Potential and acceptability of short duration pigeonpea genotypes in Tanzania

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Abstract

Experiments were conducted both on-station and on-farm to evaluate the newly introduced short duration pigeonpea genotypes for adaptation and grain yield in different agro-ecological zones and to evaluate the performance of promising ones in farmers fields. Also the experiment aimed at eliciting farmers' perceptions about the short duration genotypes. In on-station experiments conducted at eight locations in eastern, southern highlands, western, southern and central zones, yield levels of up to 3.3 t ha^{-1} were recorded while maturity from 95 to 149 days after planting. Plant height at maturity ranged from 61 to 111 cm. After several seasons of these on-station multi-location testing, two genotypes ICPL 87091 and ICPL 86005 were identified as promising. The two genotypes were advanced for testing on-farm. In the on-farm experiments, grain yield of up to 2.6 t ha^{-1} of ICPL 87091 and up to 2.5 t ha^{-1} of ICPL 86005 were realised by some farmers. Farmers preferred ICPL 87091. Some of the selection criteria for short duration pigeonpea that were mentioned by farmers included: high yielding, white seed; short cooking time, palatability and thick broth. Other criteria include early maturity, insect pest tolerance, synchronous maturity, marketability, large seeds and drought tolerance. Basing on the results from on-station and on-farm experiments, a white seeded pigeonpea genotype ICPL 87091 was recommended for release to farmers for wider dissemination by the name of "*Komboa*". It is the first pigeonpea variety to be released in Tanzania. In this paper we discuss the results and their implications to future breeding programmes in pigeonpea.

Introduction

Pigeonpea (*Cajanus cajan*) is an important grain legume grown by small holder farmers in Tanzania. The major production areas are Lindi and Mtwara regions in Southern Highlands zone; Arusha and Kilimanjaro regions in the Northern zone and Morogoro, Coast, Dar Es Salaam and Tanga regions of the Eastern zone. Both dry and fresh grains are used as relish. Much of the pigeonpea is grown as an intercrop mainly with maize and to a lesser extent with sorghum, cassava and sweet potatoes (Mbowe and Maingu, 1987; Maingu and Mligo, 1991). Due to the bimodal rainfall pattern eastern zone has, there is a high potential for the eastern zone becoming a major producer of pigeonpea, provided early maturing types are used.

Farmers in Tanzania, as in other countries in eastern southern Africa, are still growing traditional medium and long duration pigeonpea land races intercropped with cereals, short duration legumes such as groundnuts and other annuals (Balder, 1988). These land races are photoperiod sensitive and tend to be depressingly very low yielding for a crop that spent 6 - 9 months in the field with an annual average yield of 700 kg ha^{-1} towards the end of the rainy season. Mid-season dry spells, terminal drought, diseases

[redacted]sect pests sometimes affect them. The basic productivity of the land races is [redacted]fficient to interest farmers in intensifying their crop management much beyond [redacted]bsistence level. Improved varieties offer far better prospects; particularly short [redacted]ration varieties.

Short duration pigeonpea genotypes are those that are photoperiod insensitive and mature in 3 - 4 months, unlike the traditional varieties that take 6 - 9 months (ICRISAT, 1998). Since they are photoperiod insensitive they can flower at any time of the year as long as there is moisture, for that reason, there can be multiple harvests from the same crop. There are no land races that can mature within the 3-4 months period. Due to their short duration, these genotypes can provide green pea at time when the land races are not capable of doing so. They are also suitable for two cropping, the first being in the short rains and a second crop in the main rainy season. Unlike the traditional land races, sowing time is flexible and can also escape major diseases of pigeonpea such as *Fusarium* wilt. Short duration pigeonpea genotypes, unlike the traditional, long duration varieties are unsuited to traditional inter-cropping at low density.

In a sense, the traditional configuration of diversity in *space* (intercropping) is now supplemented by additional varietal option that exploits system diversity in *time* (multiple cropping). This additional dimension could enhance total farm income substantially.

