet is the least demanded in the two counties because the households said that it is not available in the local markets and its labour intensive in producing it.

In Tharaka-Nithi County, green grams were the most important crop and had had the highest number of kgs planted, followed by cowpeas, millet, pigeon peas, sorghum, maize, beans and dolichos. In this County, dolichos were least planted because they are not available in the market. Unlike in Machakos and Makueni Counties, beans and maize in Tharaka-Nithi County were the least demanded crops besides dolichos because the climate is not conducive for their production. Maize is also a staple crop in that County and the farmers sold the produce of the other crops in other Counties like Meru so as to purchase the maize. Detailed information (values) regarding the non-adoption factors for each seed variety per county is detailed below.

Across the counties, the pooled mean for beans seeding rate was the highest at approximately 7 kgs per acre. Pigeon peas, cow peas and green grams tied at around 6 kgs per acre. Sorghum seeding rate was approximated at 5 kgs per acre whereas maize, millet and dolichos seeding rates were approximated at 4 kgs per acre.

FACTORS FOR NON-ADOPTION OF DIFFERENT TECHNOLOGIES

Tables 2-4 present information on factors cited by farmers across the three Counties as the main factors hindering adoption the improved technologies. However, some of the factors linked to the technologies like poor timeliness in supply, long maturity periods and low germination percentage were not very common to many farmers.

In Machakos County, majority of the farmers said that the reasons for non-adoption of the improved maize, beans, pigeon peas, cow peas, and green grams is that they are expensive compared to the local varieties. For sorghum, limited land was cited as the main reason for non-adoption. Farmers said that after planting the main crops like maize, beans, pigeon peas and cowpeas, there was little land left for the production of the other crops. Many farmers claimed that the main reason for millet's non-adoption was due to its labour intensiveness right from planting to harvesting and also unavailability in the local markets for the produce. For dolichos lablab, many household members said that it has bad smell and taste hence not liked by many. The other reasons for non-adoption of the various crops in this county cited by the households are as presented in Table 2 above.

In Makueni County, Table 3 above, the main reason for non-adoption of maize by the farmers was because improved maize seeds were expensive compared to the local varieties. For beans, pigeon peas and cowpeas, majority of the farmers said that they had a preferred high yielding local variety which had some desirable and distinct traits. In addition, the farmers also indicated that these seeds were expensive hence a factor for non-adoption of these crops. For green grams, bad weather (coldness) especially in Kivani location was the main cause for non-adoption. The weather in Kivani is chilly hence cited not favourable for green grams production.

Farmers in this Makueni County also said that birds are a major impediment for sorghum production especially gadam sorghum in the milk stage when they lose substantial amounts to birds. Like farmers in Machakos County, many farmers in Makueni County also cited that millet production is labour intensive. Lack of demand for dolichos both in the households and in the local markets was mentioned to be the main cause for non-adoption by many households. In Thavu location for example, the few farmers who had planted dolichos had sacks and had nowhere to sell them because many people there don't consume it.

From Table 4 above, the main non-adoption factors for maize and beans in Tharaka-Nithi County (Ntugi location) were non-conducive climatic conditions for their production. Production of the other crops (except dolichos which many farmers said it is not available in that locality) is in large quantities due to favourable weather for their production. This is why many factors for non-adoption have zero values due to high adoption rates. Farmers in this county prefer producing the other crops in large quantities and then selling them to other counties in exchange for maize and beans.

Table 1: Area under each crop and seeding rates (Kg/acre).

crop	Machakos county			Makueni county			Tharaka-Nithi county			
	Kgs planted	Acres	Seed rate	Kgs planted	Acres	Seed rate	Kgs planted	Acres	Seed rate	pooled seed rate
Maize	532.0	142.0	3.8	278.0	69.6	4.0	170.0	43.0	4.0	3.9
Beans	251.0	44.0	5.7	69.0	9.3	7.4	35.5	4.1	8.6	7.2
Pigeon peas	48.5	7.9	6.2	31.5	6.8	4.7	288.0	43.0	6.7	5.8
Cow peas	141.0	22.3	6.3	32.5	7.0	4.7	718.0	97.0	7.4	6.1
Greengrams	101.0	14.5	7.0	42.0	9.0	4.7	859.0	113.7	7.6	6.4
Sorghum	32.3	9.1	3.6	9.0	2.6	3.4	217.5	30.8	7.1	4.7
Millet	0.5	0.3	2.0	1.5	0.4	3.9	374.0	53.8	7.0	4.3
Dolichos	30.3	7.1	4.3	14.3	3.1	4.6	1.0	0.3	4.0	4.3

Table 2. Factors for non-adoption of improved seed varieties per crop in Machakos County.

Crop	Expensive (%)	Poor timeliness in supply (%)	No demand in local market (%)	No demand in the hh due to smell/ taste (%)	Takes long to mature (%)	Not available in local market (%)	Low germination % (%)	Bad weather/ climatic conditions(pests/diseases, drought/cold (%)	Has ltd land (%)	Its labour intensive (%)	Has a high yielding local variety(%)
Maize	17.65	-	-	-	2.35	-	-	-	-	-	2.35
Beans	43.53	-	-	-	1.18	3.53	-	1.18	-	-	11.76
Pigeon peas	47.06	1.18	1.18	-	-	11.76	-	3.53	-	-	16.47
Cow peas	37.65	-	-	2.35	-	7.06	-	2.35	1.18	-	9.41
Green grams	35.29	-	2.35	1.18	-	9.41	-	12.94	5.88	1.17	3.53
Sorghum	11.76	-	8.24	10.59	-	12.94	1.18	11.76	16.47	11.76	1.18
Millet	11.76	-	3.53	2.35	-	27.06	-	4.71	16.47	45.88	3.53
Dolichos	10.59	-	14.12	34.12	2.35	11.76	-	8.24	7.06	3.53	2.35

WILLINGNESS TO ADOPT DIFFERENT CROP TECHNOLOGIES

Willingness to adopt was captured using the payment card method in which farmers were asked to state areas of their land they would be willing to put under different improved crop varieties. This was used to measure and estimate the amount of land they would be willing to sacrifice for improved crop varieties. The responses and the implications on total area under the crop in the three counties are here under discussed.

Willingness to adopt Maize

Figures 1a and 1b below gives information on the proportion of farmers who are willing to adopt maize and the proportion of land they are willing to allocate to each technology.

From the Figure 1a above, all the farmers in Makueni were willing to put 50% of their land under improved maize varieties against all the farmers in Machakos who were willing to apportion 30% of their land to maize production. In Tharaka-Nithi County, only 52% of the farmers were willing to put 10% of their land under improved maize varieties. This willingness to adopt maize decreases as we increase the proportion of land and gets to a maximum of 52% for Tharaka-Nithi farmers. Overall, Makueni County had a higher proportion of farmers who were willing to put much of their land under improved maize at different proportions compared to Machakos County.

A combination of the willingness to adopt and the area under maize has implication for policy (Fig. 1b). For instance, the highest willingness to adopt is when 52% of the farmers in Tharaka-Nithi and all (100%) farmers in

Table 3. Factors for non-adoption of improved seed varieties per crop in Makueni County.

Crop	Are expensive (%)	Poor timeliness in supply (%)	No demand in local market (%)	No demand in the hh due to smell/taste (%)	Takes long to mature (%)	Not available in local market (%)	Low germination % (%)	Bad weather/ climatic conditions (pests/diseases, drought/cold (%)	Has ltd land (%)	Its labour intensive (%)	Has a high yielding local variety (%)
Maize	26.83	-	-	-	1.22	-	-	1.22	-	-	8.54
Beans	32.93	-	-	-	-	17.07	-	2.44	-	-	39.02
Pigeon peas	34.15	-	-	-	-	15.85	-	2.44	-	-	37.80
Cow peas	34.15	-	2.44	3.66	-	9.76	-	4.88	1.22	-	34.15
Green grams	21.95	-	1.22	3.66	-	7.32	-	41.46	10.98	1.22	17.07
Sorghum	8.54	-	7.32	25.61	-	12.20	-	31.71	20.73	13.41	4.88
Millet	9.76	-	8.54	6.10	-	32.93	-	7.32	28.05	40.24	1.22
Dolichos	4.88	-	25.61	31.71	-	17.07	-	9.75	24.39	7.32	7.32

Table 4. Factors for non-adoption of improved seed varieties per crop in Tharaka-Nithi County.

Crop	Expensive (%)	Poor timeliness in supply (%)	No demand in local market (%)	No demand in the hh due to smell/taste (%)	Takes long to mature (%)	Not available in local market (%)	Low germination % (%)	Bad weather/ climatic conditions (pests/diseases, drought/cold (%)	Has ltd land (%)	Its labour intensive (%)	Has a high yielding local variety (%)
Maize	-	-	-	-	-	-	-	49.41	-	-	-
Beans	-	-	-	-	-	8.24	-	84.71	-	-	-
Pigeon peas	-	-	-	-	-	1.18	-	-	-	-	-
Cow peas	-	-	-	-	-	-	-	-	-	-	-
Green grams	-	-	-	-	-	-	-	-	2.35	-	-
Sorghum	-	-	10.59	9.41	-	-	-	9.41	7.06	3.53	-
Millet	-	-	1.18	3.53	-	-	-	3.53	3.53	8.24	-
Dolichos	-	-	25.88	27.06	-	75.29	-	35.29	8.24	1.18	-

Machakos and Makueni counties are willing to adopt. However, this is only achieved at 10% of the total area or target a willingness to adopt of 50% which translates to 235,724 acres (Fig. 1b). At this level however, all the farmers in Makueni, 86% in Machakos and 3.5% in Tharaka-Nithi would be willing to put half of their land under improved maize (Fig. 1a).

