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Participatory farmers' evaluation of maize varieties: A case study from Nebbi District, Uganda

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Abstract A participatory action research was conducted between July 2004 and March 2005 in Nebbi district. The purpose was to analyze farmers' evaluation criteria for selection of improved maize varieties. Twenty farmers were sampled and provided with six different improved maize seed varieties (Longe 1, Long 2 Hybrid, Longe 4, Longe 5, Pan 67 and SeedC0 407) to grow. Data were collected using individual interviews, participant observation and group discussions at three stages: before planting, from seed germination to harvest and post harvest. Farmers had diverse perceptions and complex combinations of criteria in selecting the maize varieties they grow. Large seed grain size, however, was found to be the prime physical trait that appeals to most farmers when selecting seeds whose genetic characteristics are apparently not yet known. There is a need for extension workers to focus on adaptation rather than adoption of new technologies by farmers.

Key words: Agronomic practices, maize varieties, participatory action research, Uganda

Résumé Une recherche action participative était conduite entre Juillet et Mars 2005 dans le district de Nebbi. L'objectif était d'analyser les critères d'évaluation des fermiers dans la sélection des variétés améliorées du maïs. Vingt paysans étaient échantillonnés et approvisionnés avec six variétés de semences différentes de maïs (long 1, long 2 hybride, long 4, long 5, Pan 67, et seedCo 407) pour planter. Les données étaient collectées à travers des interviews individuelles, les observations des participants et des discussions en groupes en trois phases : la période d'avant la plantation, la période de la germination à la récolte et la période d'après récolte. Les paysans avaient des perceptions et des combinaisons complexes des critères dans la sélection des variétés des maïs à planter. Les semences larges avaient des traits physiques principaux attirant les fermiers lors de la sélection des semences dont les caractéristiques ne sont pas encore connues apparemment. Il est nécessaire que les staff de vulgarisation de focaliser sur l'adaptation au lieu de l'adoption des nouvelles technologies par les fermiers.

Mots clés: Pratiques agronomiques, variétés de maïs, recherche action participative, Ouganda

Introduction

Agriculture is the mainstay of Uganda's economy accounting for 35.8% of the Gross Domestic Product and employing well over 80% of the work force. Unfortunately, the performance of the workforce has been far from satisfactory with the rate of agricultural output growth lagging well behind that of the population. This trend has increased the incidence of food insecurity and raised poverty levels; hence, food security remains a priority concern for the Government of Uganda (MAAIF and MFPED, 2000; RATES, 2003). Diversity of agricultural production (food self-sufficiency) has been among the stated policies of the Ugandan Government. Maize is one such crop that has been emphasized in the agricultural diversification strategy.

Maize is the food staple for a majority of households in Uganda, as well as a source of sustenance in many rural parts of Uganda (Agona *et al*., 2001; RATES, 2003). It is eaten in many areas of the country green or roasted on the cob or as a paste made from the flour called posho. Maize yields which average about 1.5 tons per hectare, are low compared to neighboring countries (e.g. Kenya) and compared to major corn producing countries of the world (e.g. U.S. average of 8.2 tons per hectare) but a huge potential exists for increasing the yield to well over 5 tons per hectare through increasing the use of improved varieties and appropriate crop husbandry (Uganda Seed Trade Association, 2002).

Improved varieties have been developed for various agro-ecological zones. However, the adoption rates of these varieties are reportedly low. Consequently, many farmers are only achieving a small proportion of the potential productivity from adoption of improved seeds. Moreover, studies documenting farmers' evaluation criteria and adoption of these maize varieties in Uganda have been infrequent. The paucity of empirical studies on the farmers' evaluation criteria and factors influencing adoption of different maize varieties in Uganda justifies further studies. The main objective of this study was to analyze farmers' evaluation criteria of improved maize varieties (Longe 1, Long 2 Hybrid, Longe 4, Longe 5, Pan 67 and SeedC0 407) right from pre-planting phase up to the post harvest stage.