Another interesting gain from the short duration types is the suitability for green pea production (ICRISAT, 1998). Immature (green) pigeonpea seeds are consumed as fresh vegetable in many parts of eastern and southern Africa, and other countries, where it attracts high prices and delivers a crop (and the ensuing profits) more quickly than dry peas. Since short-duration varieties are relatively photoperiod insensitive, they can be grown at different times of the year (under irrigation) to reap high off-season prices for fresh produce. If pods are removed, repeated flushes of flowers can be stimulated and several pea crops harvested from same plants.

Seeing this potential the grain legume research program introduced the short duration pigeonpea genotypes from ICRISAT for evaluation for yield, adaptability, and acceptability in Tanzania in late 1980s. However active research in short-duration pigeonpea genotypes evaluation started in 1991, with the following specific objectives:

On-station

To evaluate newly developed short-duration genotypes for adaptation and grain yield in different agro-ecological zones

On-farm

- To verify the result of the on-station trials with respect to yield
- To confirm if these short-duration pigeonpea genotypes are acceptable to farmers, and if they are compatible with existing farming system.

Methodology

On-station multilocation variety evaluations:

Between 1990/1991 and 1996/1997 cropping seasons several short-duration pigeonpea multilocation variety evaluations consisting from 12 to 20 entries per trial were conducted in eastern zone (at Ilonga, Ifakara [Katrin], Mlingano and Gairo), western zone (at Tumbi), southern highland zone (at Ismani), lake zone (at Ukiriguru), southern zone (at Naliendele) and central zone (at Hombolo). However, the number of locations were not the same for each season. Entries included in the evaluations in 1991 and 1992 were all of the determinate types. Those planted in 1993 were the indeterminate types. From 1994 to 1997 all the entries were of the determinate types. Initially, in these variety evaluations local checks, which were long-duration land races were included. This is because we did not have land races of short duration types. However, it became clear that these land races were very different from the newly developed short-duration genotypes in terms of plant types and duration to maturity. The short-duration genotypes needed closer spacing while the local land races required wider spacing for optimum productivity. Thus it was not proper to put them in one experiment. Consequently experiments, which were conducted from 1993 to 1997, did not include a local check.

The experiments were laid down in a randomised complete block design with three replications. Plot size was 4m x 5m i.e. 8 rows plots of 5 m each. Intra-row spacing was 20 cm two plants per hill and inter- rows spacing was 50 cm. The exception was for the indeterminate lines evaluated in 1993 in which the intra-row spacing was 10 cm and the inter row spacing was 30 cm. The experiments were protected from insect pests by timely and effective insecticide spray by use of knapsack sprayer or ULVA + sprayer following the recommended dosage.

Data recorded: these included date of planting, days to 50% flowering, days to 75% maturity, plant height at maturity, grain yield, 100 grain weight (g) and *Fusarium* wilt visual score of 1-3 for the wilted plants (1 = No damage, 2 = Medium damage and 3 = High damage). The data was subjected to analysis of variance.

On-farm variety verification

On-farm verification experiments were conducted in 1997,1998 and 1999 on farmers' fields in Dar es Salaam, Tanga, and Morogoro Regions in eastern zone. A total of six districts (Korogwe, Morogoro Rural, Ilala, Kinondoni, Temeke and Handeni) were selected in 1997. In 1998 Same in Kilimanjaro Region was added. In 1999, three districts namely Ilala and Kinondoni and Same were dropped. Fields where trials were conducted lie between sea level up to 600 m above sea level. Districts were the trials were conducted experiences a bimodal rainfall pattern. During the short rainy season, from October to January, only short- duration crops can be grown. The long rains, which usually fall between March-May, are more reliable and constitute the main cropping season. All trials were conducted during the long rains.

In 1997 plots were laid out in randomized blocks in 16 villages with each farmer having two replications. In 1998 and 1999 farmers planted single replicates each farmer being treated as a replicate. The plot size was 10 m x 10 m with an inter-row spacing of 50-cm and an intra-row spacing of 20 cm with two plants per hill. The

trials were entirely managed by farmers under the supervision of village extension officers.