Willingness to adopt Beans

In Machakos and Makueni Counties, all farmers are willing to devote 10% of their land under improved beans production. About 80% were willing to apportion 30% of their land to beans and over 60% were willing to put 40% of their land on beans. The proportion of farmers decreases as the proportion of land increases (Fig. 2a).

an equivalent of 54,477 acres in all three counties. To achieve the highest area under maize, one would need to However, Tharaka-Nithi farmers were not willing to devote a substantial piece of land under beans production with only a few devoting 10% and 20% of their land under beans. The probable reason may be due to unfavourable climatic conditions for beans production in that County.

As was the case in Maize, the highest adoption rates (100% in Machakos and Makueni, and 15.3% in Tharaka-Nithi) would be achieved with a willingness to allocate 10% of their areas under beans. This would however achieve 26,685 acres of beans in the three counties. The highest number of acres would be 71,062 which correspond to a willingness to allocate 40% of the land under beans (Fig. 2b). However, this implies no beans being planted in Tharaka-Nithi (Fig. 2a).

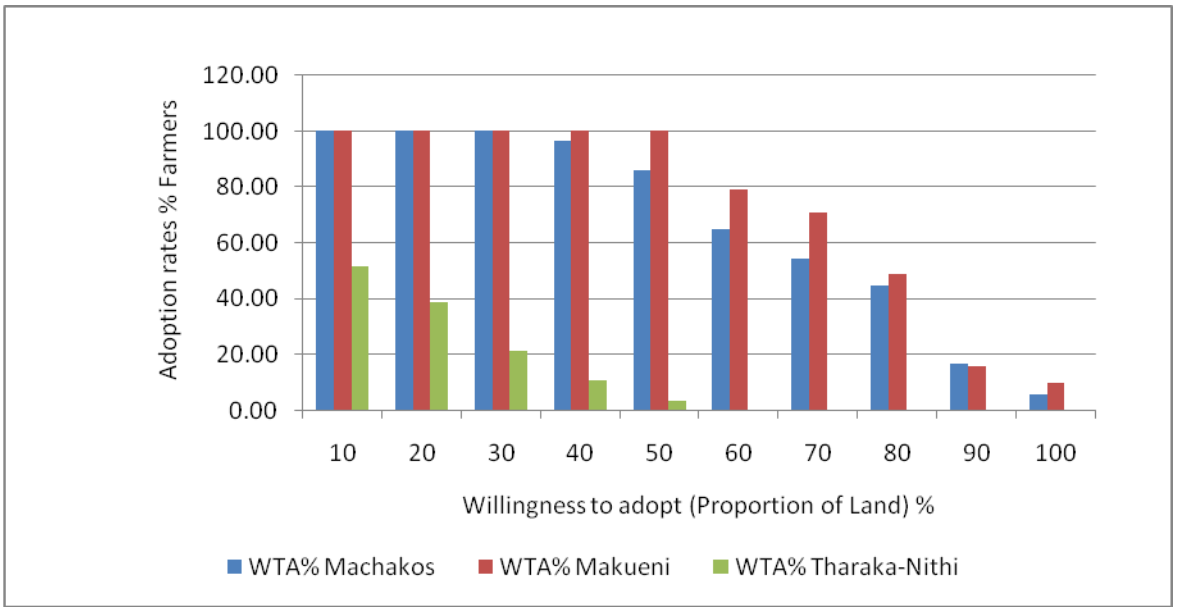

Fig. 1a. Willingness to adopt maize.

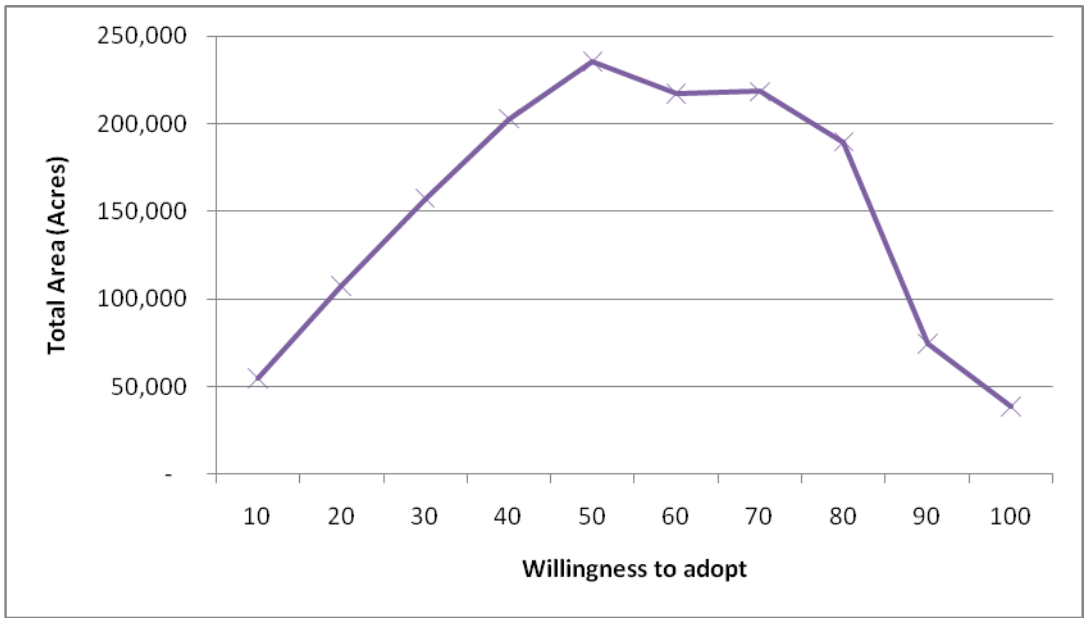

Fig. 1b. Area under maize at different willingness to adopt levels.

Willingness to adopt Pigeon Peas

Figure 3a shows that, in all the Counties, at least 50% of the farmers were willing to put 30% of their land under pigeon peas. Generally, Tharaka-Nithi farmers were more willing to devote much of their land to pigeon production compared to the other two Counties. This might be due to low maize and beans production in that County. Makueni farmers are the second and Machakos are the last. However, the appropriation of land decreases as we move to the right.

The highest adoption rates of pigeon peas are achieved when farmers are willing to put only 10% of their farms under the crop. At this level of willingness to adopt, 99% of farmers in Machakos County and 100% of the farmers in Tharaka-Nithi and Makueni counties would be willing to

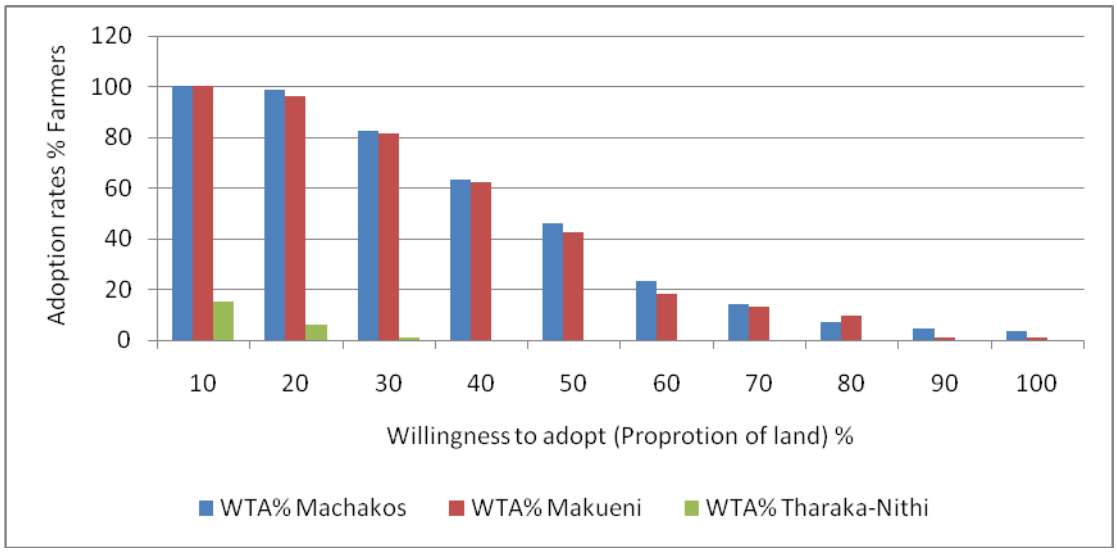

Fig. 2a. Willingness to adopt Beans.

