

**EVALUATION OF EARLY AND MEDIUM DURATION
COWPEA (*Vigna unguiculata* (L) Walp) CULTIVARS FOR
AGRONOMIC TRAITS AND GRAIN YIELD**

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ABSTRACT

Fifteen medium and ten short duration cowpea cultivars were evaluated in 1991, 1992 and 1993 late cropping seasons to determine their grain yields and agronomic traits. The experimental design was Randomized Complete Block (RCB) in four replicates. Significant differences were recorded for all the agronomic traits evaluated within both maturity groups. On the average, short and medium duration cowpea cultivars flowered 46 and 48 days after planting (DAP) and matured 86 and 89 DAP, respectively. Late flowering cultivars were found to have short pod filling and maturity periods in both maturity groups. Average grain yield ranged between 720 to 1160 kg/ha among the medium duration cultivars while a yield range of 606.3 to 1169.8kg/ha was recorded for the short duration cultivars across the years. Number of peduncles and pods per plant were significantly correlated with grain yield for both maturity groups.

INTRODUCTION

The grain yield of cowpea (*Vigna unguiculata* (L.) Walp) in the humid south western part of Nigeria is low.

In spite of the introduction of improved varieties, average grain yield is still as low as 200 - 400kg/ha.

Efforts aimed at increasing cowpea yield include breeding for disease resistance and drought tolerance or avoidance by breeding for early maturity. This is with a view to making them adaptive to

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different agro-ecological environments in Nigeria. Such varieties would be particularly suitable in areas with unreliable rainfall, especially in terms of total amount, distribution and duration, where crop failure is often attributed to early cessation of rains.

Late maturing cultivars may take as much as 240 days to mature, but studies on cowpea cultivars (Alofe and Amusan, 1982; Wien and Ackah, 1978) showed that some improved cultivars flowered at 62 days after planting (DAP). Yield evaluation usually involves the consideration of other characters that determine the overall performance of the cultivars. This is necessary because yield is a quantitative character and therefore is influenced by a number of traits acting singly or interacting with each other.

Agronomic traits of cowpea that contribute to cowpea growth, development and yield include number of days to 50 percent flowering, number of days to 95 percent maturity, number of peduncles per plant, number of pods per plant, pod length, seeds per pod, 100 seed weight and grain yield (Babalola, 1980 and Leleji 1981). A wide range of variations in productivity exist in cowpea and could provide basis for genetic improvement for

yield. Pods per plant, and seeds per pod were positively correlated with yield (Leleji, 1981; Doku, 1970; Ebong, 1971 and Ojomo, 1974). Breeding for increase in these traits could result in high yield. High genotypic coefficient of variability has been observed for pods per plant and yield (Pandita *et al.*, 1982); seeds per pod and yield (Singh and Hindirata (1969).

Some component traits are important for indirect selection for yield particularly if their heritabilities and expressivities are high. Evaluation of newly developed cultivars for agronomic traits and yield will provide information for cowpea breeders on those characters of the cultivars that need further improvement. The objective of this study therefore was to evaluate newly developed short and medium duration cowpea cultivars for grain yield and other agronomic traits and examine the relationships among various agronomic traits.

MATERIALS AND METHODS

This study was conducted at the Teaching and Research Farm of the University of Agriculture, Abeokuta, Nigeria (7°N, 3° 23'E). Ten short duration and fifteen medium duration cultivars, from the All Nigeria Cowpea Cultivars Multilocational Trials were evaluated

in a Randomized Complete Block Design in 1991, 1992 and 1993 late cropping seasons (8th Sept., 1991; 9th Sept., 1992 and 5th Sept., 1993). The experiment was replicated four times.

The short duration variety trial consisted of 5-row plots with a plot size of 4m x 2m (8m²). Spacing was 50cm x 20cm, with three seeds planted per hole. This was later thinned to 2 plants per stand. Each row consisted of 21 plants, giving a total of 105 plants per plot, and corresponding to 200,000 plants per hectare. The medium duration trial consisted of 5-row plots with a plot size of 4m x 2.4m (9.6m²). This trial was planted at a spacing of 60cm x 25cm, three seeds per hole and later thinned to 2 plants per stand, giving 17 plants per row or 85 plants per plot, corresponding to 166,666 plants per hectare.