After harvesting, yield data were recorded and subjected to analysis of variance. In 1997, each district was considered as a cluster. Farmers were considered as replicates within each cluster. Farmer assessments were done by interviewing farmers individually using an open-ended questionnaire, and matrix ranking was carried out so that farmers could rank the genotypes. In 1998, and 1999 analysis of variance was done by village. Farmer assessment was carried out using the same procedure as in 1997.

Results and discussions

On-station

Performance of the test genotypes in 1991 is shown in Table 1.1. Good performances of the test genotypes were recorded at Ilonga, Ifakara, Tumbi and Naliendele, where the location mean was 1-to 1,8 t ha^{-1}. The location, which had the best performance, was Ifakara followed by Naliendele. The genotypes performed the poorest at Hombolo and Ukiriguru in the 1991 cropping season. However, there were significant differences ($P<0.05$) between test lines at all the locations. At Ilonga highest yielding genotype was ICPL 87W (1274 kg ha^{-1}) followed closely by ICPL 86005 (1178 kg ha^{-1}). These seed yields were significantly ($P<0.05$) higher than that of the local check (915 kg ha^{-1}). In the overall performance genotype ICPL 86005 gave the highest general mean of 1349 kg ha^{-1}. The local check gave a general mean of 1047 kg ha^{-1}.

There were significant differences (($P<0.05$) between the test genotypes for number of days taken to maturity in 1991. With the exception of Ismani, the local check significantly took longer time (139 - 190 days) to reach maturity than the short duration genotypes (108 - 112 days) at all the locations.

In the 1992 cropping season, out of the eight locations, five of them had a location mean of more than a ton per hectare, in fact other locations giving more than two tons per hectare, indicating good growing conditions in those locations in that year. Mlingano gave the highest location mean of 2.4 t ha^{-1}. Significant differences ($P<0.05$) between test genotypes were noted at all the locations (Table 1.3). However the local check gave depressingly very low seed yield (95 kg ha^{-1}) at Tumbi. In the overall performance all the short duration genotypes gave seed yields of more than a ton per hectare. The local check gave only 814 kg ha^{-1}.

In 1993 cropping season different short duration genotypes were evaluated for seed yield potential at Ilonga. These included the indeterminate types. Table 1.4 shows the performance of these new genotypes. Although the performance appeared to be good (with a location mean of 2.6 t ha^{-1}) there were no significant differences ($P>0.05$) between the test genotypes. Significant differences were detected for days to 50% flowering, days to maturity, plant height and 100 grain weight. However, these test genotypes had very low 100 grain weight, most of them were below 10 g. Making them unsuitable for further testing.

In 1994 the entries for short duration multilocation testing were reviewed and more new genotypes that were white seeded and with larger seed sizes (>9 g) were included. These genotypes were tested at two locations (Ilonga and Mlingano). There were significant differences ($P<0.05$) between genotypes for grain yield at Ilonga only, (Table 1.5). At Ilonga highest grain yield was given by the brown seeded genotype ICPL 86005 (2230 kg ha^{-1}). Among the white seeded genotypes, highest grain yield was given by Kat 60/8 (1770 kg ha^{-1}) followed by ICPL 87091 (1750 kg ha^{-1}) with 100-grain weight of 11.90 g.

Varietal evaluations continued from 1994 through 1997 with good performance noted in the good seasons and poor as expected in bad seasons (Table 1.6). In general there were no disease incidences noted in all the varietal evaluations. The *Fusarium* wilt, which is the most important disease in pigeonpea, could not be seen. This may be is due to the escaping nature of short-duration genotypes.

Although the performances of the test genotypes varied with seasons depending on the environmental conditions during the cropping season, from the data presented it is clear that short duration pigeonpea genotypes have a high potential under Tanzanian conditions. There were however, seasonal variations of varietal performance.

Farmers have a high preference for seed colour and seed size in addition to grain yield. If it was for seed yield only, ICPL 86005 could have been one of the best varieties because it has performed exceedingly well across seasons. Unfortunately the seed colour of ICPL 86005, like many of the short duration genotypes, is brown, which is not the farmers' preference.