Study area. Nebbi sub-county in Nebbi District is located in northwestern Uganda between 2º 30´ and 2º 45´ north of the equator and 30º5´ and 31º10´ east of the prime meridian. The District covers a total area of 3,288sq km (1.2% of the national area). The topography of the area was largely

affected by the faulting and rifting forces. Up-arching and tilting affected the Okoro uplands and as a result, differences in localized diastrophic forces led to a variation in relief with a marked ascend towards the Democratic Republic of the Congo. Jonam county has a flat relief, Padyere is a raised plateau and Okoro is generally a highland (EMA & ECON, 2005).

The district exhibits a purely tropical climate due to her location within the eastern topographical rainfall zone. The dry and sub-humid climate is associated with orographic rainfall and thunderstorms. Rainfall follows a bimodal pattern with peaks in May and October. Temperature is generally high except in Okoro and parts of Padyere County. The district is a polyglot society in which the various ethnic groupings (Alur, Jonam, Kebu, Lendu, and Alur) have diverse historical origins dating as far back as 1000 AD. Agriculture is the dominant economic activity, employing 85% of the population. The sector remains subsistence-oriented with less than 40% of the produce sold (EMA & ECON, 2005).

Methods

Data were generated through interview of male and female farmers using Participatory Rural Appraisal (PRA) approaches, and from field observations. Evaluation data was largely collected using individual interviews while focus group discussions were held to establish the common evaluation criteria among the farmers in relation to available resources. A total of twenty farmers were selected from 101 households in two villages of Nyakagei and Juparwoth. The criteria used in the selection included: regular attendance in pre-study meetings, willingness to spare a portion of the field for pure stand maize production and the field location within the village. The selected farmers were given codes F1 to F20 corresponding to their names. Farmers were presented with six improved maize seed varieties to choose from. Phenotypic descriptions of these varieties used are presented in Table 1.

The seed colours, except for Longe 1, were artificially imparted through seed dressing at the respective sources of the seed varieties. The dented maize seed varieties (family: *Zea mays identa)* had a pronounced wrinkle or dent (depression) on top of their seed gains. The flint varieties (*Zea mays indurata*) on the other hand had their grain tops rounded, which is, protruding outwards. The semi flint varieties (MV_5 and MV_7) meanwhile, had their grain tops rather flat.

Pre-planting evaluation was conducted with these six maize varieties each packed in half-kilogram bags and coded. Farmers were asked to freely check all the seeds and choose upto three varieties that appeal most to him/her. The reasons behind the choices were sought. Field evaluations were conducted at two crop growth stages: in mid to late September 2004, about one month after planting and in late November/early December, towards harvest time. The information sought included farmers' views on the genotypic plant features such as seedling vigor, resistance to drought, field pests and diseases; relative earliness/lateness of plant development, yield potential and as well as specific management requirements, if any, of the different maize varieties planted.

Post harvest evaluations were conducted in February 2005 two months after harvest. The objectives was to identify post harvest quality attributes or characteristics most desired by the farmers, to compare and confirm the data obtained at this phase with those at the first two phases, and determine whether there were changes in the farmers' ranking of the varieties during the production cycle and why, if any. Group evaluation was finally conducted to enable the farmers share their general experiences with the different maize varieties and rank the maize varieties was done during the meeting to determine which particular varieties were considered comparatively more superior and more probable to be adopted by the farmers.

Results and discussions

Pre-planting seed selection criteria. The pre-planting seed selection results show that Pan 67 Hybrid (coded MV_6) was most preferred by the farmers who chose it as their first choice (Table 2). This variety has good physical traits that appeal to most farmers. This was closely followed by Longe 4 (MV_4). Although Longe 2 Hybrid (L2H), coded MV_2, has the second highest frequency in the first choice ranking, it was least preferred overall, with most farmers (70%) taking it as their last choice.

Table 2. Varieties selected first, second and/or last choice (N=20)

Varieties selected	First choice	Second choice	Last choice
	%	%	%
MV_6	60	20	10
MV_2	20	0	70
MV_4	10	50	20
MV_7	10	10	0
MV_5	0	15	0
MV_1	0	5	0

Table 1. Phenotypic (physical) descriptions of the six improved maize seed varieties used in the study.

