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Farmers' Perception of the Relevance of Agricultural Technologies Promoted under Plan for Modernization of Agriculture in Uganda

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Abstract: This study tigates the farmers' awareness and perception of the relevance of agricultural technologies under the Plan for Modernization of Agriculture (PMA). A survey was conducted between April-July, 2005 in the parishes of Bugulumbya, Kasambira and Nawandhyo of Buzaya county, Kamuli district. Using a two-stage random sampling technique, 120 farmers were selected and interviewed. Data analysis was done using a Statistical Package for Social Sciences (SPSS ver. 11.0) and simple descriptive and inferential statistics were run. The results showed that there is high awareness among farmers of agricultural technologies, for example improved agroforestry fallow (92%), improved variety of simsim (85%) and poultry livestock management (80%). There is a significant relationship between farmers' awareness and their perception of the relevance of technologies. Livestock technologies ($r = 0.42$, $p<0.05$), improved crop varieties ($r = 0.44$, $p<0.05$) and agroforestry technologies ($r = 0.58$, $p<0.05$) were found significant. However, the farmers' degree of awareness of soil and water conservation technologies ($r = 0.02$, $p>0.05$) was statistically not significant. It is concluded that agricultural research policy should enhance existing agricultural technologies since farmers' awareness of the technology significant affect their perception to the relevance of the agricultural technology. A rejuvenated agricultural extension system is one way envisaged to improve the awareness and perception of relevance of agricultural technologies in Uganda.

Key words: Agricultural technologies, farmers' perception, modernization of agricultural, Uganda

INTRODUCTION

The Plan for Modernization of Agriculture (PMA), a framework for eradicating poverty and improving the livelihoods of the rural subsistence farmers in Uganda. It is designed to create an enabling environment for subsistence farmers to make a better living by producing more agricultural produce and selling for income. This transformation process involves institutional and organizational reform, public sector policy adjustments, decentralized and participatory planning and pluralism in service delivery (MAAIF, 2001).

There has been great investment in agricultural research and development of new technologies in Uganda (MAAIF, 2001). Many technological innovations most of which are appreciated or used by the farmers. According to Semana *et al.* (2002) inadequate participation of rural farmers in the agricultural technology development is partly responsible for the inability of farmers to take full advantage of the improved agricultural technologies (NARO, 2001). Agricultural technology development among smallholder farmers is still very low. To improve the agricultural production, appropriate technology is necessary to suit the local economic, cultural and geogr-aphical conditions of the region (Boesen *et al.*, 2004).

Available study shows that the single most important factor behind rural poverty is low agricultural productivity (MFPED, 1997) resulting from soil fertility depletion, heavy reliance on basic indigenous technology including the use of unimproved and low-yielding planting material, limited practice of crop protection, high post-harvest losses arising from inadequate storage and processing capacity. Therefore, increasing agricultural productivity could significantly contribute to the effort to mitigate poverty in Uganda by increasing farm production and incomes.

The National Agricultural Research (NARS) Act of 2005 is a legal instrument that Uganda has developed to ensure that NARS is transformed into an innovation systems whose outputs tally with the needs of the clients (MAAIF, 2001). A review of the technologies in the NARS shows that Uganda has plenty of improved techn-ologies. However, a number of these technologies have not been adopted and used by farmers (Semana *et al.*, 2002; MAAIF, 2001). One of the problems of technology uptake is the demeaning perception by scientists of farmers as recipients of already developed technologies. Therefore, farmers rarely adopt and utilize scientific knowledge because of limited awareness and/or reluctance to relate with technology that they perceive as

irrelevant to their needs (Boesen *et al.*, 2004; Biggs and Clay, 1981). Lots of research findings have not found their way into the hands of extension staff nor farmers through appropriate packaging thereby limiting the contribution of research to the broader goal of getting improved agricultural technology to the users (Agbamu, 2000). The objective of the study was to assess farmers' awareness and perception of the relevance of agricultural technologies promoted under PMA.

MATERIALS AND METHODS

Description of study area: The study was conducted in Buzaya county which lies between latitude 0°09^{l} and 0°11^{l}N and longitude 31°50^{l}E. Annual rainfall varies from 900-1200 mm with two marked dry seasons and the average temperature ranges between 22.6 and 24.6°C. Buzaya county was selected because it has characteristics typical of the diverse social, economic, cultural, rural and urban setting found in the Busoga region. Population density is about 230 persons per km^2 and the growth rate is 2.3%. (UBOS, 2002). Subsistence agriculture is the major economic activity employing about 84% of the population (MAAIF, 2001). The bulk of agricultural production is from manually cultivated rain-fed crops. Inter-cropping is a prevalent practice (MAAIF, 2001).

