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Participatory variety selection to enhance cowpea variety development and selection in northern region of Uganda

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Abstract

Participatory variety selection trials involving farmers in northern Uganda were conducted in order to assess and select cowpea lines with desirable attributes and tolerance to virus infection. The trials were set up on-farm in farmers' field in the districts of Apac, Lira and Pader in two seasons of 2009A and 2009B. In 2009A, with involvement of farmers, 36 cowpea lines and one local check were evaluated and selected for desirable attributes. This resulted in selection of thirteen cowpea lines that were further evaluated with one local check in 2009B season following a randomised complete block design. In this participatory approach, farmers used different criteria to assess cowpea linesat the vegetative and maturity crop growth stages. Major selection criteria included the leaf appearance, leaf texture, leaf and grain taste, yield potential, pod and seed size. In the three districts farmers provided valuable knowledge in identifying the lines of preference and therefore, indicating their competence in assessing and selecting the cowpea lines. Farmers preferred the high yielding, big pod and seed sizes, virus tolerant and tasty lines. Overall, the results showed that farmers had knowledge to make decision of the preferred lines and this resulted in selection of eight more superior cowpea lines compared to the ones currently grown by farmers. The study revealed that using participatory approach also shortened the process of identifying the lines because farmers were able to quickly select the lines with traits they preferred.

Key words: Disease infection, participatory approach, preference

Introduction

Cowpea (*Vigna unguiculata* L. Walp.) is an important grain legume and contributes to a substantial amount of dietary protein for low-income rural and urban populations in Uganda (Orawu and Obuo, 2008). It is cultivated for home consumption as well as for cash in Uganda. The crop is of critical importance to rural poor small-scale farmers in Uganda as its leaves provide a source of vegetable that helps to offset early season famine (Isubikalu*et al*., 2000). In spite of its significance, the mean yield of cowpea in Uganda decreased to less than 400 kg ha^{-1} (Adipala *et al*., 1997). The low mean yields have been due to several factors, but most importantly are degeneration of the traditional cultivars and susceptibility to insect pests and diseases (Adipala *et al*., 1997; Orawu and Obuo, 2008). As a result of continuous cultivation of the traditional cultivars, the diseases especially, have become persistent and spread from season to season, thus making the crop less productive in many areas cultivated.

Studies have shown that the process of adoption of new improved varieties tended to be low in areas where there was limited farmer involvement in the research process (Tripp, 1982; Maurya *et al*., 1988). The approach to development tended not to analyse and understand farmers' real needs (Hagmann *et al*., 1999). As result of the changes in the attitudes of farmers, government and non-government institutions are increasingly becoming aware of the need to move away from giving instructions towards more participatory approach which support communities in their capacity to set and fulfil their own development goals (Hagmann*et al*., 1999). The study of Abebe *et al*. (2005) on drought tolerant maize showed that involving farmers in researchwere able to select for new and promising varieties for their localities based on their preferences. In related study, Nkongolo *et al*. (2008) strongly observed that the introduction of a participatory approach to agricultural research using farmers enabled the selection of sorghum landraces that out-performed breeder developed lines. The close cooperation between research scientists and farmers in evaluating the varieties and establishing breeding goals are strategies of participatory research (Nkongolo *et al*., 2008). Farmer participation in the breeding of crop varieties for low-resource farmers is necessary to help ensure acceptance and eventual adoption (Franzel *et al*., 1995; Gyawali *et al*., 2007). Chambers (1992) indicated that participatory approach, can promote dialogue between research scientists and village farming communities. The valuable insights of breeders in developing a product/variety could be integrated with the indigenous knowledge of farmers (Sperling *et al*., 1993). This is critical when determining which traits are valued or preferred by farmers. The breeders sometimes discard many crosses during the selection process because of traits considered undesirable; however, these traits may actually be of interest to farmers (Abebe *et al*., 2005). Participation of farmers is being advocated by many researchers and development partners as this promotes acceptance and adoption of technology, thus making them to be part of the research and development process (Maurya *et al*., 1988; Prain *et al*., 1992; Franzel *et al*., 1995; Witcombe *et al*., 1996). The participatory approach improves acceptance of improved technology and enhances farmers' knowledge, and enables indigenous knowledge and innovations to be integrated in the research. Farmers are given a wide range of new cultivars to assess and select in their established fields. Participatory variety selection is considered as a friendly approach in disseminating new improved varieties to the communities (Witcombe *et al*., 2003; Ortiz-Ferrara *et al*., 2007; Thapa *et al*., 2009). Therefore, the objective of this research was to assess and select advanced cowpea varieties with preferred attributes and tolerance to disease infection using farmer participatory variety selection approach.

Materials and methods

Trial establishment and management

Thirty six improved cowpea linesand one local type from the breeding programme at National Semi-Arid Resources Research Institute (Orawu and Obuo, 2008), were proceeded for evaluation on-farm sites in the first rainy season of 2009A in three production districts of Apac, Lira and Pader in northern region of Uganda. Trials were planted in a

randomised complete block design on three farmers' fields where each farmer's field was used as replicate in each of the three districts. The experimental land size of each farmer was 27 m x 13 m with a plot size of 6 m x 3 m. The spacing between rows was 60 cm and within rows was 30 cm. The planting was done by farmers under project team guidance. The trials were managed by host farmers and occasionally agricultural extension officers/NAADs coordinators monitored the progress of the trials in the respective districts.