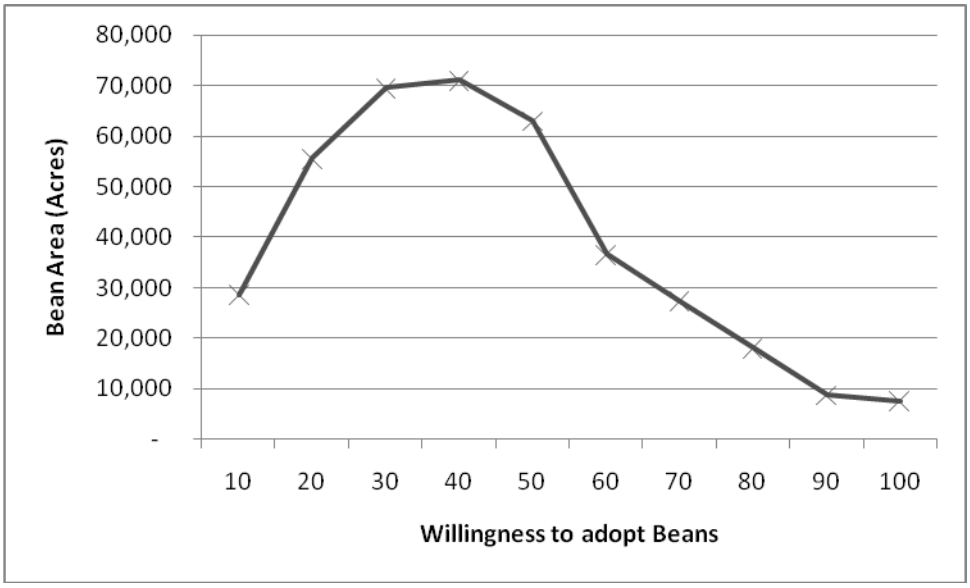

Fig. 2b. Area under beans at different willingness to adopt levels.

put their land under pigeon pea. However, the largest area under pigeon pea (57,902 acres) in the three counties would be achieved at 20% level of willingness to adopt (Fig. 3b).

Willingness to adopt Cowpeas

In all the Counties, almost all the farmers were willing to allocate 10% of their land under cowpea production. However, Tharaka-Nithi County leads in the number of farmers who are willing to devote large pieces of land under cow pea production, followed by Machakos and Makueni. For example, the proportion for farmers wishing to put half of their land under cowpea production is 48% Tharaka-Nithi, 26% Machakos, and 18% Makueni (Fig. 4a). This could be attributed to the performance of the crop in the Counties among other attributes.

As is most other crops, the highest adoption levels are achieved with willingness to adopt levels of 10%. At this willingness to adopt level almost all the farmers are willing to put 10% their land under cowpeas. However, in terms of real area in all counties, this only translates to 29,807 acres of cowpea. A willingness to adopt level of 20% achieves 52,912 acres of cowpeas which is the

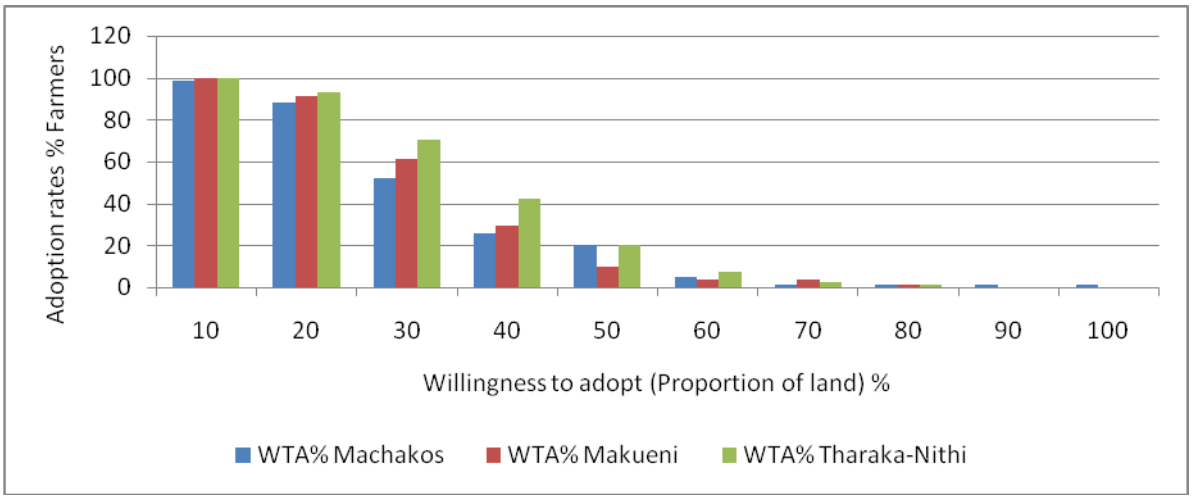

Fig. 3a: Willingness to adopt pigeon peas.

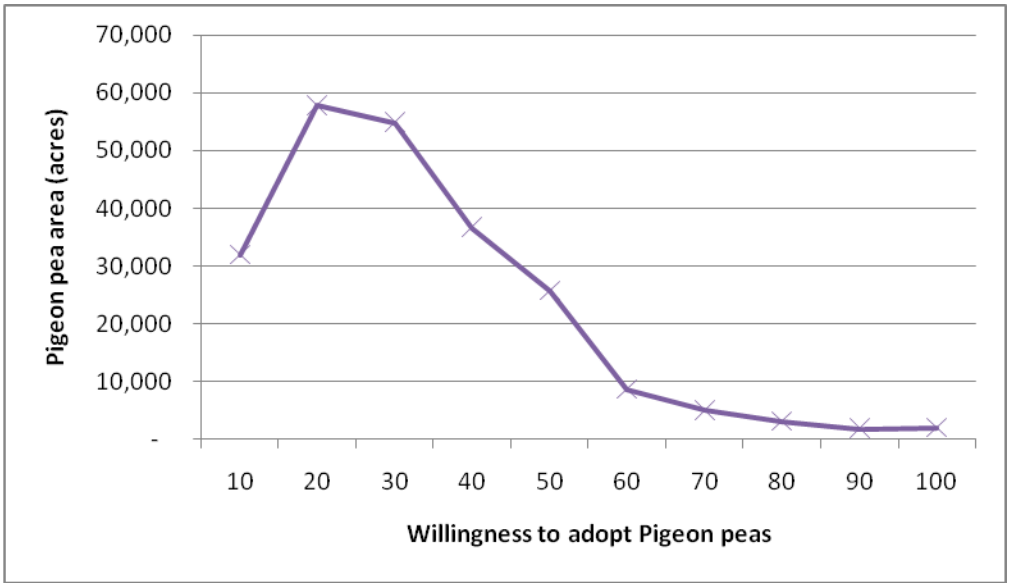

Fig. 3b. Area under pigeon pea at different willingness to adopt levels.

highest (Fig. 4b). This figure then decreases as we increase the willingness to adopt values.

Willingness to adopt Green grams

Greengrams production was dominated by farmers in Tharaka-Nithi County (Figure 5a). After enjoying bumper harvests year after year, Tharaka-Nithi farmers were more willing to allocate substantial pieces of their land under greengrams compared to farmers from the other two counties. For example, all farmers in Tharaka-Nithi were willing to allocate 10% and 20% to greengram production which is not the case in the other counties. However, this trend decreases as the land size increases.

Based on Fig. 5a, the highest adoption rates are achieved at 10% willingness to adopt level. This would however achieve 7,814 acres under green grams. The highest area (17,505 acres) in the 3 counties would be achieved at 30% willingness to adopt level (Fig. 5b).

Willingness to adopt Sorghum and Millet

In many parts of Machakos and Makueni counties, sorghum and millet were hardly grown citing their labour intensiveness in production and infestation by birds. As a

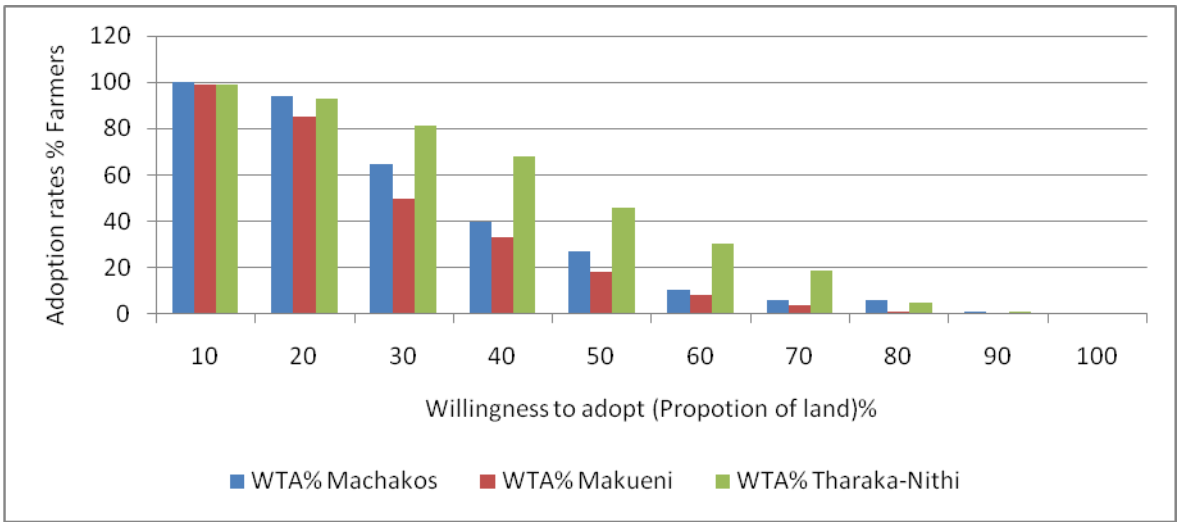

Fig. 4a. Willingness to adopt Cowpeas.