The experimental site was sandy loam (sand 80%; silt 6.4%; clay 5.6%; CEC 6.2 meq/100g, and pH 5.98).

Spraying against insect pest was done four times, commencing from five weeks after planting and repeated at weekly interval. Monocrotophos (Azodrin) was sprayed at the rate of 50ml per 10 litres of water for the first, second and third sprays. Karate was used for the fourth spray at 80ml per 10 litres of water. Weeding was done manually

three times in 1991 while a mixture of Galex (100ml/10 litres of water) and Gramoxone (50ml/10 litres of water) was used in 1992 and 1993. This was supplemented with one manual weeding before maturity.

Data were collected on number of days to 50 percent flowering, number of peduncles per plant, number of pods per plant, number of seeds per pod, 100-seedweight, pod length, pod weight and grain yield. Dried pods that have turned brown within three centre rows were harvested manually to determine the pod weight and later grain yield per plot after threshing.

Data obtained were subjected to Analysis of variance (ANOVA) and the treatment means were compared using the Least Significant Difference (LSD) method. Coefficient of Variation (CV) was also calculated for the grain yield data.

RESULTS

Table 1 shows the mean values of the agronomic traits of the medium duration cultivars evaluated. Days to 50% flowering of these cultivars ranged between 46 and 49 days after planting (DAP) while days to 95% maturity ranged between 86 and 91 DAP, resulting in an average of 48 and 89 DAP for flowering and maturity,

respectively. The number of days from flowering to maturity varied from 37 days for IAR 48W to 45 days for IT 89 KD-374 (Table 1). Cultivars IT 88D - 867 - 11 produced the shortest pod (9.34cm) while K-39 produced the longest pod (12.76cm). Number of seeds per pod varied from 5.1 for

IT 88D-867 - 11 to 10.2 for IT 87D - 885. Significant differences were also recorded for number of pods per plant with IAR 48 producing highest number (30.8) while ART 91-2 produced the lowest number (7.3).

Table 1. Mean values of agronomic traits of medium duration cowpea cultivars over three period

Cultivars	Pod length (cm)	Seeds per pod	Penducles per plant	Pods per plant	100 seeds weight (g)	Days to 50% flowering	Days to 95% flowering	Maturity period (days)
IT87D-590-5	12.75	6.0	9.2	26.6	21.20	47	86	39
IAR 48	12.46	9.2	8.7	30.8	15.60	48	89	41
IT86D-957	11.35	6.4	9.6	10.2	13.80	47	89	42
IT86D-715	11.41	6.6	8.1	8.3	16.00	48	88	40
ART 91-2	10.74	7.0	6.6	7.3	12.80	49	91	42
K-39	12.76	9.7	9.1	11.6	39.70	48	91	43
IAR 48W	11.73	7.7	9.7	12.2	15.40	49	86	37
IT 89KD-434	12.55	7.7	9.9	9.9	15.80	48	90	42
IT 87D-885	11.04	7.4	11.4	13.4	17.60	48	91	43
IT 87D-1629	12.07	10.2	10.2	11.6	16.60	47	89	42
L 72	11.85	7.4	8.8	9.8	13.50	47	91	44
IT 89KD-260	11.30	5.4	8.7	9.4	19.80	47	89	42
IT 89KD-374	10.71	6.4	11.7	10.5	19.10	46	91	45
IT 88D-867-11	9.34	5.1	9.5	9.4	16.50	47	88	41
ART 91-1	12.65	9.0	8.9	9.9	16.40	47	89	42
LSD 5%	1.79	0.69	2.47	4.94	0.10	1.89	1.91	1.07

The mean values of the traits of the short duration cultivars are shown in Table 2. The cultivars flowered between 45 and 47 DAP, giving an average of 46 DAP. IT 90k - 59, IT84S - 2246, IT90k - 101, IT 86D - 721, IT 90k 261 - 3, IT 87D - 941 and IT 90k - 76

matured within 80 - 84 DAP. Their maturity ages were significantly earlier than other cultivars like IT 85D-3577, IT 86D - 719, IFL - 132 that matured in 93 days. The average number of days to maturity was 86 DAP for short duration cultivars.