Participatory Variety Selection (PVS)

Farmers evaluated and selected the cowpea linesat vegetative and maturity growth stages of the crop during the first rainy season of 2009A based on the selection criteria agreed upon by farmers. In the first rainy season of 2009A, because of the large numbers (36 cowpea lines) that were introduced on-farm, farmers assessed and selected the lines based on leaf appearance, leaf texture, pod size, seed size and yield potential only. This was intended to reduce the large number of cowpea lines to manageable number for easy tasting of cowpea lines for leaves and grains when cooked in the next season of evaluation. Based on farmers' selection, 13 cowpea lineswere selected in the first season of 2009A and these were further evaluated and selected in the subsequent second rainy season of 2009B. The same methodology, sites, districts and selection criteria used in the previous season were followed to evaluate and select the 13 improved cowpea lines. The tasting of cooked leaves and grains of the selected cowpea lines by farmers were considered in the season of 2009B.

The PVS was applied at two different crop growth stages namely vegetative (i.e. when crop was still at its tender growth stages) and maturity (i.e. when the crop was ready for harvest). In each district, participating farmers from selected parishes (the representative farmers involving both men and women from each parish) were invited to one of the host farmers to carry out the exercise of assessment and selection of cowpea lines. During the PVS exercises at either vegetative or maturity stages, participating farmers from each district were put into two categories i.e. as group and individual farmers. At different periods of the crop growth stages, the group farmers tasted the cooked leaves and grains of each variety and gave their own opinion whether the variety was good or not. Similarly, ten individual farmers were selected from among the participants and tasted the cooked leaves and grains of each cowpea line. They also gave their own opinion about the cowpea line whether good or not (based on individual assessment). This was intended to give opportunity to the two categories (i.e. individual and group) a chance to make assessment and selection of the cowpea linesthat were of best preference based on the selection criteria agreed by the farmers themselves. The tasting of the cowpea linesfor leaves and grains happened at different times of the growth stages of the crop.

Data collection and analysis

At the vegetative stage, the following selection criteria were used: leaf appearance (i.e. whether leaves were clean/health or slightly health/clean or very infected by diseases, leaf texture (i.e. whether plant leaves were tender/soft or slightly soft or slightly rough or very rough) and leaf taste (i.e. whether cooked leaves were very nice/tasty, slightly nice/tasty and

not nice/tasty). While at maturity stage, farmers considered pod and seed size (i.e. whether small or medium or big) and yield performance (i.e. farmers conducted visual observation of the performance of each cowpea linein the field per plot).

Scores were used by the farmers to judge the suitability of particular cowpea lineboth at vegetative and maturity stages and this was done through mutual agreement (Table 1). The information agreed upon was recorded in the data form by the farmers themselves provided by the project team. After assessing all the attributes of each cowpea line, farmers decided as group either they liked or disliked the cowpea linebased on their overall analyses of the attributes they preferred. Farmers on individual basis also provided their opinion on the cowpea lineand this was computed into scores. The cowpea linesthat attained higher scores were the ones that the farmers preferred especially for the attributes such as leaf appearance, leaf texture, leaf taste, grain taste and yield potential, while for pod and seed sizes were scored differently and therefore, the cowpea lines with low scores were preferred (Table 1).

All data recorded by farmers in the different districts were synthesized and compiled for analysis using Genstat package fifteenth edition. The analysis of variance and means were separated using the Least Significant Differences (LSD) at 0.05 probability level.

Results

Gender composition in assessment of cowpea linesin 2009A and 2009B seasons

At the vegetative stage, a total of 96 farmers and 129 farmers were involved in the assessment of cowpea lines in 2009A and 2009B seasons, respectively (Table 2). At maturity stage, 63 farmers and 106 farmers participated in the selection of cowpea lines in 2009A and 2009B seasons, respectively. In 2009A season, the proportion of men represented 49% and women 51% during vegetative

Table 1. Farmers' selection criteria of the cowpea linesat vegetative and maturity growth stages

Cowpea attributes	Score range	Description
Leaf appearance	1-4	1 = Severe disease and death of plants, 2 = diseased plants, 3 = slightly diseased plants and 4 = health/clean plants without infection/symptoms
Leaf texture	1-4	1= very rough leaves, 2= slightly rough leaves, 3= slightly smooth leaves and 4= very smooth leaves
Yield potential	1-4	1= poor yield, 2= medium yield, 3= good yield and 4= very good yield
Pod size	1-3	1 = big, 2 = medium, 3 = small
Seed size	1-3	1 = big, 2 = medium, 3 = small
Preference	1-3	1=don't like it, 2=slightly like it, 3=like it very much

Table 2. Number of men and women farmers who participated in assessment and selection of 36 cowpea lines in 2009A and 13 cowpea lines in 2009B seasons with one local check at two different growth stages in three districts

District	Vegetative stage assessment				Maturity stage assessment			
	Gender (2009A)		Gender (2009B)		Gender (2009A)		Gender (2009B)	
	Men	Women	Men	Women	Men	Women	Men	Women
Apac	10	13	4	20	9	8	14	24
Lira	12	22	15	45	10	16	5	12
Pader	25	14	18	27	8	12	27	24
Total	47(49)*	49(51)*	37(28.7)*	92(71.3)*	27(42.9)*	36(57.1)*	46(43.4)*	60(56.6)*

*Figures in brackets indicate the percentages

stage assessment, while at maturity stage assessment, men were 42.9% and women were 57.1% (Table 2). In 2009B season, men represented 28.7% and women were 71.3% at the vegetative stage assessment, while at maturity stage assessment, men were 43.4% and women were 56.6%. The results showed more women who participated in the selection of cowpea lines than their male counterparts, indicating that most men spend the valuable time in carrying out small businesses in the urban centres (farmers' opinion). This meant that women play a major role of taking charge of field related activities and therefore, women participate a lot in the selection of the cowpea lines at two different growth stages.