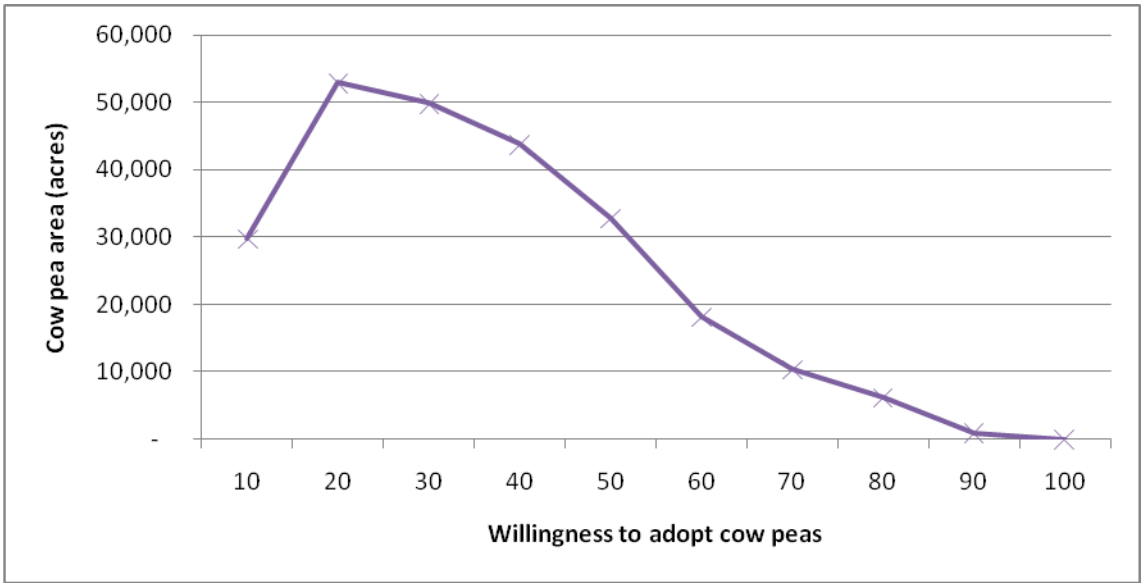

Fig. 4b. Area under cowpea at different willingness to adopt levels.

result, many farmers were not willing to adopt them in those two Counties. However, sorghum and millet production were dominant in Tharaka-Nithi hence their high willingness to adopt levels by farmers. However, even in Tharaka-Nithi, not all farmers were willing to allocate even 10% of their land proportion to each fo the crops beacuse both of them are not treated as main food crops in the county.

The highest adoption rates are achieved at 10% willingness to adopt levels for both crops. However, from Fig. 6b, this would only achieve a total of 6,080 acres of sorghum in the 3 counties and 6,240 acres of millet. The highest area under sorghum in the 3 counties (7,744 acres) would be achieved at a willingness to pay level of 20% whereas; the highest area under millet would be 11,249 acres and would be achieved at 30% willingness to adopt.

Willingness to adopt Dolichos

Across the Counties, dolichos lablab was not common especially in Tharaka-Nithi County thus receiving very little

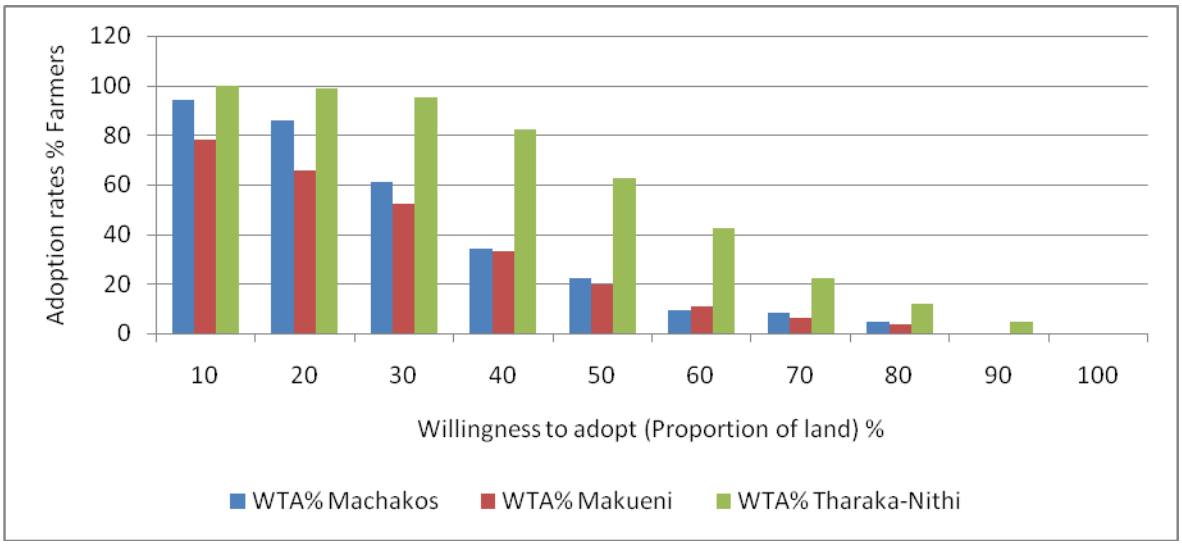

Fig. 5a. Willingness to adopt greengrams.

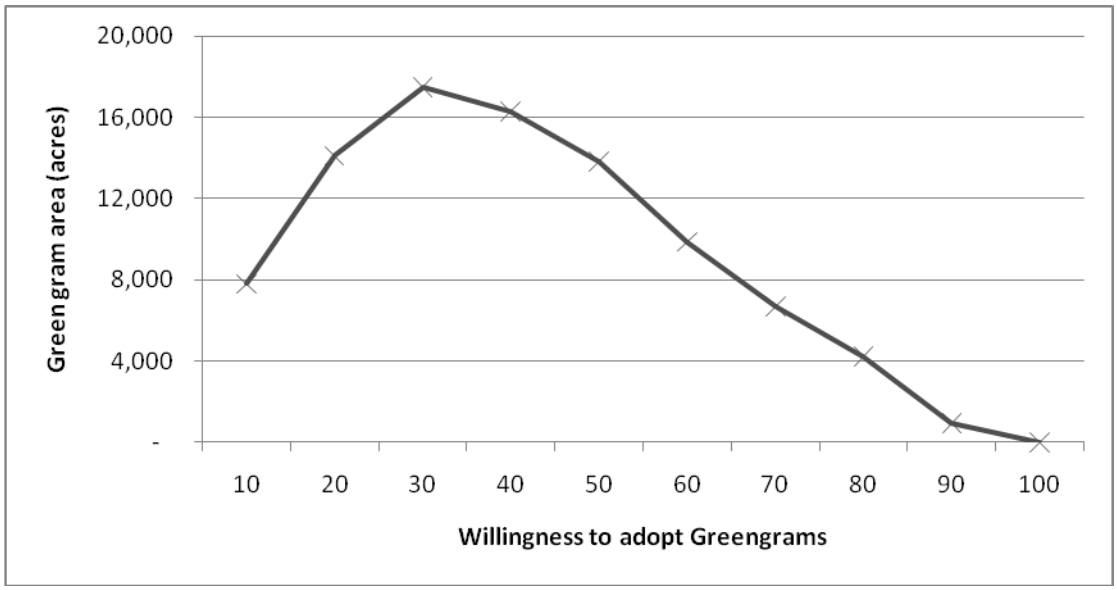

Fig. 5b. Area under green grams at different willingness to adopt levels.

land allocation by most farmers. Machakos was the only county where a few farmers attempted to grow it but with low proportion of land allocated to it. The few farmers who grew it in Makueni did not have a ready market for it hence low willingness to adopt.

Data from the Ministry of Agriculture (2007) shows that Machakos recorded a total of 1,040 acres under Dolichos, 396 acres in Tharaka-Nithi and no acreage in Makueni county. This is an indication that the crop is not popular in these counties.

WILLINGNESS TO PAY FOR DIFFERENT CROP TECHNOLOGIES

This sub-section discusses the farmers' willingness to pay for seed of different crop technologies at different price levels across the Counties. The willingness to adopt estimated the farmers' sacrifice in terms of land area. This question was followed by another contingent valuation payment card which asked farmers the monetary sacrifices they were willing to make to get a certain amount of seed for improved crop varieties.