The district has a total population of 528,126 people, the population density is about 230 persons per km^2 and the growth rate is 2.7%. The ethic groups include the Baganda (70%), Baruli (28%) and others (2%). Eighty nine percent of the population are subsistence farmers (MFPED, 2000).

Data collection: Data were collected from April-July, 2005 in the 3 parishes of Bugulumbya, Kasambira and Nawandhyo of Buzaya County. Using a stratified random sampling technique, two villages were selected in each parish making a total of six villages. From each village 10 tree farmers were selected and interviewed. Other data were obtained through review of district environmental reports, focused group discussions, interviews and personal observations made during the fieldwork process. A cross-sectional descriptive research design employing both quantitative and qualitative methods was employed. The parishes were purposively selected because they were classifies as PMA compliant (MAAIF, 2001). A two-stage random sampling technique was used to select a sample size of 120 respondents were selected for focused group interviews. Participatory Rapid Appraisal (PRA) tools which included open interviews, focused group discussions and semi-structured questionnaire was administered to the respondents. Information was collected on farmers' awareness and perception to the relevance of agricultural technologies such as agroforestry technologies, soil and water conservation, livestock multiplication technologies and improved crop varieties. Additional information was obtained from the district NAADS Coordinator.

Data analysis: The data collected were entered in the SPSS version 11.0 and analysed using cross-tabulation and correlations. The Pearson Product Moment Correlation was used to show the relationship between awareness and farmers' perception of the relevance of the different technologies. Descriptive statistics were used to obtain percentages, frequencies, chi-square values and relevance indices. The relevance indices were delivered as a ratio of percentage relevance to percentage awareness. The indices were used to compare the farmers' perception of the relevance of technologies that are popular among farmers. The average of the indices among technology categories reflect the farmers' preference for the given technology.

RESULTS AND DISCUSSION

Farmers' awareness of agricultural technologies promoted by PMA: There were four major kinds of agricultural technologies in Buzaya county under PMA framework. The survey covered farmers' awareness and perception of the relevance of selected agricultural technologies (Table 1). The results showed that farmers' awareness of the technologies varied. The most popular technologies were: improved agroforestry fallows (92%); hedgerow intercropping (87%), vegetative practices (84%), improved simsim varieties (85%) and poultry management technology (80%). The results further show that clonal coffee varieties (30%), multi-storey (42%) and fish pond management (45%) technologies were not popular among farmers in the study area.

Farmers' perception of the relevance of agricultural technologies: The technologies perceived to be relevant by the farmers included: Improved crop varieties (98%), livestock technologies (92%) and agroforestry technologies (82%). The soil and water conservation technologies, however, were perceived to be less relevant by the farmers. Towards the end of 1960s, eight outstanding clones in terms of yield, bean size, vigor and cup quality were selected. Clonal coffee mother gardens were established in 14 main robusta growing districts including Kamuli in 1970. By 1987 two of the coffee clones had been dropped because of high susceptibility to coffee leaf rust, leaving six clones, namely, IS/3, IS/2, IS/6, 223/53 and 258/24 (Mubiru, 1996). It is estimated that clonal coffee yields up to 3000 kg of unhusked coffee bean weight per hectare, which is over twice the yield for traditional coffee (1200 kg^{-1}ha).

Table 1: Farmers' perception, use and assessment of use of selected agricultural technologies (n = 120)

	Awareness perception		
Technologies	Aware (%)	Relevance (%)	Relevance index
Agroforestry technologies (0.82)			
Improved fallow **	92	87	0.95
Hedgerow intercropping*	87	53	0.61
Multistorey	42	25	0.60
Homegarden **	50	60	1.20
Clonal coffee ns	30	12	0.40
Soil and water conservation (0.44)			
Contour ploughing*	76	12	0.16
Trash lines ns	66	18	0.27
Terraces*	78	58	0.74
Vegetative practices	84	12	0.14
Compost and green manure ns	60	53	0.88
Improved crop varieties (0.98)			
Banana**	80	73	0.91
Cassava**	75	82	1.09
Beans**	76	75	0.99
Simsim*	85	70	0.82
Maize**	74	83	1.12
Livestock technologies (0.92)			
Multiplication of goats*	74	58	0.78
Cattle cross-breeding*	68	63	0.93
Fish ponds management ns	45	42	0.93
Poultry management**	80	87	1.09
Feed grinder (350 kg per hour)	76	67	0.88

** = 0.01 level of significance, * = 0.05 level of significance, ns = not significant

The technologies perceived to be relevant by the farmers included: improved agroforestry fallow (87%), poultry management (87%), improved cassava varieties (82%) and maize (83%). Vegetative practices (12%), contour ploughing (12%), clonal coffee varieties (12%) and trash lines were perceived not be very relevant by the farmers. This finding tallies with the individual technology relevance indices, whereby, homegarden (1.20), improved maize and cassava varieties (1.12; 1.09), respectively and poultry management (1.09) were perceived to be relevant.