Farmers'assessment of 36 cowpea lines and one local checkat vegetative stage in 2009A season in the districts of Apac, Lira and Pader

Farmers start to harvest tender leaves of cowpea for consumption when the cowpea seedlings are two weeks old and this continues up to six weeks (NaSARRI, 2008). Thereafter, picking of leaves stops because the leaves start to mature and harden (NaSARRI, 2008). In view of this, farmers in different districts of the region assessed the cowpea lines when the plants were within the required picking period for leaves.

During 2009A season, 36 cowpea linesand one local check (*Ebelat*) were evaluated and selected on-farms by farmers. The farmers observed disease symptoms on the cowpea lineson the basis of leaf appearance to determine whether they were disease infected or not (Table 3). In the three districts, farmers assessed and identified four cowpea lineswith resistance todisease infection and these included MU-93 x Blackcowpea-6-8, MU-93 x Ecirikukwai-14-8, MU-93 x

Table 3. Farmers' assessment and selection of 36 cowpea linesand one local check using different selection criteria at vegetative stage in Apac, Lira and Pader districts during 2009A season

Lines	Average scores for different selection criteria						Farmers' overall preference
	Leaf appearance			Leaf texture			
	Apac	Lira	Pader	Apac	Lira	Pader	
IT82D-516-2 x Ebelat-13-10	2.5	2.8	2.5	4.0	3.5	4.0	2.3
IT82D-889 x Blackcowpea-1-14	3.0	2.3	3.5	2.5	1.5	2.3	1.5
MU-93 x Ecirikukwai-14-5	4.0	3.0	3.3	3.0	3.5	3.8	2.4
SECOW-2W x Blackcowpea-15-1	3.5	2.0	2.5	2.5	3.3	2.3	1.4
MU-93 x Ecirikukwai-14-11	4.0	3.0	3.8	2.5	3.3	3.3	2.7
SECOW-2W x Blackcowpea-15-2	3.5	2.8	2.8	1.5	2.5	3.3	1.6
IT82D-889 x Blackcowpea-1-9	2.5	2.8	3.0	4.0	2.5	2.5	1.6
IT82D-889 x Blackcowpea-1-2	3.0	3.0	1.8	2.5	3.0	1.5	2.3
IT82D-516-2 x Blackcowpea-4-13	3.0	3.8	3.3	4.0	3.5	1.3	1.9
SECOW-2W x Ecirikukwai-10-4	4.0	3.5	3.3	3.0	3.8	4.0	2.0
MU-93 x Blackcowpea-6-11	3.0	4.0	2.5	2.5	2.8	2.8	2.1
MU-93 x Ecirikukwai-14-8	4.0	4.0	3.8	3.0	3.0	3.0	2.3
MU-93 x Blackcowpea-6-3	4.0	4.0	3.5	4.0	3.5	3.0	2.0
MU-93 x Ecirikukwai-14-15	4.0	4.0	3.0	4.0	3.8	3.5	2.0
IT82D-516-2 x Ebelat-13-9	3.5	3.3	3.3	3.0	3.0	2.8	2.0
IT85F-2841 x Ecirikukwai-7-6	4.0	2.0	3.5	4.0	3.0	4.0	2.3
IT85F-2841 x Ecirikukwai-7-7	3.5	4.0	3.3	2.5	3.5	3.0	2.5
MU-93 x Blackcowpea-6-8	4.0	4.0	4.0	2.0	3.5	4.0	2.3
IT82D-516-2 x Ecirikukwai-8-6	3.5	4.0	2.5	2.5	3.3	2.5	2.3
IT82D-516-2 x Ebelat-13-6	2.0	2.3	3.3	3.0	3.0	3.5	2.6
IT82D-516-2 x Blackcowpea-4-9	2.0	2.5	3.3	2.5	2.5	3.3	1.9
SECOW-2W x Ecirikukwai-10-6	2.5	3.0	3.0	3.0	3.8	4.0	2.4
SECOW-2W x Ecirikukwai-10-9	3.5	3.3	3.0	3.0	4.0	4.0	2.5
IT82D-516-2 x Blackcowpea-4-7	2.5	2.3	2.5	4.0	2.8	3.0	1.8
SECOW-2W x Blackcowpea-15-3	2.5	2.0	2.0	2.5	2.0	2.5	1.6
IT82D-516-2 x Ebelat-13-11	1.0	3.8	2.3	3.0	2.8	3.3	2.6
SECOW-2W x Ecirikukwai-10-7	2.5	2.5	3.3	2.0	3.5	4.0	2.3
IT82D-516-2 x Ecirikukwai-8-1	2.5	3.3	3.0	2.5	3.8	3.3	1.8
MU-93 x Blackcowpea-6-10	4.0	3.5	3.5	3.5	2.0	2.3	1.7
SECOW-2W x Blackcowpea-15-9	3.0	3.0	2.3	3.0	2.3	1.8	1.6
IT82D-516-2 x Blackcowpea-4-14	3.0	3.5	2.0	3.5	3.8	3.3	2.0
IT85F-2841 x Ecirikukwai-7-8	4.0	2.3	3.8	4.0	2.8	4.0	2.4
IT82D-516-2 x Ecirikukwai-8-4	2.5	4.0	3.5	2.5	3.0	3.0	2.3
IT82D-516-2 x Ecirikukwai-8-2	2.5	3.3	2.0	3.5	3.3	2.0	1.6
IT82D-889 x Blackcowpea-1-8	3.5	2.8	2.8	2.5	1.8	2.8	1.8
IT85F-2841 x Ecirikukwai-7-1	4.0	3.8	3.3	2.5	3.8	3.8	2.4
Local check (*Ebelat*)	2.5	3.3	3.0	3.0	3.3	3.3	2.1
Overall mean	3.1	3.2	3.0	3.0	3.1	3.1	2.1
LSD (0.05)		1.3			1.1		1.0
CV%		20.7			17.3		21.1

Leaf appearance scores: 1= very wrinkled/mosaic leaf, 2= leaf wrinkled/mosaic leaf, 3 = slightly health/clean, 4 = health/clean leaf. Leaf texture scores: 1 = very rough leaf, 2 = slightly rough, 3 = slightly smooth leaf, 4 = very smooth leaf. Yield potential scores: 1 =poor, 2=medium, 3=good, 4=very good. Farmers' preference scores: 1 = don't like it, 2 = slightly like it, 3 = like it very much

Blackcowpea-6-3 and MU-93 x Ecirikukwai-14-15,while SECOW-2W x Blackcowpea-15-3 was the most susceptible to disease infection.

