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Yield performance of short duration pigeon pea cultivars in northern and Eastern Uganda

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Abstract

Field experiments were carried out at Serere Agricultural and Animal Production Research Institute (SAARI) and Ngetta Experimental Station to evaluate the yield performance of short-duration pigeon pea lines. The study was conducted in two stages; on-station and on-farm trials. On-station trials were carried out during first rains of 1993, 1994 and 1995, while on-farm trials were carried in Lira district during the first rains of 1996 and 1997. Twelve improved pigeon pea lines were evaluated and Apio-Elina local pigeon pea variety was used as check (control). Improved pigeon pea line gave higher yields than the local variety. Amongst the improved lines, KAT 60/8 and ICPL 87091 consistently gave high yields across the sites and years. Highest yield 3200 kg ha-1 was obtained from KAT 60/8, while the lowest yield (570 kg ha-1) was from the local variety. KAT 60/8, ICPL 87091, ICPL 87102 and ICPL 87104, performed well and were selected for on-farm testing. Results from on-farm trials indicated that KAT 60/8 and ICPL 87091 performed better that the other two and were then recommended for release. KAT 60/8 was then named as SEPI 1 while ICPL 87091 named as SEPI 2.

Key words: Short duration, pigeon pea, improved lines, on-farm trials, local variety

Introduction

Pigeon pea (*Cajanus cajan*) is a very important grain legume crop grown in northern and eastern Uganda (Areke *et al.* 1994; Silim et al., 1992). It is mainly used as sauce and income earner. Pigeon pea's nitrogen-fixing ability is an added asset to the deep root system, which facilitates the recycling of deep-seated nutrients to upper zones of soil profile. Despite its importance, yields obtained by farmers are low and farmers have attributed this to cultivation of land races, which have low yield potential. In addition to having low yield potential, local varieties are long duration, taking more than ten months to mature (Esele, 1994; Areke et al.,1994). Due to their long duration, they are prone to wild fires that are common during dry season. Among the other causes of low yields are; insect pests and poor agronomic practices.

It is known that yields can substantially be increased by the use of short/or medium high yielding varieties. In adverse climates of reduced moisture, improved short-duration varieties give higher yields than varieties with longer duration. Therefore to increase pigeon pea yields and stability, it calls for the development of short duration cultivars that are high yielding, that can escape drought and permit the growing of two crops in a year. This would improve food availability throughout the year, and the surplus would be sold, therefore increasing household income, thus reducing poverty in rural areas. This study was carried out to evaluate the performance of short-duration lines (cultivars) under the rain fed conditions in northern and eastern Uganda.

Methodology

This study was conducted in two stages; on-station trials and on-farm trials. Screening of lines obtained from

ICRISAT was done on-station and then few promising lines (cultivars) were tested on farmers' fields.

On-station trials

Short-duration nurseries obtained from ICRISAT-Nairobi Kenya were evaluated at SAARI during first rains of 1993, 1994 and 1995. During the first rains of 1995, this trial was replicated in Ngetta Experimental station in Lira. Twelve lines were tested for their adaptation and yield performance. These lines were compared amongst themselves and also with local variety (Apio-Elina) as a control. The experiments were conducted in a randomized complete block design replicated four times. Each plot measured 5 x 4 m. Since the emphasis was on developing high yield varieties with desirable attributes, the crop was protected against insect pests and weeds. Weeding was done twice, and four sprays of Dimethoate (400g a.i. ha^{-1}) were applied.

At crop maturity all plants in each plot except those from border rows were harvested, pods sun dried and threshed. The plot yields were used to estimate yields per hectare.

The data was collected on growth and yield parameters, but for this paper, only yield attributes will be presented. Data was subjected to analysis of variance using Genstat computer package.

On-farm trials

The promising pigeon pea lines with attributes desired by farmers in the pigeon pea major growing region (Lira); ICPL 87091, ICPL 87102, ICPL 87104 and KAT 60/8 were then tested at farmers' fields under farmers' conditions. These lines had desirable attributes, which include mainly; big seed size, cream, seed colour, and good taste. The objectives of this were to compare performance of the new cultivars with local varieties under farmers' conditions and to elicit farmers' perception of these new cultivars and for them to identify cultivars that meet the desirable attributes.

