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Farmer evaluation of an advanced cowpea line for agronomic performance in eastern Uganda

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Abstract

The study explored farmers' assessment of the new improved cowpea line MU-93 against a local cultivar (*Ebelat*) in terms of yield, pest and disease resistance and farmers' preference for home consumption and market. The study was carried out within the Integrated Pest Management (IPM) Farmer Field School environment where the advanced cowpea line MU-93 was used as a resistant component of a cowpea IPM package. The yields of MU-93 were markedly higher than those of *Ebelat;* unsprayed MU-93 yielded higher than Ebelat, even when *Ebelat* was sprayed weekly. MU-93 had higher germination percentage, better growth vigor, high leaf and pod production as well as good grain taste. In addition MU-93 had lower pest and disease infestation, higher grain yield, good seed quality and higher market preference. However, it is a late maturing line compared to *Ebelat*, and after the budding stage its leaves and pods were considered relatively unpalatable. MU-93 also produces fewer but longer pods with bigger grains than *Ebelat*. *Ebelat* had moderate germination percentage, early maturity, and had good leaf taste. Basing on the farmers' positive assessment, MU-93 has been submitted to the Uganda Variety Release Committee for possible national release.

Key words: Farmer Field School, integrated pest management, Uganda, *Vigna unguiculata*

Introduction

The results of the study conducted by Makerere University Cowpea Improvement Project in 1993 revealed that cowpea *Vigna unguculata* (L.) Walp production is constrained by a number of factors but most importantly, narrow germplasm base, use of inherent low yielding cultivars, pests, diseases and lack of improved seed (Sabiti *et al.*, 1994; Adipala *et al.*, 1997). During the last 10 years, the Cowpea Improvement Project has focused on identification of high yielding and adaptable genotypes for possible release to Ugandan farmers. A product of several on-station studies has been the identification of a high yielding genotype from the International Institute of Tropical Agriculture (IITA) germplasm collections, locally code named MU-93. This particular genotype possessed several good attributes but lacked farmer assessment and evaluation for these attributes. Thus this study was designed to explore farmers' assessment of the new improved variety MU-93 against a local popular cultivar *Ebelat*. The criteria evaluated were yield, pest and disease resistance, preference for home consumption and market preference. Previously, Isubikalu *et al.* (1999) documented differential preference for home vis-à-vis market. It was envisaged that the information generated would provide a basis for possible release of the variety and enhance farmer adoption. The study was carried out within the Integrated Pest Management (IPM) Farmer Field School (FFS) environment where MU-93 was used as a resistant component of an IPM for cowpea (Karungi *et al.*, 2001).

Materials and methods

Study areas and farmer selection

The study was carried out in three districts of Eastern Uganda namely Kumi (1°31'N, 33°53'E, 1127m above sea level, annual rainfall 1200mm), Pallisa (1°13'N, 31°42'E, 1219m above sea level, annual rainfall 1500mm) and Kaberamaido (1°45'N, 31°42' 1127m above sea level, annual rainfall 1100mm), where dissemination of cowpea IPM package was being carried out by Makerere University Cowpea Improvement Project using the Farmer Field Schools approach (Karungi *et al.*, 2001; Nabirye *et al.*, 2003).

One hundred and eighty (180) farmers were chosen purposively to participate in the study. The farmers were drawn from 9 cowpea farmer field schools, 3 from each district, i.e. Amusala, Kameke, and Agule in Pallisa district; Akuoro, Olupe and Okouba in Kumi district; and Omwony, Amotoot and Aipecitoi in Kaberamaido district. These schools were formed with the major objective of disseminating Integrated Pest Management (IPM) knowledge to many farmers. The IPM components being tested were early planting (2-4 weeks after on-set of the planting season), close spacing (30 x 20 cm), use of pest resistant cultivars, and 3 well timed sprays (once at budding, flowering and podding), supplemented by pest scouting to ensure spraying when pest control is required. Each farmer field school consisted of 25-35 farmer members and one extension worker, who conducted season long training of member farmers on different aspects of IPM. From each farmer field school, 20 farmers were selected to take part in the genotype evaluation, on the basis of regular attendance and active participation in experimentation.