The leaf texture was one of the important criteria of selecting the cowpea linesby farmers with regards to leaf smoothness and tenderness.The results indicated that 13 cowpea lines including the local check had smooth and tender leaves with scores equivalent to 3.0 and above the overall mean score across the three districts (Table 3). The cowpea lines selected with smooth and tender leaves were IT82D-516-2 x Ebelat-13-10 and MU-93 x Ecirikukwai-14-15, while the cowpea line with rough leaves was IT82D-889 x Blackcowpea-1-14.

On the analysis of results, the farmers' overall preference revealed that most cowpea lines had their mean scores equivalent to and above the overall mean score (Table 3). Observation was made oneighteen varieties which had low scores below the overall mean score, indicating that they were not preferred by farmers. The cowpea lines with scores of 2.3 and abovewere considered good by farmers, thus resulting in the selection of 13 cowpea lines across the three districts at the vegetative stage. The most preferred varieties with the highest mean scores were MU-93 x Ecirikukwai-14-11, IT82D-516-2 x Ebelat-13-11, IT82D-516-2 x Ebelat-13-6 and SECOW-2W x Ecirikukwai-10-9 (Table 3).

Farmers' assessment of 36 cowpea lines and one local check at maturity stage in 2009A season in the districts of Apac, Lira and Pader

The assessment of cowpea lines by farmers at maturity stage indicated that consideration was based on three agronomic attributes (pod size, seed size and yield potential) in all the three districts of Apac, Lira and Pader during 2009A season. Observation on the different cowpea lines was made by farmers in the on-farm fields and assessed them according to the preferences. The results on pod size indicated that farmers preferred cowpea linesIT82D-889 x Blackcowpea-1-14 and IT82D-889 x Blackcowpea-1-2 with big pod sizes with mean scores equivalent to and below the overall mean score (Table 4). However, the cowpea line SECOW-2W x Ecirikukwai-10-9 and local check had the smallest pod sizes with mean score of 3.0 above the overall mean score. The rest of the cowpea lines exhibited moderate pod sizes with scores close to the overall mean score with the exception of the cowpea lines SECOW-2W x Ecirikukwai-10-4, MU-93 x Ecirikukwai-14-8, IT82D-516-2 x Blackcowpea-4-9, SECOW-2W x Ecirikukwai-10-6 and SECOW-2W x Ecirikukwai-10-7 which had varying pod sizes across the three districts (Table 4).The cowpea lines IT82D-889 x Blackcowpea-1-14 and IT82D-889 x Blackcowpea-1-2 had relatively bigger seed sizes across the three districts. However, the cowpea line SECOW-2W x Ecirikukwai-10-9 had the smallest seed size with the highest mean score compared to the rest of the cowpea lines. Using yield potential, nine cowpea lines performed better than the local check and these included the following; IT82D-889 x Blackcowpea-1-8, SECOW-2W x Blackcowpea-15-9, MU-93 x Blackcowpea-6-10, IT82D-889 x Blackcowpea-1-2, IT82D-516-2 x Ecirikukwai-8-4, IT82D-889 x Blackcowpea-1-14, MU-93 x Blackcowpea-6-11, IT82D-516-2 x Ecirikukwai-8-6 and IT82D-516-2 x Ebelat-13-10. These had mean scores

Table 4. Farmers' assessment and selection of 36 cowpea linesand one local check using different selection criteria at maturity stage in Apac, Lira and Pader districts during 2009A season