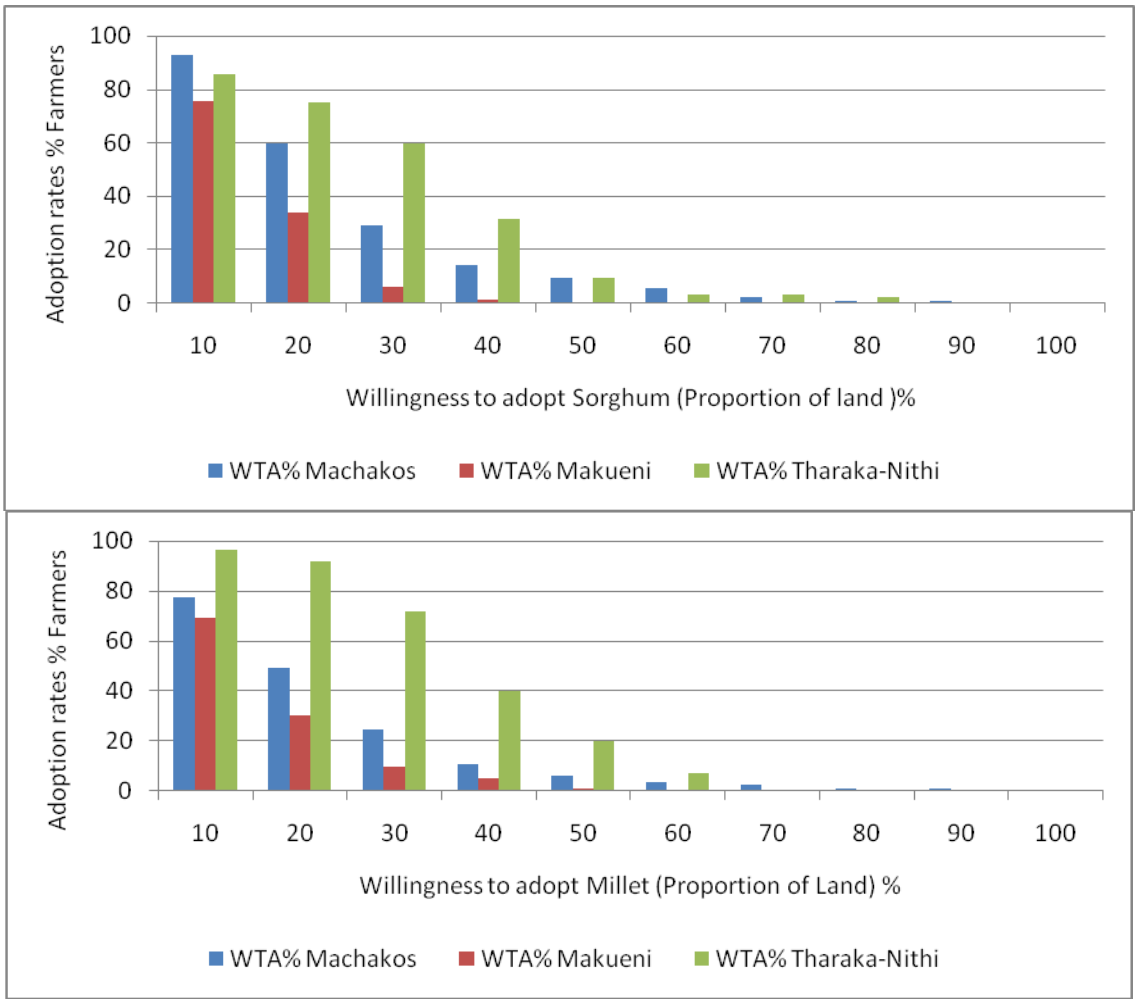

Fig. 6a. Willingness to adopt sorghum and millet.

Quantities of seed for the different crop technologies were computed and plotted against different willingness to pay price levels in each county as shown by the figures below.

Willingness to pay for maize seed

In all the three Counties, the quantity of improved maize seeds which would be demanded/purchased decreases as the price increases. The choke price for households in Machakos and Makueni Counties was Kshs 700/2kg packet where as for Tharaka-Nithi households; it was Kshs 500/2kg packet (Fig. 8a). This shows that farmers in Tharaka-Nithi County have a lower WTP for maize compared to farmers in the other two Counties. In many cases, Machakos County has the highest levels of quantity of maize which would be demanded at particular prices followed by Makueni. This shows that, it is more profitable for seed suppliers to venture and supply higher quantities of improved maize seeds in Machakos and Makueni markets than in Tharaka-Nithi.

Fig. 8b shows the total tonnage demanded at WTP levels. Prices of Kshs 300 and below would record demands of over 500 tons of seed in the 3 counties. Whether supplying maize seeds at prices of Kshs 300 or below is viable, depends on the cost of production by the seed suppliers.

Willingness to pay for bean seed

Across the Counties, it is also evident that it is not profitable to supply beans in Tharaka-Nithi County compared to the other two counties because the quantity of the bean seeds which would be demanded at particular prices is low (Figure 9). The maximum WTP for beans in Tharaka-Nithi was Kshs 120 per kg where as in Machakos and Makueni, it was Kshs 200. Even at prices of below Kshs 80, the most one can supply in Tharaka-

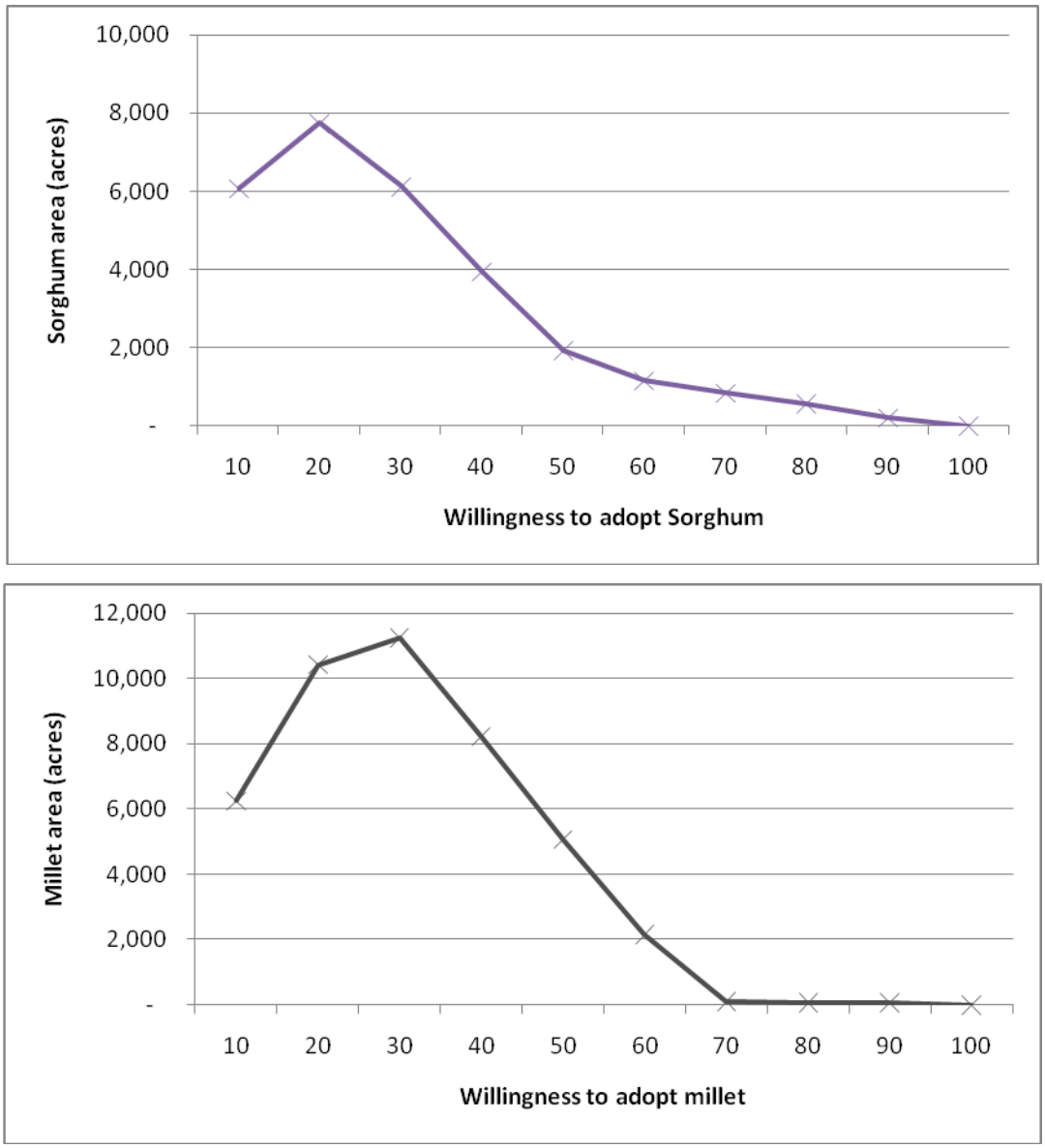

Fig. 6b. Area under sorghum at different willingness to adopt levels.