Four sites from Lira were identified and ten farmers from each site were selected and trials conducted in their fields. Four cultivars; ICPL 87091, ICPL 87102, ICPL 87104 and KAT 60/8 were tested and Apio-Elina and Agali were used as checks (controls). The trial was laid in complete randomized block design replicated twice. The plots measured 10 x 10 m. The plots were farmer-managed, although researchers provided advice, especially on spraying. The crop was protected against insect pests and weeds.

The agricultural extension workers arranged for farmers to visit the on-farm trials and recorded their comments on the new cultivars. This was to enable researchers to know farmers' perception of the new pigeon pea lines.

Results and discussion

On-station trials

(i) Growth attributes

In first rains, 1993, all lines matured within 92 to 97 days, however, in 1994, they took slightly a longer time to mature (Tables 1 and 2). This could be attributed to the differences in amount of rain received in the season. In first rains 1993, the rains were less and short and this possibly caused these lines to mature earlier than their average time. When sites were compared, these lines tended to take slightly longer time to mature in Ngetta than in SAARI (Table 3). The possible explanation for this difference could be in the amount and the duration of rains received for the two sites. Ngetta had heavier and longer rains than SAARI which could have prolonged the maturity period for these lines in the former site.

These lines were generally short, all of them measuring less than 1 m in height compared to the local varieties which measured up to 2 m (Table 1).

(ii) Yield and yield attributes

Across both sites and throughout the years, high yields were obtained from KAT 60/8 and ICPL 87091 (Tables 1, 2 and 3). This meant that their yield performance was consistent and stable and this is one of the characteristics farmers desire in a variety. In addition,

Table 1. Performance of 12 genotypes Short-duration Pigeon pea lines at SAARI in first rains of 1993.

Genotype	Days to y maturit	Plant height (cm)	Seed yield kg ha^{-1}
ICPL 90029	92.7	59.7	2550
ICPL 87101	93.0	62.2	2240
ICPL 151	94.3	52.9	2030
ICPL 87091	97.0	70.7	1990
ICPL 87 B	94.3	55.1	1970
ICPL 90028	95.7	48.1	1920
ICPL 87 W	94.0	60.6	1820
ICPL 87102	95.3	58.9	1770
ICPL 86005	93.0	73.2	1560
ICPL 83 016	97.0	69.8	1510
ICPL 87104	92.3	53.9	1420
KAT 60/8	110.0	75.5	2480
Apio-Elina (local)	156	198.3	570
Parameter means	**93.19**	**67.06**	**1702.1**
SED	**1.35**	**5.23**	**98**
CV (%)	**1.7**	**20.6**	**30.8**

Table 2. Performance of short duration pigeon pea lines in SAARI first rains 1994

Genotype	Seed Color	Days to maturity	Grain yield (kg ha-1)	100-seed mass (g)
ICPL 87 B	Brown	108.7	1430	10.3
ICPL 87 W	Cream	108.3	1420	11.0
ICPL 87102	Cream	108.0	1750	10.0
ICPL 151	Brown	107.3	1840	560
ICPL 83016	Brown	107.3	1490	14.0
KAT 60/8	Cream	108	3200	11.6
ICPL 90028	Brown	107	2130	10.0
ICPL 87104	Cream	106	1600	12.6
ICPL 87091	Cream	108.3	2450	11.0
ICPL 86005	Brown	108	2530	10.7
ICPL 90029	Brown	108.7	1510	10.7
ICPL 97101	Brown	107.9	2000	13.0
Apio-Elina	Brown -Cream	176	560	8.2
Parameter means		**113.04**	**1839.23**	**11.19**
SED		**1.45**	**180**	**1.7**
CV (%)		**0.83**	**41.82**	**14.1**

these lines had cream seed colour, which most farmers in the pigeon pea growing region prefer. ICPL 90029, and ICPL 87101 gave very high yields, but they had the disadvantage of having brown seed colour. These automatically disqualified them in the farmers' view and hence were not selected for on-farm testing. All the lines gave higher yields than the local variety check. Improved genotypes had bigger seeds as indicated by their high 100 seed weights, which ranged from 10 to 14 g (Tables 2 and 3) and this is one of the desired attributes by the farmers and external markets (outside Uganda). Lowest 100 seed weight was obtained from the local variety (Apio-Elina).