Lines	Average scores for different selection criteria									Farmers' overall preference
	Pod size			Seed size			Yield potential			
	Apac	Lira	Pader	Apac	Lira	Pader	Apac	Lira	Pader	
IT82D-516-2 x Ebelat-13-10	2.0	2.5	2.8	2.0	2.5	2.3	2.8	3.5	3.0	2.7
IT82D-889 x Blackcowpea-1-14	1.0	1.0	1.3	1.5	1.0	1.0	3.3	3.5	3.0	2.1
MU-93 x Ecirikukwai-14-5	2.0	2.0	2.5	2.8	2.0	2.5	2.8	3.0	3.0	2.4
SECOW-2W x Blackcowpea-15-1	2.5	2.0	2.5	2.3	1.5	2.8	2.8	2.5	4.0	1.8
MU-93 x Ecirikukwai-14-11	2.3	2.5	2.3	2.5	2.5	2.8	2.3	4.0	2.0	2.5
SECOW-2W x Blackcowpea-15-2	2.5	2.0	2.5	2.3	2.0	2.8	2.3	3.0	4.0	1.9
IT82D-889 x Blackcowpea-1-9	2.5	3.0	3.0	2.5	2.0	2.5	2.3	2.5	2.0	1.8
IT82D-889 x Blackcowpea-1-2	1.0	1.0	1.3	2.0	1.0	1.3	3.3	4.0	4.0	2.4
IT82D-516-2 x Blackcowpea-4-13	2.0	1.5	2.5	2.0	1.5	2.8	1.5	2.5	2.0	1.6
SECOW-2W x Ecirikukwai-10-4	1.5	1.5	2.8	2.0	1.5	2.3	3.3	2.5	1.0	2.1
MU-93 x Blackcowpea-6-11	2.5	2.0	2.0	2.3	2.0	2.0	3.0	3.5	3.0	1.8
MU-93 x Ecirikukwai-14-8	2.0	2.0	1.5	2.5	2.0	1.3	2.8	3.0	2.0	2.0
MU-93 x Blackcowpea-6-3	3.0	3.0	2.0	2.5	3.0	2.0	4.0	4.0	2.0	2.2
MU-93 x Ecirikukwai-14-15	2.0	2.5	2.3	2.8	2.5	2.3	2.5	3.5	2.0	2.6
IT82D-516-2 x Ebelat-13-9	2.0	2.0	2.5	2.3	2.0	2.5	2.3	2.5	3.0	2.1
IT85F-2841 x Ecirikukwai-7-6	2.5	2.5	2.0	2.5	2.5	2.0	2.8	2.5	2.0	2.2
IT85F-2841 x Ecirikukwai-7-7	3.0	2.5	2.5	2.5	2.5	2.5	2.5	3.0	3.0	2.4
MU-93 x Blackcowpea-6-8	3.0	2.0	2.0	2.5	1.5	2.0	3.3	3.5	2.0	2.7
IT82D-516-2 x Ecirikukwai-8-6	3.0	2.5	2.5	2.3	2.5	2.3	2.8	3.5	3.0	1.8
IT82D-516-2 x Ebelat-13-6	2.0	2.0	2.5	2.0	2.5	1.5	2.8	3.0	1.0	2.3
IT82D-516-2 x Blackcowpea-4-9	2.0	1.5	2.3	2.5	1.5	2.3	3.5	2.5	3.0	2.3
SECOW-2W x Ecirikukwai-10-6	1.0	1.5	2.5	2.0	2.0	2.5	2.8	3.0	1.0	2.9
SECOW-2W x Ecirikukwai-10-9	3.0	3.0	3.0	3.0	3.0	3.0	2.0	2.5	1.0	2.6
IT82D-516-2 x Blackcowpea-4-7	2.5	2.0	2.3	2.5	1.5	2.8	2.5	2.5	1.0	2.3

Table 4. Contd.

Lines	Average scores for different selection criteria									Farmers' overall preference
	Pod size			Seed size			Yield potential			
	Apac	Lira	Pader	Apac	Lira	Pader	Apac	Lira	Pader	
SECOW-2W x Blackcowpea-15-3	2.5	2.0	2.5	2.3	2.5	2.3	3.0	3.0	3.0	2.3
IT82D-516-2 x Ebelat-13-11	2.0	2.0	2.5	2.3	2.0	3.0	2.3	3.0	1.0	2.8
SECOW-2W x Ecirikukwai-10-7	2.0	2.0	1.8	1.8	2.0	1.0	2.5	3.0	1.0	2.3
IT82D-516-2 x Ecirikukwai-8-1	3.0	2.5	3.0	2.3	2.5	2.8	2.3	3.0	4.0	1.7
MU-93 x Blackcowpea-6-10	2.5	2.0	2.5	2.3	2.0	2.5	3.5	3.5	4.0	1.7
SECOW-2W x Blackcowpea-15-9	2.5	2.5	2.8	2.0	2.0	2.3	4.0	4.0	3.0	1.9
IT82D-516-2 x Blackcowpea-4-14	2.5	2.0	2.5	2.0	1.5	2.3	2.3	3.5	2.0	1.9
IT85F-2841 x Ecirikukwai-7-8	2.5	2.5	2.3	2.5	2.5	2.0	3.0	2.5	1.0	2.6
IT82D-516-2 x Ecirikukwai-8-4	3.0	2.5	3.0	2.8	2.5	2.0	3.3	4.0	3.0	2.2
IT82D-516-2 x Ecirikukwai-8-2	3.0	2.5	2.0	2.8	2.5	2.0	1.5	3.8	1.0	1.5
IT82D-889 x Blackcowpea-1-8	3.0	3.0	2.8	2.3	2.0	2.8	4.0	4.0	3.0	2.1
IT85F-2841 x Ecirikukwai-7-1	2.5	3.0	2.5	2.8	2.5	2.3	3.3	3.0	1.0	2.6
Local check (*Ebelat*)	3.0	3.0	3.0	3.0	3.0	2.8	2.5	4.0	1.0	2.3
Overall mean	2.3	2.2	2.4	2.4	2.1	2.3	2.8	3.2	2.3	2.2
LSD (0.05)		0.6			0.9			1.2		1.0
CV%		14.2			18.9			16.4		23.1

Pod size scores: 1 = big, 2 = medium, 3 = small; **Seed size scores**: 1 = big, 2 = medium, 3 = small; **Farmers' preference scores**: 1 = don't like it, 2 = slightly like it, 3 = like it very much

equivalent to and above the overall mean scores (2.8, 3.2 and 2.3), an indication of good yield potential across the three districts (Table 4). The cowpea lines IT82D-889 x Blackcowpea-1-8 and SECOW-2W x Blackcowpea-15-9gave the highest mean yield potentials (4.0, 4.0 and 3.0) across the three districts. While cowpea linesIT82D-516-2 x Blackcowpea-4-13, SECOW-2W x Ecirikukwai-10-9 and IT82D-516-2 x Ecirikukwai-8-2 were assessed by farmers as poor yieldersacross the three districts (Table 4).