In 1994 a new genotype ICPL 89091, which was white-seeded and had good performance and good seed size ranging from 10.00 to 13.80 g depending on the environment was identified. The line was further evaluated in 1995 through 1997 and found to be performing consistently well. The genotype ICPL 890 and another good performing genotype ICPL 86005 were both introduced on-farm for the farmers to select a variety of their choice.

On-farm variety verification

In 1997, there was no significant ($P>0.05$) yield difference between the two varieties tested in Korogwe and Handeni. However in Morogoro Rural District, ICPL 86005 yielded higher than ICPL 87091 (Table 2.1). ICPL 86005 was also significantly taller than ICPL 87091 in both Korogwe and Morogoro Rural districts. There was no significant yield and plant height difference between four genotypes evaluated in Dar -es-Salaam.

In 1998 and 1999, there was no significant ($P>0.05$) yield difference between the two genotypes in all clusters (Table 2.2). Similarly there was no significant height difference between the two genotypes except at Melela village in Morogoro Rural district where ICPL 87091 was taller than ICPL 86005 in 1998 and in Korogwe cluster where in 1999, ICPL 87091 was significantly taller than ICPL 86005 ($P<0.05$;

Table 2.3). Plants in Morogoro cluster were shorter than those in Korogwe cluster (Table 2.3).

During all the years, farmers in all locations ranked ICPL 87091 higher than ICPL 86005 (Table 2.4). These results were consistent with individual farmers' selection of the best variety (Table 2.5). Farmers in all districts, and during both years selected ICPL 87091 as the best variety (Table 2.5). Farmers' perception of desirable qualities in a short-duration variety is indicated in Table 2.6.

Short-duration pigeonpea genotypes have a potential in Tanzania because of their early maturity making them suitable for double cropping. Thus in bi-modal rainfall areas, they can be grown in both the short and long rains. Their main drawback is that they mature when environmental conditions are favourable for insect pests and are very susceptible to insect pest attack. They, therefore, require spraying to control insect pests and under good management the crop has very high yield. Heavy attack by insects means that they are targeted to farmers who are conversant on how to use and handle pesticides. These include cotton farmers and vegetable growers.
One of the characteristics of pigeonpea crop is its ability to ratoon. There is potential of ratooning short-duration pigeonpea in areas of good rainfall like Korogwe and valley bottoms in all agroecologies of eastern Tanzania. More research on this is needed on the farmers' fields.

Farmers in all districts rated early maturity as one of the important characteristics they would like in any variety. This quality not only helps the crop to escape drought, but also allows farmers to market green pigeonpeas when prices are high.

The genotypes evaluated were similar in yield potential (Tables 2.1& 2.2). However, differences on yield levels between clusters were observed. For instance, Mazinde village in Korogwe had consistently higher yields than the other locations. This was partly caused by differences in pest management and rainfall. Farmers at Mazinde village were better managers than the rest.

Farmers selected ICPL 87091 as the best variety. Reasons for selecting this variety were several (Table 2. 5). However the most frequently mentioned reasons were taste/palatability, cooks faster, big seeds, good seed color and high yielding. Selection criteria mentioned by most farmers included; high yielding, fast cooking, palatability, early maturing, insect and drought resistant (Table 2.5). These and others mentioned in Table 2. 5 should be taken into account in future for short-duration pigeonpea breeding program. It is worth mentioning that seed color was not an important attribute for farmers in Dar es Salaam. One of the reasons is that the high demand for green pigeon peas in the market made farmers sell their crop before maturity when the seed of all varieties tested were green. In other clusters, dry grain was important and farmers preferred white seeded types. Results of the present study show that ICPL 87091 is acceptable to farmers in Eastern Tanzania, and if released will be widely adopted. We therefore recommended that this genotype be released as a variety to farmers for wider dissemination and adoption. However, wider dissemination will depend on the aggressiveness of the extension staff in demonstrating the new variety and the new cropping system. In addition the seed delivery system should be in a position to make the seed available to whoever, would like to have it.