Correlation between awareness and perception of agricultural technologies under PMA: Farmers' awareness and perception of the relevance of the technologies is of great interest to the NARS in Uganda. The results show a significant relationship between farmers' awareness and perception of the relevance of agroforestry technologies, livestock management and improved crop varieties. However, there is no significant relationship between the farmers' awareness and perception of soil and water conservation approaches (Table 2).

Table 2: Zero-order correlation between farmers' awareness and perception of agricultural technologies

Technologies	Correlation coefficient(r)	P-value
Agroforestry technologies	0.58	p<0.05
Soil and water conservation technologies	0.02	p>0.05
Improved crop varieties	0.44	p<0.05
Livestock technologies	0.42	p<0.05

S = Significant at p<0.05; NS = Not Significant

The farmers' awareness and perception of the relevance of agricultural technologies has a significant impact on the rate of adoption of technologies promoted under the PMA.

According to the survey results, agroforestry technologies were perceived to be relevant by the farmers except the clonal coffee. However, clonal coffee has not be widely adopted by the smallholder farmers because compared to traditional coffee, clonal coffee is a higher input and thus high cost technology, which may deter its adoption if the high cost makes it unaffordable to many farmers. The could partly explain why many farmers in the study area who had a chance to evaluate clonal coffee by participating in the farmer trial demonstrations never planted it beyond the demonstration plots). This is in contrast with the cassava case where farmer participation fuelled the adoption of improved cassava varieties. Farmers' reported that "before clonal coffee was introduced, there was no wilt and now all we hear on radio and from extension agents is that clonal coffee is tolerant to the wilt. What a coincidence!.

Such misconception need to be rightly addressed by Uganda Coffee Development Authority (UCDA), otherwise the future of coffee in Uganda is threatened. With regard to Coffee, the UCDA needs to intensify edu. And extension programs to educate farmers to the benefits of clonal coffee, while at the same time address-ing the risks associated with the adoption of clonal coffee.

The findings show that fish pond management technology was also not popular among farmers because the technology was still new to the farmers. Fish farming was introduced to the smallholder farmers in Bugulumbya parish by Integrated Rural Development Initiaves, an NGO dealing in small-scale bee-keeping and fish farming. The farmers reported that fish farming requires high technical skills, demands more labourer, highly perishable on harvest yet markets were not locally available.

On the other hand, several factors led to lack of awareness of soil and water conservation technologies among farmers. There was limited understanding of PMA and its objectives amongst the public, private sector and civil society; lack of appropriate micro-financing for expensive soil and water conservation structures; and slow roll-out of PMA and/or NAADS to the farmers which left some sub-counties of the district without effective advisory services regarding soil and water conservation approaches. According to Semana *et al.* (2002) such perception is surprising especially at a time when there is increasing consciousness for sustainable environment management and efficiency in resource utilization.

Technologies on improved varieties of some arable crops are also perceived to be relevant by the farmers. These crops feature prominently in the farming systems in the study area. Our study and many others (Nabbumba, 1998; Chambers and Ghildyal, 1985) show that the farmers' perception and eventual use of any agricultural technology, practice or innovation can improve if farmers have a good understanding of the technology in respect to its contribution to the farmer's welfare. Following Otim-Nape *et al.* (1999) the yield for improved varieties of cassava was set at 20 tons^{-1}ha^{-1}. Since this is a little over two times the base yield (9 tons^{-1}ha) used to calculate the gross margins for local cassava varieties.

The positive farmers' perception to improved crop varieties might have been due to the seed "loaning" system whereby a farmer was given 0.5 kg of beans, maize and simsim seed to plant and after harvest was required to bring back 1 kg, which would be distributed to other farmers. About 21 tonnes of improved seed were distributed to over 100 farmers in the study area within two years and some of these farmers also shared seeds with other farmers.

In addition to the to the training programmes carried out by the extension staff operating in the district, the "graduates" of the farmer field schools were now passing on knowledge and skills to other farmers in the communities. In Kasambira parish, farmers' perception was influenced by a farmer's familiarity with the type of maize, beans or simsim. For example, farmers showed positive perception to NABE 12c bean variety which yielded 6 tonnes^{-1}ha. In Nawandyo parish, where climbing beans were not known, farmers preferred WR1946, a variety which was well known to be disease resistant, high yielding (4.8 tonnes^{-1}ha) and producing medium size seeds.