Experimental establishment and farmer involvement

Farmers were involved in the management of the trials during the entire study period. For three consecutive cropping seasons i.e., July - November, 2001; March - July, 2002 and July-November, 2002, farmers in their respective schools planted two varieties *Ebelat* and MU-93. *Ebelat* is an erect land race, matures in about 80 days and has large, white and black eyed seeds. MU-93 is also erect, matures in about 90 days, large seeded and is off-white and brown eyed. Each variety was planted in 10 x 10 m plots, with 1m spaces between plots at a plant spacing of 30 x 20 cm as described by Obuo *et al.* (1997). The plots were kept weed-free by regular hand hoeing. Plots (see Table 1) were either not sprayed with insecticide (first control), or sprayed three times, i.e., once at budding, flowering and podding (Karungi *et al.*, 2000b), or sprayed once weekly (second control). The two controls used represented farmers who do not spray at all, a common practice among many resource poor households or spray very frequently, without consideration of economic injury levels and action thresholds (Isubikalu *et al.*, 1999; Nabirye *et al.*, 2003). Included were plots where they practiced broadcasting (farmers practice), a common practice in Uganda (Isubikalu *et al.*, 1999) and sprayed weekly. The experimental design was a randomised complete block design (RCBD) arranged as a split plot (as practiced by many commercial cowpea growers). Treatments were varieties in main plots and spray schedules in sub plots. Each Farmer Field School served as a replicate.

Table 1. Field layout of the cowpea trials in each FFS.

Plot 1: *Ebelat* + no spraying	Plot 5: MU-93 + no spraying
Plot 2: *Ebelat* + 3 sprays	Plot 6: MU-93 + 3 sprays
Plot 3: *Ebelat* + weekly spray	Plot 7: MU-93 + weekly spray
Plot 4: *Ebelat*+ farmers practice	Plot 8: MU-93 + farmers' practice

Data collection and analysis

Using a questionnaire with subjective scores, farmers evaluated germination percentage, growth vigor, days to flowering and maturity, taste of the cooked leaves, pods and grains. They also assessed leaf and pod production together with pest and disease resistance of the lines. At harvest, other attributes evaluated included grain yield, seed quality in terms of seed damage and market preference in terms of size and color. These data were analysed using Statistical Package for Social Scientists (SPSS) computer package. Yield data for all the seasons were subjected to Analysis of variance using Genstat computer package (Lawes Agricultural Trust, Rathamsted Experiment Station, 1993). The costs associated with the different spray schedules are shown in Table 2 and were used to calculate the profitability (marginal returns) of each spray treatment. The marginal returns indicate the value of the yield gained due to spraying relative to the cost of the spray schedule. A value of marginal return less than 1 indicates that the increase in cowpea yield does not compensate for the cost of spraying.

Results

The age of the farmers who took part in the evaluation exercise ranged from 22-62 years but the majority (68.7%) were between 28-40 years implying that the sample was composed mainly of youthful farmers. Farmers in all the trial sites reported that the introduced line MU-93 had a higher germination percentage (above 80%), high growth vigor, high leaf and pod production as well as good grain taste (Table 3). In addition the introduced line had low pest and disease infestation, higher grain

Table 2. Costs of insecticide application used in calculating marginal returns.

Number of sprays	Item	Cost[a]
1	Insecticide[b]	66,667
	Knapsack sprayer[c]	100,00
	Labour for spraying[d]	92,500
	Labour for harvesting[e] and threshing additional gain[f]	31,111
	Total	290,278
3	Additional insecticide	133,334
	Labour for two more sprays	185,000
	Labour for harvesting and threshing additional gain	62,222
	Total cost for one spray	290,278
	Total	670834
5	Additional insecticide	133,334
	Labour for two more sprays	185,000
	Labour for harvesting and threshing additional gain	62,222
	Total cost for 3 sprays	608,612
	Total	1,030,612
8	Additional insecticide	200,001
	Labour for three more sprays	277,500
	Labour for harvesting and threshing additional gain	93,333
	Total cost for 5 sprays	968,390
	Total	1,539,224

[a] free market price at the time of the study
[b] calculated ha^{-1}
[c] cost of the sprayer and depreciation of 5 years
[d] labour for spraying was calculated at one person-day ha^{-1}
[e] labour for harvesting and threshing calculated ha^{-1}
[f] value of cowpea at the time of the study was 800 Ug. sh kg^{-1}, 1US$ = 1650 Ug. sh.

yield (Tables 4 and 5), good seed quality and high market preference especially when sprayed weekly. Overall, it received very high acceptability scores. Nevertheless MU-93 flowers relatively late (54 days after planting) and consequently matures latter (85 days) than the local check (77 days). MU-93 produces fewer pods than *Ebelat* but yields much higher than *Ebelat* because of its longer pods, hence more (and infact heavier) seeds per pod. The leaves and pods of MU-93 were also considered less palatable compared to those of *Ebelat*.