Conclusions:

The new short-duration pigeonpea genotypes, being a new cropping system, have shown high potential and are acceptable to the farmers in Tanzania. However, wide spread dissemination will seriously be hampered by inadequate seed delivery systems. Although the improved short-duration genotypes have shown to have high potential in terms of productivity, they have important deficiencies that are likely to reduce their yield potential in some environments and their appeal to consumers and producers. The deficiencies include small seed size and susceptibility to wilt, and insect pests. For instance seed size of ICPL 87091 requires further improvement from 12-13 to over 15 g per 100 seeds. Thus future research on short-duration pigeonpea will need to focus on correcting deficiencies in these varieties.

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References

Balder, B. (1988) Cropping Pattern. Pages 51-557. In Pulse crops (Balder, B.; Ramanujam, S.and Jain, H.K. Eds). New Delhi, India: Oxford and IBH Publishing Co. Pvt. Ltd.

Chauhan, Y.S. Venkataratnam, N., and Sheldrake, A.R. (1987) Factors affecting growth and yield of short-duration pigeonpea and its potential for multiple harvests. Journal of Agricultural Sciences Cambridge 109: 519-529.

ICRISAT, (1998) From orphan crop to pacesetter. Pigeonpea improvement at ICRISAT. Patancheru 502 324, Andhra Pradesh, India. P 9-11.

Mbowe, F. F. A. and Maingu, Z.E. (1987) The status of pigeonpea production in Tanzania. A paper presented at the ICRISAT's Pigeonpea Scientist Meeting 2-5 June 1987. Nairobi.

Maingu, Z.E and Mligo J. K. (1991) Pigeonpea production Systems and Research in Tanzania. In Singh, Laxman, Silim S.N. Ariyanayagam, R.P and Reddy M. V (eds) proceeding of the first Eastern and Southern Africa Regional Legumes (Pigeonpea). Workshop. 25-27 June 1990. Nairobi. Kenya. ICRISAT. P 83-90

Table 1.1 Average grain yield (kg ha^{-1}) of entries evaluated in short - duration Pigeonpea multilocationa indicated locations in 1991.

Entry name	Ilonga	Ifakara	Gairo	Tumbi	Ismani	Ukiriguru
ICPL 87B	830	1904	632	889	815	301
ICPL 83024	985	2030	528	859	455	303
ICPL 85012	967	2227	561	948	321	304
ICPL 86005	1178	2523	573	1398	983	301
ICPL 86012	963	2022	612	859	-	305
ICPL 85014	644	1300	573	879	484	300
ICPL 151	937	-	-	-	-	-
ICPL 87W	1274	-	-	-	-	-
ICPL 87102	941	-	-	-	-	-
LOCAL check	915	1960	936	731	237	307
Mean	963.4	1996.5	630.3	937.0	549.0	302.9
SE ±	164.1	278.8	28.3	133.6	124.8	1.15
CV (%)	34.1	24.2	28.3	24.7	39.4	0.66

Table 1.2 Average days to 75% maturity (d) of entries evaluated in short duration pigeonpea multilocational trials at the indicated locations in 1991.

Entry name	Ilonga	Ifakara	Tumbi	Ismani	Ukiriguru	Naliendele	General mean
ICPL 87B	109	129	107	98	102	101	108
ICPL 83024	112	129	99	96	102	101	106
ICPL 85012	110	129	103	97	102	99	107
ICPL 86005	109	129	99	99	102	102	107
ICPL 86012	111	129	111	97	102	95	107
ICPL 85014	110	127	99	97	102	95	105
ICPL 151	110	-	-	-	-	-	-
ICPL 87W	111	-	-	-	-	-	-
ICPL 87102	108	-	-	-	-	-	-
LOCAL check	190	143	140	98	139	145	142
Mean	117.8	130.8	108.3	97.5	107.1	105.2	
SE ±	1.4	0.6	2.0	0.0	0.2	0.9	
CV (%)	2.4	0.8	3.3	0.0	0.4	1.5	

**Table 1.3 Average grain yield (kg ha^{-1}) of entries evaluated in short - duration pigeonpea multilocational t
indicated locations in 1992.**