For the farmers to perceive a given technology as relevant, the technology must be compatible with their long-time practiced farming system. Therefore, a high degree of awareness implies that the technologies have or are compatible with farmers' farming systems and expectations (Maxwell, 1995; Biggs and Clay, 1981; Scoones, 1999). Historically, Kamuli district is well known as a simsim producing area, accounting for 30% of the production, but from the year 2000 yields were severely reduced by simsim root rot. On this basis, therefore, the factors to be considered in the farming systems for example labour allocation according to time and gender could strength the above explanation.

The favourable perception for agroforestry technologies could be due to the dependency on fuelwood (firewood and charcoal) for looking and domestic heating (Jacovelli and Caevalho, 1999). Available literature shows that 90% of the low income rural population in Uganda depends on agroforestry products as a source of affordable energy for cooking and domestic heating (UBOS, 2002; MAAIF, 2001). This underscores the importance of farmer participatory approach in technology development and transfer. Through participation, farmers are stimulated to evaluate and adopt innovations that fit well within their goals and socio-economic complexity.

Farmers preferred livestock technologies especially poultry, feed grinders and mixer. This is because a deeper litter system of poultry production has improved welfare among subsistence farmers. The Community Integrated Development Initiatives (CIDI), an NGO had pioneered a method of improving local chickens through programmed hatching on one particular day of the week as well as cockerel exchange. Farmers were organized into groups and trained in the selection and breading of local chickens, modern husbandry practices and improved soil fertility with manure. Much of the research into improved chicken productivity is carried out at Serere Agriculture and Animal Production Research Institute (SAARI), Kawanda Agriculture and Animal Research Institute (KAARI) and Makerere University, but little information finds its way to the farmers, therefore, CIDI has networked with these institutions to enable people on the ground to benefit.

Additionally, the results show that soil and water conservation approaches were not as popular and were perceived to be less relevant compared to livestock

husbandry and improved crop varieties. This was attributed to the physical labour and high level of competency required to establish and maintain the soil and water conservation structures. According to Boesen *et al.* (2004) many farmers in Uganda have low education levels, are poor and therefore, regard soil and water conservation innovations as a bother, an extra burden to their constrained family incomes.

It is not surprising that farmers ranking soil conservation measures as less relevant because in Uganda, traditional extension services focused on land productivitiy, crop varieties and pest control and ignored soil and water conservation (Semana *et al.*, 2002). Secondly, most villages in the study area are inaccessible, making it difficult to link research, extension and farmers. To increase farmers' awareness and perception of the soil management approaches, there should be synergetic linkages and strong partnerships in research and development agencies under PMA.

The results show no significant relationship between farmers' awareness and relevance of the agroforestry technologies, improved crop varieties and livestock husbandry. The farmers' awareness of any technology, does not in any form affect their perception of the relevance of the technology. This is because these technologies are commonly practiced in the farming system and seem to provide for the current interests and needs of the farmers. The perception of farmers of agroforestry, crop husbandry and livestock multiplication technologies, emphasizes the need for a demand-driven technology generation as opposed to the tradition supply-driven extension philosophy.

Past studies (Boesen *et al.*, 2004; Nabbumba, 1998; Maxwell, 1995) have reported that the farmers' socioeconomic as level of education, age, farming experience and size of landholding are some of the factors influence perception and use of a technology. The farmers' perception may be indicative of the overall correct understanding of the technology, however, some of these technologies are new and expensive to acquire given the poor economic standards of the farmers in Kamuli district.

Farmers are the best judges of agricultural technologies. It is crucial therefore, that they are given chance to get more involved in NARO's research process. The cassava case in this study clearly shows that involving farmers in the evaluation, multiplication and transfer of improved cassava varieties significantly improved their perception. This is because farmers were able to communicate what they wanted to researchers, who in turn responded by addressing the farmers' need. Involving farmers in determining NARO's research agenda would also ensure that research is demand driven and problem solving, thus making the research more relevant.

CONCLUSION AND RECOMMENDATIONS

- Farmers' perception of the relevance of agricultural technologies is affected by awareness of the technology in question.
- There was no significant relationship between farmers' awareness and perception of the relevance of technologies such as soil and water conservation.
- Agricultural research policy should enhance existing agricultural technologies since farmers' awareness of the technology significant affect their perception to the relevance of the agricultural technology.
- The results of this research suggest that similar research should be carried out in all agro-ecological zones in the country to establish location-specific issues related to farmers' awareness and perception of the relevance of agricultural technologies.

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