Variety	Colour	Size	Shape	Texture
MV_1 (Longe 1)	White	Medium	Dented	Hard
MV_2 (L2H)	Light brown	Small	Slightly round Flinty	Compact and very hard
MV_4 (Longe 4)	Red	Large	Broad and thin Semi dent	Soft and floury
MV_5 (Longe 5)	Bluish	Medium	Semi flint	Hard
MV_6 (Pan 67)	Red	Large	Broad and thick Dented	Soft and floury
MV_7 (SeedC0 407)	Green	Medium	Semi flint	Hard

Farmers use a combination of many but similar criteria in selecting the maize varieties they grow. The main criteria farmers apply in choosing maize varieties and the extent of contribution of each criterion are shown in Table 3. Large seed grain size is the prime factor most of the farmers considered in making decision on which seed variety to choose first. This is evident by high (65%) response by the farmers as being the major criterion for choosing Pan 67 (MV_6) and Longe 4 (MV_4) varieties combined.

The results, however, show that a particular trait considered an important criterion for selecting a given seed variety by one farmer may be considered less important by another farmer. For instance, whereas 55% of the farmers considered MV_6 their first choice on the basis of its large seed size, 10% considered the same seed variety (MV_6) their last for the same reason, that is, its large seed size. The same scenario applies to MV_2, which was selected first choice for its small seed grain size by 10% of the farmers but was considered last choice for the same reason (small seed size) by majority (65%) of the farmers.

Field performance evaluation criteria. The farmers considered a number of criteria in evaluating the performance of the different maize varieties in the field right from germination to harvest time (Table 4). The most important criteria across many varieties were early maturity, high yield, drought tolerance and tolerance to field pests and diseases. Early maturity was considered an important criterion for three main reasons. Early maturity varieties allow farmers to prepare land in order to plant the crop twice a year to fit the bimodal rainfall pattern. Other reasons are that early maturity allows the crop to escape drought and ensure early and quick provision of cash and food to the households to alleviate hunger.

Most farmers were divided as to whether high yield, drought tolerance or tolerance to field pests and diseases was the most important criteria. However, after some lengthy discussions, they agreed that even if a variety has a high potential yield and does not escape or tolerate drought, field pests and diseases, no yield could be realized, as such drought, field pests and diseases tolerance were considered the most important criteria.

Post harvest maize variety selection criteria. The farmers' post harvest maize variety selection criteria varied from one variety to another (Table 5). Sweet taste and resistance to storage pests are the two main criteria that cut across all the varieties. Resistance to storage pests was considered an important for maize variety selection because maize is a staple food crop in this part of the country and it is eaten throughout the year mainly as a paste made from the flour called posho. Therefore, grains longevity while in storage free from pests is often very

Table 3. Primary criteria for selecting some varieties first, second and/or last choice (N=20).

First choice			Second choice			Last choice		
Variety	Criteria	%	Variety	Criteria	%	Variety	Criteria	%
MV_2	Hard seed texture	10	MV_6	Large seed grains	15	MV_2	Seed too small	65
	Small seed size	10		Seed wholeness	05		Seed too hard	05
MV_4	Large seed size	10	MV_4	Large seed grains	30	MV_4	Lightness of seed grains	20
				Soft seed grains	20			
MV_6	Heavy grains weight	05	MV_7 MV_5	Seed uniformity	10	MV_6	Seed too large	10
	Large seed size	55		Seed wholeness	10			
				Seed uniformity	05	-	-	-
MV_7	Heavy grain weight	10	MV_1	Small seed grains	05	-	-	-

Table 4. Main field performance evaluation criteria for maize variety selection (N=20).

Desirable traits	Improved maize variety					
	MV_1 (Longe 1)	MV_2 (L2H)	MV_4 (Longe 4)	MV_5 (Longe 5)	MV_6 (Pan 67)	MV_7 (SeedC0407)
High yield	-	73	30	60	80	85
Early maturity	40	-	100	50	50	80
Drought tolerant	40	85	25	55	30	40
Tolerance to field pests and diseases	45	80	-	70	40	55
Tolerance to weeds	20	45	30	40	-	-
Good germination	-	68	-	-	63	75
Good/tight husk cover	30	53	-	-	35	-

The figures are percentage responses.

important. Besides, maize variety which stores longer without much quantity and quality losses are deemed more desirable for their marketing values.