Based on the selection criteria used by farmers for preference of the cowpea lines, the results revealed that 20 cowpea lines and one local check attained the mean scores equivalent to and above the overall mean score (Table 4). The 12 cowpea lines which attained mean scores of 2.4 and above were strongly preferred by farmers. The most preferred varieties by farmers were SECOW-2W x Ecirikukwai-10-6, IT82D-516-2 x Ebelat-13-11, IT82D-516-2 x Ebelat-13-10, and MU-93 x Blackcowpea-6-8 (Table 4). Consolidating the two results based on the desirable attributes both at vegetative and maturity stages, the results indicated that 13 cowpea lines were preferred and selected by farmers during 2009A season (Tables 3 and 4). The selection of thecowpea linesby farmers formed a strategy to evaluate further in their fields to ascertain their good performance to lead to final selection during 2009B season. The cowpea lines selected and preferred included IT82D-516-2 x Ebelat-13-10, MU-93 x Ecirikukwai-14-5, MU-93 x Ecirikukwai-14-11, IT82D-889 x Blackcowpea-1-2, MU-93 x Ecirikukwai-14-15, IT85F-2841 x Ecirikukwai-7-7, MU-93 x Blackcowpea-6-8, IT82D-516-2 x Ebelat-13-6, SECOW-2W x Ecirikukwai-10-6, SECOW-2W x Ecirikukwai-10-9, IT82D-516-2 x Ebelat-13-11, IT85F-2841 x Ecirikukwai-7-8 and IT85F-2841 x Ecirikukwai-7-1 (Table 4).

Farmers' assessment of 13 cowpea linesand one local check at vegetative stage in 2009B season in the districts of Apac, Lira and Pader

In the districts of Apac, Lira and Pader, farmers assessed the cowpea lines and observed with mild disease symptoms on some cowpea linesat the vegetative stage(Table 5). In the three districts, farmers selected three cowpea lines as being resistant to disease infection. The most resistant cowpea lineswere MU-93 x Blackcowpea-6-8, IT85F-2841 x Ecirikukwai-7-7 and SECOW-2W x Ecirikukwai-10-6 with scores of 4.0 in the three districts. The rest of the cowpea lines were considered slightly resistant (Table 5), while cowpea linesIT82D-516-2 x Ebelat-13-10 and local check (*Ebelat*) were rated low by farmers and it was concluded that they are susceptible to disease infection in the three districts.

The leaf texture is the integral part of the crop which farmers considers as important for consumption as vegetable sauce. It was observed that farmers selected cowpea lineSECOW-2W x Ecirikukwai-10-6 as one with very smooth leaves and with high mean score of4.0 and was considered as good for consumption across the three districts (Table 5). Five cowpea lines were observed with slightly smooth leaves with scores ranged from 3.0 to 4.0 in the three districts. The cowpea line IT82D-889 x Blackcowpea-1-2 was rated by farmers as having very rough leaves while the rest of the cowpea lineshad slightly smooth leaves.

The results of leaf taste done by the groups and individual farmers in different

Table 5. Farmers' assessment and selection of 13 cowpea linesand one local check using different selection criteria at vegetative stage in Apac, Lira and Pader districts during 2009B season

Lines	Average score for different selection criteria												Farmers' overall preference
	Leaf appearance			Leaf texture			Leaf taste (group assessment)			Leaf taste (individual assessment)			
	Apac	Lira	Pader	Apac	Lira	Pader	Apac	Lira	Pader	Apac	Lira	Pader	
IT82D-516-2 x Ebelat-13-10	4.0	2.5	3.0	4.0	3.5	4.0	2.0	3.0	2.0	1.0	2.5	1.5	2.2
MU-93 x Ecirikukwai-14-5	4.0	3.5	3.5	4.0	2.5	2.5	3.0	3.0	1.5	3.0	1.5	1.5	2.3
MU-93 x Ecirikukwai-14-11	4.0	3.5	4.0	2.0	4.0	4.0	1.0	1.5	2.0	2.0	1.0	2.5	1.5
IT82D-889 x Blackcowpea-1-2	3.0	4.0	3.5	1.0	2.0	1.0	1.0	2.0	1.5	1.0	1.5	1.0	1.5
MU-93 x Ecirikukwai-14-15	4.0	3.5	4.0	4.0	3.0	4.0	1.0	2.5	3.0	3.0	2.5	2.0	2.3
IT85F-2841 x Ecirikukwai-7-7	4.0	4.0	4.0	4.0	2.0	3.5	3.0	2.5	1.0	3.0	1.5	1.5	2.2
MU-93 x Blackcowpea-6-8	4.0	4.0	4.0	1.0	2.0	3.0	3.0	3.0	2.0	2.0	3.0	2.0	2.7
IT82D-516-2 x Ebelat-13-6	4.0	2.5	2.0	4.0	4.0	3.5	3.0	1.0	3.0	1.0	1.0	1.5	2.3
SECOW-2W x Ecirikukwai-10-6	4.0	4.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0	3.0	2.5	2.5	2.7
SECOW-2W x Ecirikukwai-10-9	4.0	4.0	3.0	4.0	3.0	4.0	3.0	3.0	3.0	3.0	2.0	3.0	3.0
IT82D-516-2 x Ebelat-13-11	3.0	3.0	4.0	4.0	3.0	3.0	1.0	2.0	1.5	2.0	2.0	2.5	1.5
IT85F-2841 x Ecirikukwai-7-8	3.0	3.5	4.0	4.0	1.5	3.0	3.0	2.0	1.0	3.0	1.5	1.0	2.0
IT85F-2841 x Ecirikukwai-7-1	3.0	3.5	3.0	4.0	2.5	3.0	2.0	2.0	2.0	3.0	2.0	2.0	1.8
Local check (Ebelat)	3.0	2.0	3.0	2.0	3.0	4.0	1.0	2.0	3.0	2.0	1.5	2.0	2.0
Overall mean	3.6	3.4	3.5	3.3	2.9	3.3	2.1	2.3	2.1	2.3	1.9	1.9	2.1
LSD (0.05)	1.7			2.0			1.8			1.5		1.0	
CV%		23.1			26.9			38.4			36.7		41.0