Entry name	Ilonga	Ifakara	Gairo	Tumbi	Ismani	Mlingano
ICPL 87B	1062	1530	711	585	660	2512
ICPL 83024	1094	1219	696	688	467	2462
ICPL 85012	1422	1141	837	570	601	2203
ICPL 86005	1489	1691	974	859	703	2366
ICPL 86012	1793	1633	1104	629	729	2835
ICPL 85014	1130	1213	1170	459	699	2166
ICPL 151	2244	1370	718	711	461	2503
ICPL 87W	1456	1685	1163	600	507	2592
ICPL 87102	1126	1443	666	622	260	2253
Local check	540	490	370	95	-	2296
Mean	1334	1342	861	582	565	2419
SE+	91.63	108.50	44.79	65.44	36.56	59.88
CV (%)	28.52	35.75	17.79	23.06	30.24	14.97

Table 1.4 Performance of entries in short duration pigeonpea International trial (indeterminate) grown at Ilonga during 1993 growing season

Entry name	Days to 50% flower	Days to 75% mature	Plant height (cm)	100 grain weight (g)	Grain yield (kg ha^{-1})
ICPL 90043	55	118	140	8	3111
ICPL 85045	60	117	132	9	3055
ICPL 87115	57	126	139	7	2944
ICPL 86023	58	115	105	12	2916
ICPL 90050	57	118	119	9	2916
ICPL 88034	61	118	147	8	2777
ICPL 90054	62	117	137	9	2750
ICPL 86015	56	114	134	9	2694
ICPL 90048	57	119	120	9	2611
ICPL 90053	59	121	136	9	2583
ICPL 87114	53	112	130	9	2527
ICPL 90046	60	121	131	9	2472
ICPL 89018	56	115	127	10	2444
ICPL 89007	57	114	118	12	2588
ICPL Upas 120	57	114	115	8	2333
ICPL 90045	53	113	114	8	2250
ICPL 90044	56	116	120	9	2111
ICPL 90043	55	113	94	9	1638
Mean	57	113	125	9	2584
CV (%)	1.91	1.36	7.97	5.34	20.64
LSD $_{(0.05)}$	2.45	3.54	22.31	1.11	ns*

ns* = not significant

Table 1.5 Performance of entries in short - duration pigeonpea adaptation trial at two locations, in 1

Entry	Ilonga				Mlingano		
	Days to FF	Days to Maturity	Plant height (cm)	Grain yield (kg ha^{-1})	Days to FF	Days to maturity	Plant height
ICPL 87091	67	104	98.3	1250	69	127	88
ICPL 86005	63	102	95.0	2230	67	124	83
ICPL 90028	64	102	84.7	1920	69	125	71
ICPL 90029	65	104	84.3	1560	69	124	64
ICPL 90013	66	103	86.3	1210	70	126	69
ICPL 87101	64	102	91.0	1850	65	124	80
ICPL 87104	64	103	77.0	940	66	125	65
ICPL 87105	65	104	90.0	1120	66	124	84
ICPL 88027	66	104	87.7	1500	68	125	69
ICPL 87w	66	105	86.3	1750	70	127	73
ICPL 90001	61	104	82.7	1580	60	125	83
ICPL 90024	63	102	92.0	1650	66	125	71
ICPL 83024	64	104	82.3	1540	67	125	78
ICPL 87109	66	104	100.3	1630	71	125	84
KAT 60/8	74	114	100.0	1770	75	149	111
ICPL 86012	63	102	81.7	1420	65	124	61
ICPL 87115	66	104	106.0	1560	67	125	98
ICPL 90050	63	102	98.7	1540	69	125	90
Mean	65	104	90.2	1580	68	126	79
LSD $_{0.05}$	2.72	1.64	0.95	710	5.67	1.63	21.8
CV (%)	2.52	0.93	16.65	20.10	4.13	3.96	19.4

Table 1.6 Seed yields (kg ha^{-1}) of five outstanding short-duration pigeonpea genotypes 1994 - 1 several locations