Nithi is 5 tons of beans. Machakos County seems to have higher demands for beans compared to Makueni at all price levels. At an average price of Kshs 100/kg, the quantity of seeds which would be demanded in Machakos is about 163 tons (twice) that of Makueni (81 tons). At that price in Tharaka-Nithi, the quantity of beans which will be demanded is very low about 2 tons. Therefore, like in the case of maize, seed suppliers can reap higher profits by supplying more improved beans to Machakos County and in Makueni County.

Willingness to pay for Pigeon pea seed

At different price levels, Figure 10 shows that farmers in Machakos seem to have higher demands for pigeon peas followed by Makueni and Tharaka-Nithi in that order. Tharaka-Nithi farmers seem to have the least WTP for improved pigeon peas with a choke price of Kshs 100/kg where as farmers in the other two Counties have the maximum WTP of Kshs 200/kg. Although farmers in Tharaka-Nithi County purchased and planted more pigeon peas during the survey period, their overall WTP for the pigeon peas is low.

Willingness to pay for Cowpea seed

The results of Figure 11 show that Makueni farmers would demand more cowpea seeds at different WTP levels to the other two Counties. The maximum WTP levels

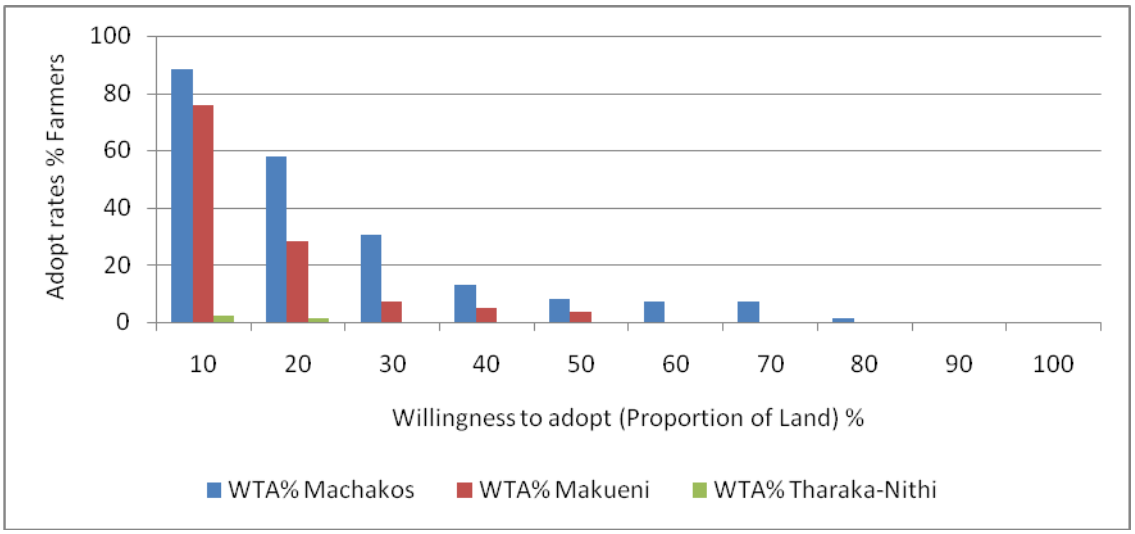

Fig. 7a. Willingness to adopt Dolichos.

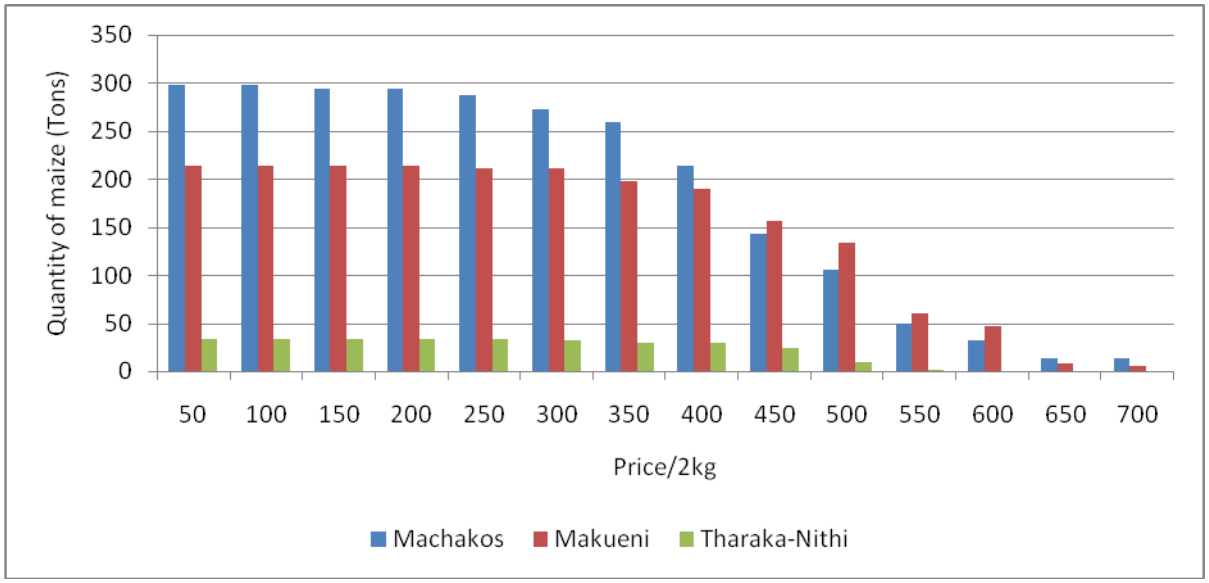

Fig. 8a. WTP for 2 kg maize pack.

in Makueni and Machakos are Kshs 200 for a kg of improved cow peas against Kshs 120 in Tharaka-Nithi. Therefore, farmers in Machakos and Makueni Counties have a higher WTP for cow peas and hence higher quantities demanded compared to those of Tharaka-Nithi County.

Willingness to pay for Greengrams seed

Figure 12 shows that, farmers in all the three Counties were willing to pay the maximum Kshs 200 per kg of improved green grams. At all price levels, Makueni County has the highest potential demand for greengrams seed. At low price levels of up to an average price of Kshs 100 per kg, Tharaka-Nithi farmers would demand slightly higher quantities of green grams compared to farmers in Machakos, but at higher prices, the converse is true. Generally, in all the three counties, supply of improved green grams would be a viable business.

Willingness to pay for Sorghum and Millet seed

Figure 13 indicates that the maximum WTP for a kg of sorghum in both Makueni and Tharaka-Nithi was Kshs 140 where as for Machakos, it was Kshs 200. On the

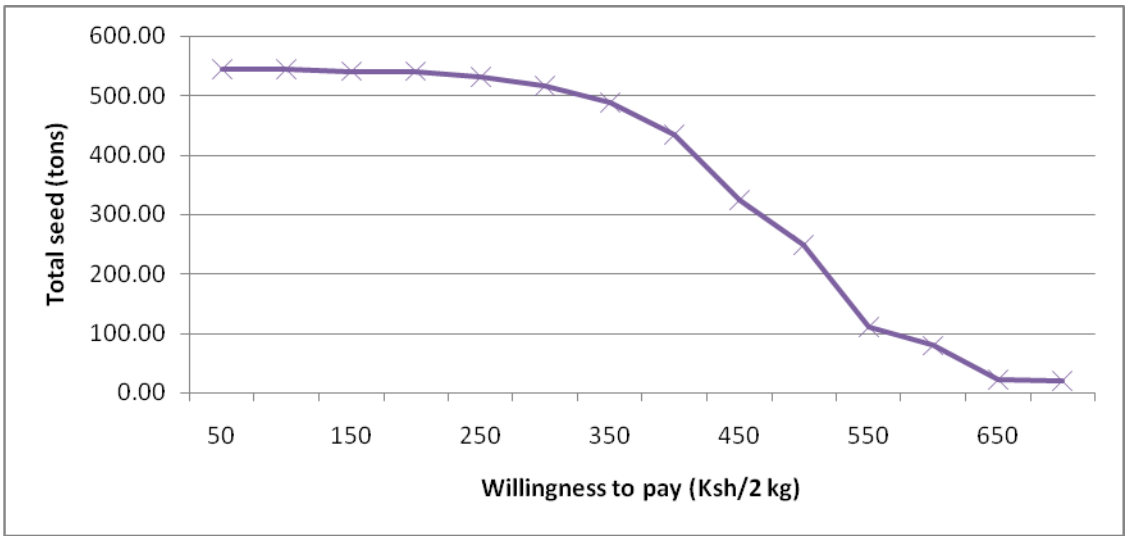

Fig. 8b. Total maize seed demand at different WTP prices.