Leaf appearance scores: 1= very wrinkled/mosaic leaf, 2= leaf wrinkled/mosaic leaf, 3 = slightly health/clean, 4 = health/clean leaf. Leaf texture scores: 1 = very rough leaf, 2 = slightly rough, 3 = slightly smooth leaf, 4 = very smooth leaf. Leaf taste scores: 1 = not nice, 2 =slightly nice, 3 = very nice. Farmers' preference scores: 1 = don't like it, 2 = slightly like it, 3 = like it very much

districts of Apac, Lira and Pader are presented in Table 5. The assessment carried out by group farmers showed that two cowpea linesSECOW-2W x Ecirikukwai-10-6 and SECOW-2W x Ecirikukwai-10-9 had very nice or tasty leaves when cooked in the three districts. This was followed by cowpea linesMU-93 x Blackcowpea-6-8 and MU-93 x Ecirikukwai-14-5. Similarly, the assessment carried out by individual farmers showed that the cowpea liesSECOW-2W x Ecirikukwai-10-6 and SECOW-2W x Ecirikukwai-10-9 had the most nice or tasty leaves. This was followed by cowpea linesMU-93 x Ecirikukwai-14-15, MU-93 x Blackcowpea-6-8 and IT85F-2841 x Ecirikukwai-7-1. Generally, the opinions of the two categories of farmers (group and individual farmers) provided similar opinion on the taste of the two cowpea lines SECOW-2W x Ecirikukwai-10-6 and SECOW-2W x Ecirikukwai-10-9 across in the three districts. It was observed that the cowpea lineIT82D-889 x Blackcowpea-1-2 was consistently tasteless as reported by the group and individual farmers.

In general, farmers' preference for cowpea linesbased on the general agronomic attributes at the vegetative stage showed that eight cowpea lineshad their mean scores above the overall mean score indicating they were the most preferred by farmers. These were with the exception of six cowpea lineswhich had the mean scores below the overall mean score (Table 5). The cowpea lineSECOW-2W x Ecirikukwai-10-9 was strongly preferred by farmers and had a score of 3.0. This was followed by MU-93 x Blackcowpea-6-8 and SECOW-2W x Ecirikukwai-10-6 in the three districts. The cowpea linesMU-93 x Ecirikukwai-14-5, MU-93 x Ecirikukwai-14-15 and IT82D-516-2 x Ebelat-13-6 were moderately preferred by farmers. However, the cowpea linesMU-93 x Ecirikukwai-14-11, IT82D-889 x Blackcowpea-1-2 and IT82D-516-2 x Ebelat-13-11 attained scores which were below 2.0 and were not liked by farmers due to their agronomic attributes. Generally, farmers in the three districts considered three cowpea linesSECOW-2W x Ecirikukwai-10-9, MU-93 x Blackcowpea-6-8 and SECOW-2W x Ecirikukwai-10-6 as being suitable for leaf consumption at the vegetative stage.

Farmers' assessment of 13 cowpea linesand one local check at maturity stage in 2009B season in the districts of Apac, Lira and Pader

Results of the different attributes assessed by farmers in the three districts are presented in Table 6. The farmers assessed the cowpea lineIT82D-889 x Blackcowpea-1-2 with relatively big pod size compared to the rest with mean score of 1.0 in the three districts. However, farmers considered cowpea linesSECOW-2W x Ecirikukwai-10-9, IT82D-516-2 x Ebelat-13-11 and SECOW-2W x Ecirikukwai-10-6 with the smallest pod sizes with a mean scores of greater than 2.0 in the three districts (Table 6). It was observed that the rest of the cowpea lines had moderate pod sizes with mean scores ranging from 1.0 to 2.0 in the three districts. The results showed that most cowpea lineshad variable seed sizes based on farmers' assessment in which case, a particular cowpea linehad mean scores either lower or higher than the overall mean scores in the three districts. The cowpea line IT82D-889 x Blackcowpea-1-2 had relatively big seed sizes based on their mean scores in the

three districts. However, the cowpea lineSECOW-2W x Ecirikukwai-10-9 and the local check (Ebelat) had the lowest mean score compared to the rest of the cowpea linesas assessed by farmers.

Based on yield potential, the cowpea lineswhich were mostly preferred by farmers included MU-93 x Blackcowpea-6-8 and IT82D-889 x Blackcowpea-1-2. These were followed by MU-93 x Ecirikukwai-14-11, SECOW-2W x Ecirikukwai-10-9 and IT82D-516-2 x Ebelat-13-11. They had scores above or equivalent to the overall mean score (Table 6), indicating they were good yielders. However, the cowpea linesIT82D-516-2 x Ebelat-13-10 and IT82D-516-2 x Ebelat-13-6 had the lowest mean scores and therefore not good yielders.

Assessment for grain taste using both the group and individual farmers indicated that four cowpea linesnamely IT82D-516-2 x Ebelat-13-10, MU-93 x Ecirikukwai-14-11, SECOW-2W x Ecirikukwai-10-6 including the local check (Ebelat) had a very nice or tasty grains when cooked in the three districts. They were followed by cowpea linesSECOW-2W x Ecirikukwai-10-9, MU-93 x Ecirikukwai-14-15 and IT85F-2841 x Ecirikukwai-7-8. The assessment of the cowpea lines by individual farmers for grain taste showed that most cowpea lineswere moderately tasty, but cowpea lineIT85F-2841 x Ecirikukwai-7-8 had the most tasty grain taste compared to the others. Generally, the opinions from the two different categories of farmers (group and individual assessment) were variable on some cowpea lines; some of them were rated moderate taste, while others were rated low in the three districts.