Genotypes	1994	1995					1996	
	Ilonga	Ilonga	Mlingano		Naliendele	Ismani	Ilonga	Mling
			S+	M				
ICPL 86005 (B)*	2230	700	660	270	600	750	-	3270
ICPL 87091 (W)	1750	-	760	330	890	660	2500	2620
ICPL 86012 (W)	1420	610	750	270	870	750	2160	3150
ICPL 87109 (W)	1630	720	750	230	720	660	2200	2660
ICPL 87101 (B)	1850	-	930	290	830	750	2120	-
Mean	1580	560	780	300	730	640	2150	2680
S.E.±	-	0.03	0.05	ns	ns	ns	0.09	0.02
LSD(0.5)	2.72							
CV (%)	20.1	25.62	41.72	34.91	65.16	33.25	24.25	12.50

*B = Brown and W = White seeded

+ = Short rains M = Main rains

Table 2. 1. Mean grain yield and plant height of two short duration-pi
in the farmer's fields in Korogwe, Morogoro rural, and Handeni district

	Grain yield (kg/ha)			
Genotypes	Korogwe	Morogoro rural	Handeni	Korogwe
ICPL 87091	2087	223	122	135
ICPL 86005	2150	595	129	200
CV(%)	12	9	40	17
SE ±	128	19	26	15
	(P=0.6)	(P=0.001)	(P=0.7)	(P=0.002)

Table 2. 2 Mean grain yield (kg/ha) and plant height (cm) of two short duration genotypes grown in the farmers fields in five districts in Eastern Tanzania in 1998.

		Korogwe	Same	Morogoro rural		
Variables	Genotypes			Mikese	Melela	Manga
Grain yield	ICPL 87091	2254	1250	2008	950	1467
	ICPL 86005	2306	1650	1741	1300	1966
	CV(%)	13	3	5	23	53
	SE ±	135	117	141	171	351
		(P=0.06)	(P=0.007)	(P=0.09)	(P=0.15)	(P=0.5
Plant height	ICPL 87091	116	-	-	115	143
	ICPL 86005	117	-	-	104	133
	CV(%)	10	-	-	4	9
	SE ±	4.0	-	-	2.4	7.4
		(P=0.4)			(P=0.06)	(P=0.4

Table 2.3. Mean grain yield (kg/ha), plant height (cm) and days to first flower of two short duration Pigeon pea genotypes grown in the farmers' fields in five districts in Eastern Zone in 1999.

Variables	Genotypes	Korogwe		Morogoro Rural	
		Mazinde	Mtonga	Fulwe	Mangae
Grain yield	ICPL 87091	2596	533	1280	275
	ICPL 86005	2492	600	1390	662
	CV (%)	12.6	9.5	14.8	77
	S.E.	87.6	54.3	247.2	280.1
		(P=0.4)	(P=0.26)	(P=0.42)	(P=0.47)
Plant height	ICPL 87091	146.9	180.0	105.0	82.5
	ICPL 86005	128.0	169.0	109.0	91.0
	CV (%)	4.7	1.4	24.4	4.0
	S.E.	2.9	3.7	9.8	5.9
		(P=0.0001)	(P=0.03)	(P=0.82)	(P=0.2)
Days to first flower	ICPL 87091	60.2	62.3	63.0	-
	ICPL 86005	59.5	57.6	53.6	-
	CV (%)	3.7	2.5	20.0	-
	S.E.	0.7	1.4	5.6	-
		(P=0.07)	(P=0.06)	(P=0.27)	

Table 2.4. Matrix ranking of two pigeonpea genotypes as assessed by farmers in 5 dist Zone in 1997, 1998, and 1999. (Scoring scale; 0=very poor, 1=poor, 2=about 4=very good)