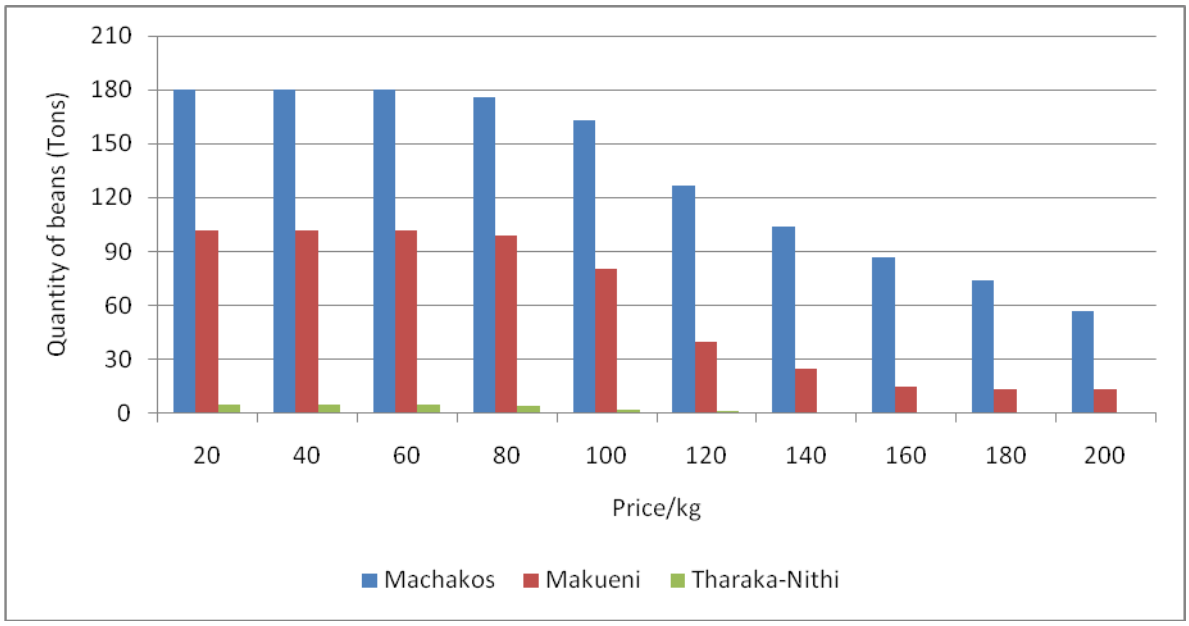

Fig. 9. WTP for beans.

other hand, the maximum WTP for millet in Tharaka-Nithi was Kshs 120 per kg where as in Machakos and Makueni, it was Kshs 200. Although the WTP for sorghum and millet was low in Tharaka-Nithi, these two crops show a high potential of uptake in the County. The quantity of millet for example which would be demanded at low prices of between Kshs 20-60 per kg is very high in Tharaka-Nithi than in the other two Counties. However, comparing to the other crops discussed above, the quantity of sorghum and millet demanded and area under the two crops is low. Therefore, their supply to the three counties should be limited in comparison to the other crops.

Willingness to pay for Dolichos seed

Dolichos was not a major crop in all the three Counties. In Tharaka-Nithi County for example, Dolichos was hardly

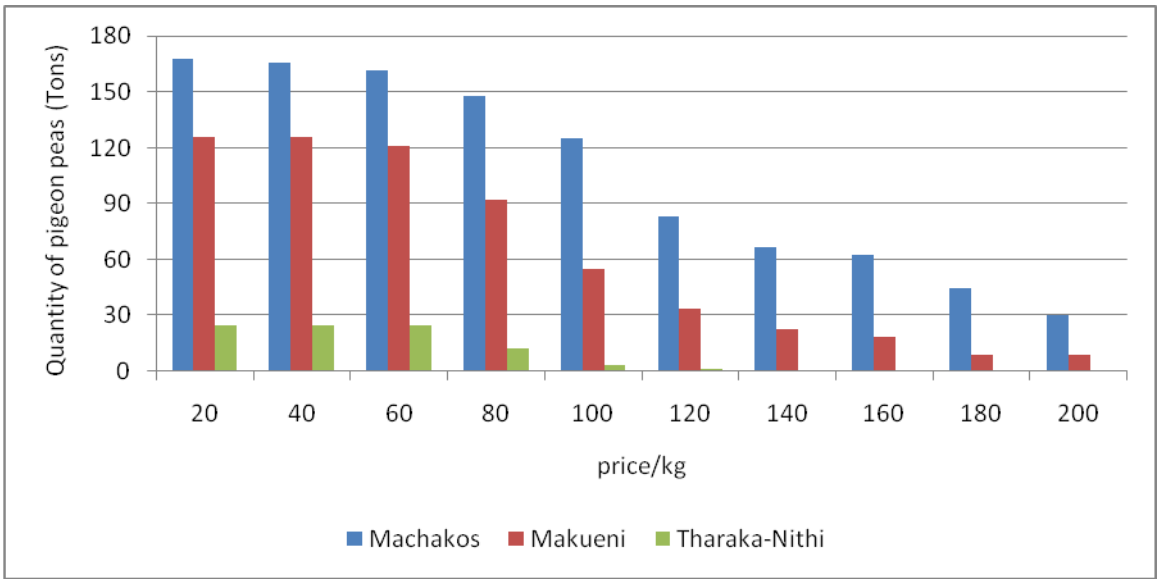

Fig. 10. WTP for pigeon peas.

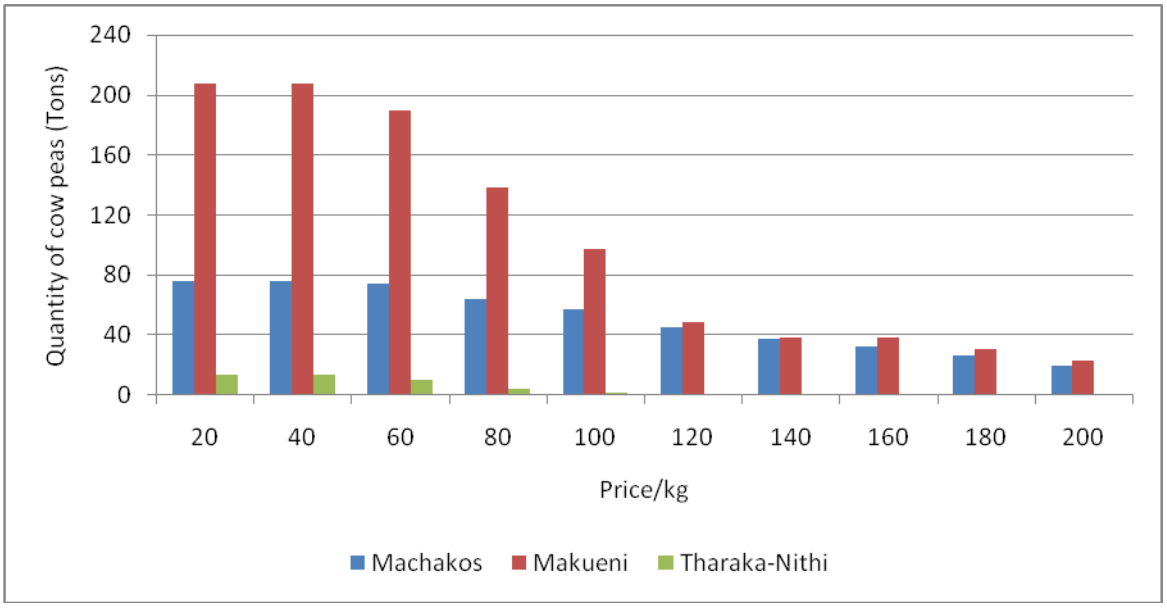

Fig. 11. WTP for cowpeas.

grown by the farmers. Machakos County led in Dolichos production followed by Makueni. This is why we can see little quantities of Dolichos which would potentially be demanded at different price levels in these two Counties and almost nothing in Tharaka-Nithi. For instance, at all price levels, farmers in Machakos would demand less than a tone of seed, those is Makueni would demand less than half a ton, while the demand in Tharaka-Nithi would be negligible. This is despite its high nutritive value.

CONCLUSION AND POLICY RECOMMENDATIONS

Across the Counties, some farmers were willing to adopt some technologies but did not do so because of being sold at very high prices they could not afford. For a 2 kg maize pack for example, majority of them quoted a price range of between Kshs 200-350 for all maize varieties as an affordable price to many. Therefore, it would be necessary for the seed suppliers to make the prices of