Ebelat had moderately good germination percentage, early maturity, and good leaf pod and grain taste. In addition *Ebelat* showed high leaf production and good seed quality (Table 3). Most of these good attributes were achieved after *Ebelat* was sprayed weekly with an insecticide; a practice that was found not to be cost effective (Table 5). Poor *Ebelat* attributes as judged by the farmers were its lower growth vigor, high pest infestation, low grain yield and lower market preference especially when grown without chemical spraying.

Average yield performance of the test lines are shown in Table 5. The yields of MU-93 were markedly higher than those of *Ebelat*; unsprayed MU-93 yielded (859 kg ha^{-1}) better than weekly sprayed *Ebelat* (585 kg ha^{-1}). MU-93 sprayed 8 times produced the highest yields (1773 kg ha^{-1}), followed by MU-93 sprayed 3 times (1676 kg ha^{-1}). Both treatments tripled the yield of *Ebelat* sprayed

Table 3. Farmers' assessment criteria for MU-93 and Ebelat in 3 districts of eastern Uganda.

Positive attributes	Percentage scores	
	Ebelat	MU-93
High germination %	40.6	53.3
High growth vigor	48.3	73.9
Early flowering	61.1	12.8
Tasty leaves	70.6	46.1
Tasty pods	69.4	32.8
Tasty grains	61.7	65.6
Low pest infestation	31.1	70.6
Low disease infestation	48.3	70.0
Early maturity	68.9	12.8
High grain yield	14.4	85.6
High seed quality	46.1	67.8
High market preference	53.9	68.9

- Subjective scoring by farmers- no specific scale used.

Table 4. Summary of qualitative information from participating farmers about the two cowpea varieties.

Variety	Strong points	Weak points
Mu-93	High germination % High growth vigor Pest and disease resistant High grain yield High seed quality High market preference	Late flowering Late maturity Less palatable leaves (after budding) Low pod production
Ebelat	Moderate germination % Early flowering Early maturity High leaf & pod production Tasty leaves, pods & grains Good seed quality	Low grain yield High pest susceptibility Low growth vigor Low market preference if unsprayed

Table 5. Mean[b] grain yields and marginal returns of two cowpea genotypes for different insecticide spray schedules.

Treatment	Grain yield (kg ha^{-1})	Yield gain (kg ha^{-1})	Marginal returns[a]
Ebelat not sprayed	248	-	-
Ebelat + 3 sprays	372	124	0.16
Ebelat + 8 sprays	585	337	0.07
Ebelat + broadcast + 8 sprays	540	292	0.16
MU-93 not sprayed	859	611	-
MU-93 + 3 sprays	1676	1,428	1.88
MU-93 + 8 sprays	1773	1,525	0.84
MU-93 + broadcast + 8 sprays	1427	1,179	0.65
s.e.d	77.4	-	-
C.V. %	28.6	-	-

[a] Marginal returns greater than 1 are profitable.
[b]Pooled data for 3 sites and 3 seasons.

weekly. While both weekly sprays and 3 sprays produced high yields of MU-93, spraying cowpeas 8 times (once weekly throughout the growing season) was not cost-effective. The overall yield gains and marginal returns are presented in Table 5. Marginal returns were generally higher when the improved line was sprayed, however, only the 3 sprays (once at budding, flowering and podding) had a marginal return greater than 1. Similar results were reported by Karungi *et al.* (2000) and Nabirye *et al.* (2003) whose studies showed that spraying cowpea once at budding, flowering, and podding stages was more cost effective and profitable than spraying cowpea weekly throughout the growing season.

Discussion

Farmers did not reject any of the varieties, but gave specific appreciation for each of them. The major positive attributes of MU-93 were its high grain yield, high growth vigor, lower pest and disease infestation, high seed quality and high market preference. On the other hand, *Ebelat*'s positive attributes were: taste, early flowering and early maturity. The variations in performance of the genotypes seemed to be associated with the difference in genetic composition. For instance although *Ebelat* produces more pods than MU-93, its yield is lower than that of MU-93 because the improved line has longer pods which hold more and heavier seeds than *Ebelat.* However, after budding the leaves of MU-93 became rough and this may be a physiological insect defense mechanism for the elite line. Thus, leaves of MU-93 can comfortably be consumed if harvested before budding. This has got an advantage in that farmers can consume the cowpea leaves without being exposed to pesticide residues if they adopt the cost-effective spray schedule of spraying once at budding, flowering and podding.

Basing on the farmers' preference for the elite cowpea material, MU-93 has been submitted to the Uganda Varietal Release Committee for possible national release. If approved this will be the first varietal release for Makerere University since the early 1970's. Some farmers in the study area have already adopted this genotype.

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