	1997		1998		
	ICPL 87091	ICPL 86005	ICPL 87091	ICPL 86005	ICPL 87
Criteria					
Resistant to insects	1.9*	2.4*	2.3*	2.3*	1.2
High yielding	3.6	2.9	2.5	3.0	3.3
Synchronous maturity	3.0	2.0	-	-	-
Early maturing	2.9	2.5	3.1	3.7	3.6
Marketable	3.0	2.2	3.5	2.4	4.0
Drought resistant/tolerant	3.5	3.5	2.8	2.9	3.0
Resistant/Tolerant to wilt	2.6	2.6	2.4	2.2	-
Big Seed	2.8	2.1	3.4	2.4	4.0
Palatable/tasty	3.4	2.3	3.5	2.6	3.9
Fast cooking	3.5	2.7	3.1	2.5	4.0
Seed colour	3.7	1.8	3.5	2.3	4.0
Thick soup	4.0	2.0	-	-	4.0
Enlargement upon cooking	-	-	-	-	3.0
Easy to pick harvest	-	-	-	-	4.0
Resistant to high rainfall	-	-	-	-	4.0
Easy to thresh	-	-	-	-	4.0
Heavy seed	-	-	-	-	4.0
Easy to pill when green	-	-	-	-	4.0
Good/fast germination	-	-	-	-	4.0
Overall	2.9	2.4	3.0	2.6	3.6

*mean scores pooled over farmers

Table 2.5. Farmers perception (* = % number of farmers) of the best genotype an

	1997		1998		
	ICPL 87091	ICPL 86005	ICPL 87091	ICPL 86005	ICPL 8
Dar es salaam	85*	15*	81	19	-
Korogwe	75	25	67	33	87
Morogoro Rural	-	-	50	50	85
Same	-	-	100	0.0	-
Overall	80	20	75	25	86
Reasons for selection	**	**	**	**	**
Palatable/tasty	66	6	54	0	51
Fast cooking	61	6	43	8	1
Easy to pill (when green)	0	0	11	0	0
Big seed	50	0	30	8	1
Good seed color	17	0	30	0	2
Insect resistant	0	6	16	11	3
Early maturing	22	0	19	11	2
High yielding	50	6	14	16	3
Short Plant type	11	0	8	0	0
Drought resistant	6	0	14	14	0
Heavy seed	0	0	5	0	3
Marketability	31	0	5	0	1
Synchronous maturity	0	0	0	0	3
Thick soup	0	0	0	0	7
Branches starting closer to the ground	0	0	0	0	3
Many seed per pod	0	0	0	0	3
Big pods	0	0	0	0	3
Good/fast germination	0	0	0	0	1

Total number of farmers (n): Dar es salaam 13 &16 for 1997 & 1998 respectively, Korogwe 4, 9 & 16 for 1997,19
Respectively, Morogoro rural, 10, &13 for 1998 & 1999 respectively and Same were 2 for 1998 only.

6. Farmers perception of qualities they would like to see in a short duration pigeonpea variety (Farmers criteria ction)

Criteria	1997			1998			1999		
	Korogwe	Morogoro rural	Dar es salaam	Korogwe	Morogoro	Dar es Salaam	Korogwe	Morogoro rural	Dar es salaa
High yielding	75*	-	66*	33*	30*	57*	31*	58*	
White seed	50	-	0	22	10	13	25	0	
Fast cooking	50	-	60	55	33	50	0	50	
Palatable/tasty	50	-	53	33	10	38	31	41	
Early maturing	100	-	66	100	40	69	43	58	
Insect resistant	75	-	33	22	40	50	63	33	
Synchronous maturity	50	-	0	0	0	0	0	0	
Marketable	25	-	33	22	10	0	25	0	
Big seeded	25	-	26	55	0	13	43	25	
Drought resistant	0	-	60	17	20	17	25	8	
Thick soup	0	-	13	0	0	0	0	0	
Long pods	0	-	0	0	10	0	0	0	
Short plant type	0	-	0	66	0	0	0	8	
Soft seed coat	0	-	0	0	0	0	0	0	
Disease resistant	25	-	26	0	0	25	0	8	
Easy to pick harvest	0	-	0	0	0	0	6	8	
Easy to pill (green)	0	-	0	0	0	0	0	8	
Adopted to wide range of soils	0	-	0	0	0	0	0	8	
No flower abortion	0	-	0	0	0	0	0	8	
Resistant to weeds	0	-	0	0	0	0	0	8	
Fast germination	0	-	0	0	0	0	0	8	
No. of farmers (n)	4		15	9	10	16	16	12	

*= % number of farmers