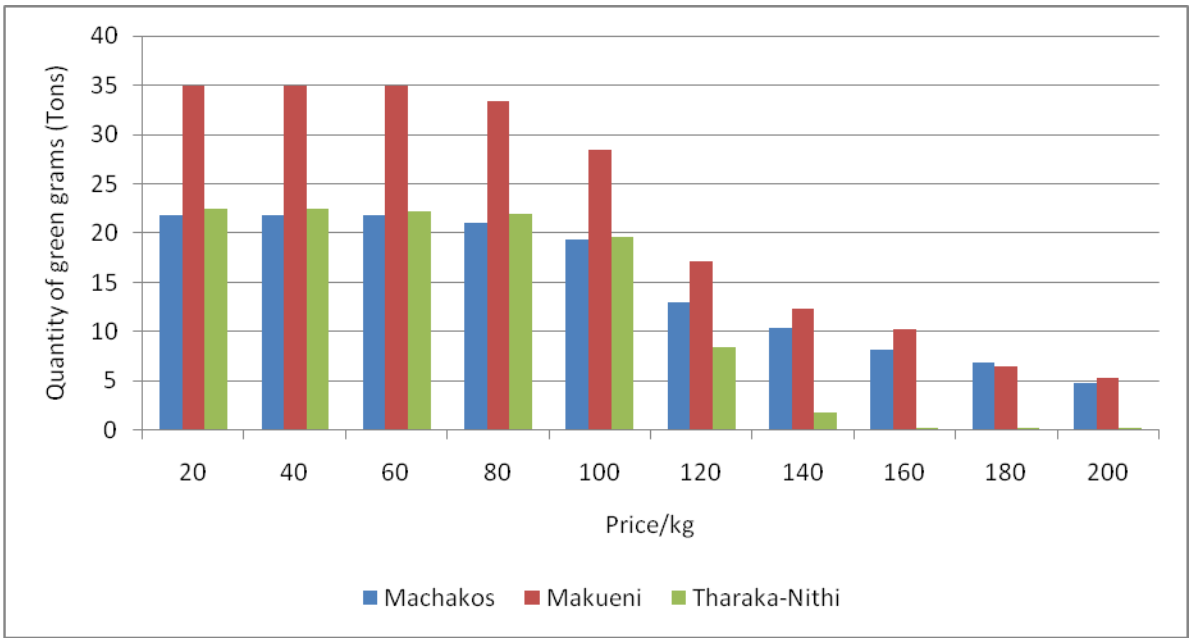

Fig. 12. WTP for greengrams.

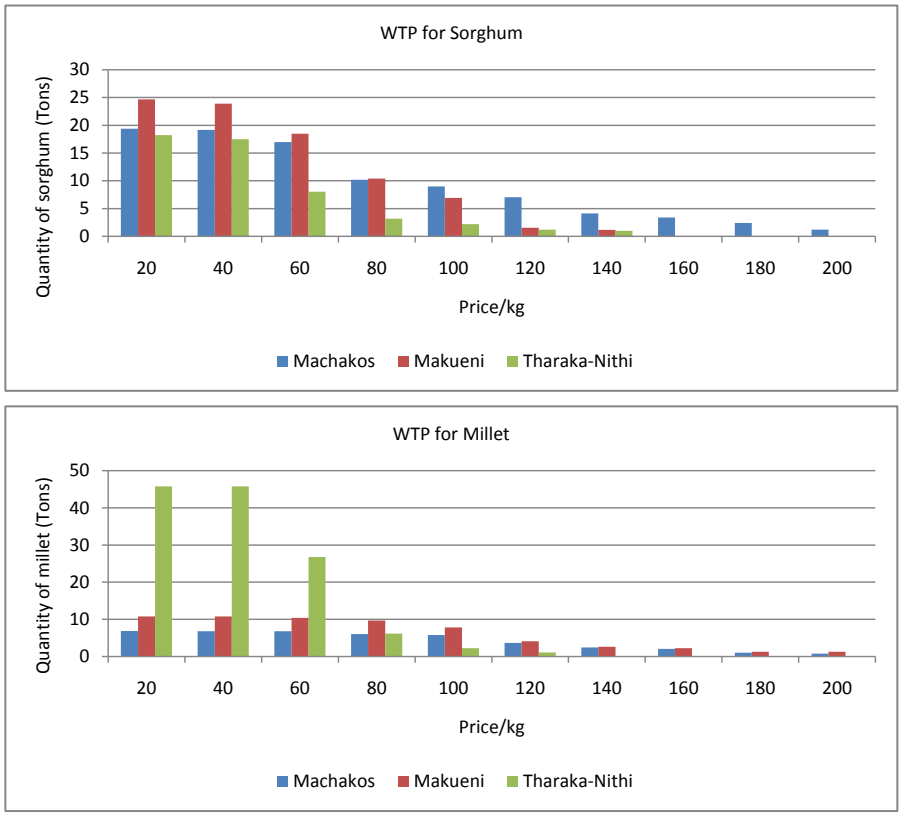

Fig. 13. WTP for sorghum and millet.

these crop technologies to be more affordable as possible so as to increase the adoption rates. Furthermore, a number of farmers said some technologies had no demand in the markets. For example,

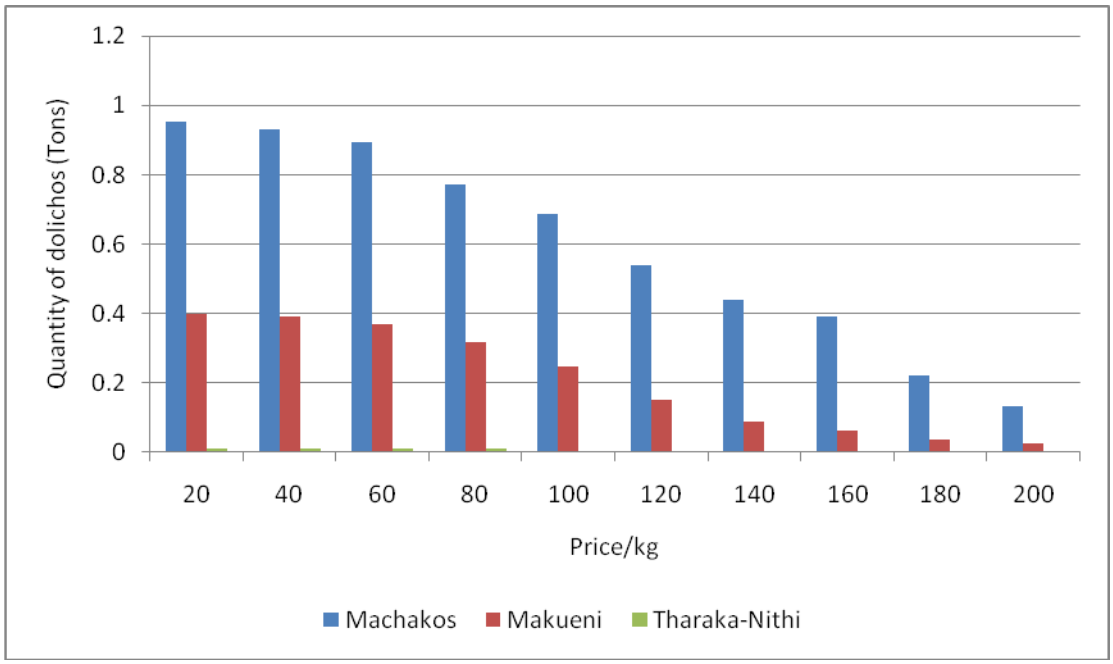

Fig. 14. WTP for dolichos lablab.

majority of farmers in Makueni said Dolichos has no market there hence there was no need of producing it. This also applies to other crops in other counties like sorghum and millet in Machakos and Makueni. In regard to this, it would be recommendable that the government and other stakeholders find a ready market for most of these crops so as to encourage more production by the farmers.

Despite the high nutritive value contained in Dolichos lablab, majority of the farmers cited its bad smell and taste as a reason for not growing it. Majority of them said that they were unwilling to grow a crop they could not consume hence its low demand in all the Counties. The other crop which lacked demand in the households was sorghum. It is therefore recommended that sensitization on nutrition status of each crop be done to the farmers across the Counties. By so doing, more and more farmers would see the importance of each crop in their diets which would probably make them increase their intakes and adoption rates.

From the survey, it was found that maize and beans do not do well in Tharaka-Nithi County due to un-favourable climatic conditions for their production. Due to this, it is recommended that seed suppliers should embark on supplying other seed types other than maize and beans because it is not profitable to venture into maize and beans business in Tharaka-Nithi County.

For the willingness to adopt results, farmers indicated that they were willing to take up new technologies. With regards to this, there has to be a conscious policy decision by the government to promote uptake of these technologies through different channels such as extension, media and other appropriate channels. The uptake of technology is also subject to the cost of that technology. From the willingness to pay results, it is clear that farmers will be willing to pay for new technologies up to a certain price. Thus, there is need to have consultation between the government (both national and county) and the seed suppliers on the supply prices. If such prices are without the reach of many farmers, then schemes such as subsidies could be introduced on certain targeted technologies, so as to improve their uptake.

ACKNOWLEDGEMENT

I would like to acknowledge Kenya Agricultural Research Institute for their financial support in undertaking this study.

REFERENCES

ASDS (2010). Agricultural Sector Development Strategy (2010-2020). Government of Kenya press.

CAADP (2010). Comprehensive Africa Agriculture Development Programme compact. Government of Kenya.

Carson RT, Flores NE, Meade NF (2001). Contingent Valuation: Controversies and Evidence. Environ. Resource Econ. 19, 173-210.

Fredrik C, Peter M (2005). Willingness to pay among Swedish households to avoid power outages: A random parameter Tobit model approach. *Elforsk rapport* 05:04

Ryan M, Watson V (2009). Comparing welfare estimates from payment card contingent valuation and discrete choice experiments. Health Economics 18(4): 389-401.

Willis KG (2002). Iterative bid design in Contingent Valuation and the Estimation of the revenue maximizing price for a cultural good. J. Cult. Econ. 26: 307-324.