Taste was considered important criterion because most farmers in this part of the country are subsistence. They grow maize mainly for farm household consumption. No farmer was willing to grow varieties for hie/her own home consumption if the cobs (raw or roasted) and the paste are not tasty. Large cobs and grain size was also highly preferred especially for MV_6 (Pan 67) and MV_4 (Longe 4) varieties. The belief is that maize grains from larger cobs produce high yields in subsequent generation.

Final group evaluation. The final group preference ranking exercise conducted during the project wrap-up meeting (Table 6) shows that that Longe 2 Hybrid (MV_2) which was apparently rejected initially in the pre-planting grain selection phase turned out to be the overall most preferred variety followed by Pan 67 (MV_6) which had been the most preferred at the beginning of the study (pre-planting grain selection phase). The change of preference in favour of Longe 2 Hybrid is attributed to its many desirable genotypic traits especially high yielding ability, drought tolerance, resistance against field and storage pests and diseases, relative to the other varieties despite its major limitations of having relatively small grain size and long maturity period.

The fact that Pan 67 (MV_6) became the second most preferred variety at the end of the season (final group evaluation) despite its also high yield potential, larger grain size as well as early maturity over Longe 2 Hybrid, suggest probably that farmers are sometimes reluctant to adopt some good varieties either due to inadequate knowledge or lack of extension advice. It is important therefore to note that farmers have diverse perceptions and complex combinations of criteria they use in selecting the maize varieties they grow. Incorporation of their preferences in selection of maize varieties in breeding process would increase likelihood of adoption of the varieties. Whereas maize breeding cannot incorporate all the desired attributes, the key attributes should be included in particular varieties and many varieties should be bred focusing the demands of different groups of farmers.

Conclusions and recommendations

There is no universally single most important criterion that farmers of Nebbi sub-county in Nebbi district use to

Table 5. Post harvest maize variety selection criteria (N=20).

Criteria for preference	Improved maize variety					
	MV_1 (Longe 1)	MV_2 (L2H)	MV_4 (Longe 4)	MV_5 (Longe 5)	MV_6 (Pan 67)	MV_7 (SeedC0407)
Resistance to storage pests	40	85	60	50	65	55
Sweet taste	20	70	30	55	45	40
Large cobs and grain size	20	-	55	-	80	-
Kernels shell easily	-	20	70	-	40	45
Liked and sell faster in the market	-	45	55	-	90	-
Boils faster with little firewood	-	40	45	-	20	-
Yield more flour	-	-	-	-	20	-

The figures are percentage responses.

Table 6. Final group preference ranking of improved maize varieties (N=20).

Desirable traits	Improved maize variety					
	MV_1	MV_2	MV_4	MV_5	MV_6	MV_7
High yield	1	4	2	3	5	6
Early maturity	2	1	6	4	3	5
Drought tolerant	4	6	1	5	2	3
Tolerance to field pests and diseases	3	6	1	5	2	3
Resistance to storage pests	1	6	4	2	5	3
Large cobs and grain size	2	1	5	4	6	3
Sweet taste	1	6	2	5	4	3
Ease of shelling	1	3	6	2	4	5
Marketability	1	2	5	4	6	3
Tolerance to weeds	4	6	3	5	1	2
Good germination	1	5	2	3	4	6
Good/tight husk cover	4	6	2	1	5	3
Total score	25	52	39	43	47	45
Rank	6	1	5	4	2	3

Figures under each use variety are the scores given to it by the group response. Score 6 indicates highest preference while score 1 indicates lowest preference.

select a given maize variety to plant. A mix of criteria is often considered. Initial acceptance or rejection of a given a maize variety is greatly influenced by the phenotypic characteristics of its seeds especially if the variety has not been planted before. Other criterion however includes high yield potential, early maturity, tastes, grain size, and tolerance to drought, pests and diseases. The evaluation criteria also depended on new challenges and opportunities encountered by farmers throughout the maize production cycle.

There is need for commercial seed producers to always ensure that new seed varieties released on market are of normal/average grain size to avoid potentially best performing crop varieties being rejected by farmers before even proving their general performance as was the case with Longe 2 Hybrid (MV2). There is also need for researchers and extension workers to refocus their technology transfer goal to adaptation rather than adoption of new technologies by appreciating and accommodating farmers' perspective of doing things and establishing strong rapport with them as well as integrating their indigenous knowledge at every stage of technology development and transfer.

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