The preference of cowpea linesbased on all the agronomic attributes assessed at maturity stage showed that five cowpea lineshad their mean scores (1.3, 1.7, 1.8, 2.1 and 2.2) below the overall mean score (2.3)and therefore less preferred by the farmers. Farmers selectedeight cowpea lines and one local checkand gave mean scores equivalent or above the overall mean score and therefore preferred by them (Table 6). The most preferred cowpea linewas MU-93 x Ecirikukwai-14-11 because it contained all the attributes preferred by farmers. This was followed by MU-93 x Ecirikukwai-14-5, IT82D-889 x Blackcowpea-1-2, MU-93 x Blackcowpea-6-8, SECOW-2W x Ecirikukwai-10-9 and local check. While, cowpea lineIT82D-516-2 x Ebelat-13-6 was the least preferred in the three districts. From farmers' assessment of preference, five cowpea lines MU-93 x Ecirikukwai-14-11, MU-93 x Ecirikukwai-14-5, IT82D-889 x Blackcowpea-1-2, MU-93 x Blackcowpea-6-8 and SECOW-2W x Ecirikukwai-10-9 were considered as the best cowpea lines which contained all the desirable agronomic attributes at maturity stage in the three districts.

Discussion

Generally, the research showed that farmers selected the cowpea linesaccording to the different attributes at two different growth stages (vegetative and maturity). These constituted their preferences. Farmers mostly preferred cowpea linesIT85F-2841 x Ecirikukwai-7-8, IT82D-516-2 x Ebelat-13-10 and MU-93 x Ecirikukwai-14-15 at the vegetative stage. These were selected because of good tolerance to disease infection, good leaf taste and good texture. At maturity stage, the selected cowpea lines were MU-93 x Ecirikukwai-14-5, IT82D-889 x Blackcowpea-1-2 and MU-93 x Ecirikukwai-14-11 because of their good

yield potential, good grain taste, reasonably good pod and seed sizes. Farmers also selected cowpea lines which had good attributes at both growth stages and these included MU-93 x Blackcowpea-6-8, SECOW-2W x Ecirikukwai-10-6 and SECOW-2W x Ecirikukwai-10-9.

The study clearly demonstrated that a participatory variety selection approach (PVS), as an aid to farmer involvement in research, enabled in utilising local farmers' knowledge. The approach provided a friendly atmosphere for farmers to engage themselves in assessing and selecting cowpea attributes that were suitable for them to use. This kind of approach showed that farmers have valuable knowledge and can decide for the things they want for their sustainable benefit in crop production. These finding were similar to ones reported by Nabirye *et al.* (2003) during the farmer experimental learning approach, observed that farmers identified the Integrated Pest Management options for cowpea pest control suited for their needs, thus allowing them to be part of the process of technology verification. In related studies by Biggs (1978), Rhoades and Booth (1982) and Kitch*et al.* (1998) acknowledged the idea of involving farmers that they have valuable knowledge and they can do agricultural research on their own. The results of the study observed that more women were involved in assessment and selection of cowpea varieties than their men counterparts who participated at two different crop growth stages. This further suggests that women play a big role in management of field activities constituting of number of crop enterprises. Studies have shown that the gender division of labour is not only related to the work done by men and women but also recognises men and women do different work and hence possess different types of indigenous knowledge (Nkongolo *et al.*, 2008). Providing the farmers with a wide range of choices of cowpea linesgives them an opportunity to make better selection of the preferred lines. This is because the more diverse of the cowpea linesfor good quality attributes, the better the acceptance and adoption of the cowpea linesby the farmers. In this study, eightcowpea lineswere selected by the farmers in the three districts. This makes the breeding process to move much faster to release the cowpea linesin relatively short period of time.

Knowledge on crop attributes that are preferred by farmers is essential when developing improved cowpea varieties (Coulibaly and Lowenberg-DeBoer, 2002). Breeders need to know what characteristics farmers want, such that when an improved variety is availed to them it possesses the preferred traits of interest. Traits of interest to farmers in this study were very significant to them for variety cowpea lineacceptance and eventual adoption. These results showed that engaging farmers in assessing cowpea varieties for desired attributes is beneficial because it allows the identification of varietieswhich are the most desirable for the communities rather than an individual (Mohammadi *et al.*, 2011). Kitch *et al.* (1998) indicated that farmers seek varieties with particular traits, such as large white seeds that command a premium price. Coulibaly and Lowenberg (2002) observed that market studies are useful in indicating varieties with characteristics preferred by consumers, which sell for a premium price.

Conclusion

In conclusion, therefore, this study enabled farmers to identify cowpea lines developed from the research institute (NaSARRI) with the best attributes which met their considerations in their own environment. Many farmers were interested to participate in selecting the cowpea linesand this enabled them to select lineswith best traits. Theparticipatory variety selection approach with farmers' involvement has been reported to increase acceptance, dissemination and adoption of new developed cowpea lines. These results provided an indication that involving more women has the capacity of selecting cowpea linesof significance in their local environments for production than their men counterparts. This further suggests that women play a big role in management of the field activities especially cowpea crop for their desirable attributes. The study revealed that the farmers were eager to learn and participate in selecting the cowpea lines. The PVS method brings the research scientists and farmers together and enables the research scientist understand the real needs of the communities. The active participation of farmers is essential in accelerating selection and acceptance of new cowpea lines developed by breeders. Eight cowpea lines were selected by farmers and considered them as superior to what they currently grow because of the key attributes especially the high yielding, resistance, smooth leaves, tasty leaves and grains. Using PVS as a method in the breeding work, showed to shorten the process of developing new crops because farmers can quickly select the lineswith traits they prefer. Consequently, it improves on the farmers' acceptance and adoption rates of the released crops leading to increased cowpea production in the region.

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