The coefficient of variation was generally low (2.1. to 17.8 %) and hence minimal experimental error, suggesting that any differences in the days to maturity and yield values could be attributed to the genotype.

From the on-station trials, four lines; ICPL 87091, ICPL 87102, ICPL 87104 and KAT 60/8 were selected for on-farm testing. The criteria that were suggested by farmers for selecting the lines were large seed size, cream seed colour and high yield (Silim et al., *1992).*

Table 3. Performance of short duration pigeon pea lines in SAARI and Ngetta during first rains 1995

Treatment	Seed colour	Days to maturity		Seed yield kg/Ha		100 seed (g)	
		SAARI	Ngetta	SAARI	Ngetta	SAARI	Ngetta
ICPL 87091	Cream	114	120	1031	1635	12	11
ICPL 87109	Brown	114	123	1156	1656	12	12
ICPL 87101	Brown	109	115	864	1479	12	12
ICPL 87102	Cream	118	130	1427	2056	11	10
ICPL 87104	Cream	111	120	697	1170	8	9
ICPL 87105	Cream	113	119	916	1257	11	12
ICPL 86005	Brown	113	120	594	1567	12	12
ICPL90029	Brown	111	119	844	1941	13	13
ICPL 87 W	Cream	108	116	771	1354	10	9
ICPL 90013	Brown	107	114	1125	1616	10	9
ICPL 90050	Brown	113	118	1167	2463	8	9
KAT 60/8	***Cream***	***130***	***131***	***1200***	***2209***	***12***	***12***
Apio-Elina	***Brown-cream***	***162***	***169***	***374***	***520***	***7***	***9***
Site means		**108.79**	**115.29**	**869**	**1494.51**	**9.86**	**9.93**
SED		**3.977**	**3.5**	**297**	**269.6**	**-**	**-**
C.V (%)		**1.78**	**2.5**	**31.52**	**21.5**	**22.15**	

On-farm trials

Table 4 shows results obtained from on-farm trials. It is clearly seen that that improved cultivars gave significantly higher yields than locals. Yields obtained from the improved cultivars were about three times higher than the local varieties. In addition, improved cultivars matured earlier than the local varieties (Table 4) indicating the advantages of these cultivars. In spite of taking long to mature, the local varieties still gave very low yields. Highest yield (1500 kg ha^{-1}) was recorded for ICPL 87091, while the lowest yield was obtained from Alio-elina.

From informal interviews most farmers preferred the improved cultivars to their locals because of high

Table 4. Performance of improved pigeon pea cultivars local varieties on-farm during first rains of 1997.

Treatment	Maturity days		Yield (kg ha^{-1})	
	1996	1997	1996	1997
ICPL 87091	90	93	1485	1500
KAT 60/8	98	115	1300	1200
ICPL 87102	89	96	1252	1130
ICPL 87104	89	90	1190	1105
Apio-Elina (local)	168	153	502	458
Agali (local)	256	275	562	500
Yearly means	**98.75**	102.75	920.78	876.44
S.e.d	3.2	5.2	132	120.4
C.V.%	**13.8**	**18.5**	**32.1**	**45.8**

Obuo J.E., *et al.* yields, cream seed colour and big seeds. However, among the improved cultivars, farmers preferred KAT 60/8 due to its insect pest tolerance and its suitability for intercropping with cereals (a common practice in pigeon pea major growing regions).

Conclusions and Recommendations

Results from on-station and on-farm trials indicated that KAT 60/8 and ICPL 87091 performed well and shown consistence in their yields throughout. These cultivars were released in 1998,and named as SEPI 1 and SEPI 2 for KAT 60/8 and ICPL 87091, respectively. There is need now to multiply foundation seed of these cultivars so as to make it available to limited number of farmers and interested NGO and other service providers in order to have their seed access to other farmers.

These varieties have disadvantage of being attacked by many insect pests and therefore, future research should be focused on developing insect pest tolerance/ resistant varieties.

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