The number of days from flowering to 95% maturity for the cultivars were close. This varied from 35 for IT 84S - 2246 (control) to 47 for IFL - 132 and IT 85 - 3577. The pod length of the early maturing cultivars varied from 11.86cm for IFL - 132 to 14.51 cm for IT 85D - 3577. The number of seeds per pod also varied from 5.3 for IT 85D - 3577 to 8.2 for IT 86D - 721. The number of

Pods per plant varied between 7.3 for IT 86D - 719 and 13.3 for IFL - 132. These were much lower than the number of seeds per pod (16.3) observed for IT 84s - 2246 (control). Grain yield data of medium duration cowpea cultivars across the years are shown on Table 3. The average grain yield varied from 729 kg/ha for L-72 to 1160.00 kg/ha for k-391.

Table 2. Mean values of agronomic traits of short duration cowpea cultivars over three period

Cultivars	Pod length (cm)	Seeds per pod	Penducles per plant	Pods per plant	100 seeds weight (g)	Days to 50%	Days to 95%	Maturity period
IT90K-59	12.23	7.6	10.1	11.9	13.25	46	83	37
IT85D-3577	14.51	5.3	9.7	11.8	18.75	46	93	47
IT 86D-719	12.28	6.8	8.3	7.3	14.45	47	93	46
IT 90K261-3	13-11	6.7	8.0	8.8	14.05	45	85	40
IT 87D-941-1	14.49	6.0	7.5	8.4	16.08	46	84	38
IT 90K-76	12.94	6.8	10.2	12.4	14.38	46	85	39
IFL-132	11.86	7.0	10.4	13.3	10.83	46	93	47
IT 845-2246	12.30	6.9	12.3	16.3	13.73	46	81	35
IT 90K-101	13.79	7.8	11.8	12.6	15.95	45	83	38
IT 86D 721	12.76	8.2	7.7	8.2	15.15	45	84	39
LSD 5%	1.79	1.57	4.48	6.80	1.39	1.3	5.9	0.67

Table 3. Grain yield of medium duration cowpea cultivars
Grain Yield (kg/ha)

Variety	Grain Yield (kg/ha)			Mean Kg/ha	1991, 1992, 1993
	1991	1992 ¹	1993	1991 & 1992	
IT89KD-434	664 ²	1461 ⁶	499.92 ⁷	1062.5	874.93
IAR 48	596 ⁵	1261 ⁸	485.86 ⁸	928.5	780.95
IAR-48W	435 ⁹	1006 ¹²	-	720.5	-
IT86D-957	571 ⁶	1581 ³	-	1076.0	-
IT87D-1629	432 ¹⁰	1631 ²	583.24 ⁴	1031.5	882.08
IT88D-867-11	203 ¹²	1369 ⁷	531.17 ⁶	786.0	701.06
ART 91-2	529 ⁷	1063 ¹¹	749.88 ¹	796.0	780.63
K-399KD-374	807 ¹	1513 ⁴	-	1160.0	-
IT 89KD-374	476 ⁸	1638 ¹	636.36 ³	1057.0	916.79
L-72	415 ¹¹	1025 ¹⁰	-	720.0	-
IT 86D-715	636 ³	1294 ⁷	749.88 ¹	966.0	983.29
ART 91-1	613 ⁴	1169 ⁹	546.79 ⁵	891.0	776.26
CV%	41	35	45.5		
LSD 5%	319	659	366.41		

1. The superscript are the rankings of the average grain yield

Table 4 shows the grain yield data of short duration cowpea cultivars. IT 87D - 941 - 1 recorded comparatively high yield across the years. The grain yield of cultivar IT 84s - 2246 (control) ranked 5th, 4th and 4th among the other cultivars in 1991, 1992 and 1993, respectively.

Table 4. Grain yield of early duration cowpea cultivars
Grain Yield (kg/ha)

Cultivars	Grain Yield (kg/ha)			Mean Kg/ha	Mean kg/ha
	1991	1992	1993	1991 & 1992	1991, 1992, 1993
IT90K-59	420 ⁶	1250 ⁵	600 ⁷	835.0	756.67
IT 85D-3577	325 ⁸	887.50 ⁹	-	606.25	-
IT 86D-719	554	881.25 ⁹	603.13 ⁶	717.63	603.13
IT 90K-261-3	312 ⁹	1331.25 ³	925.00 ¹	821.63	858.08
IT87D-941-1	503 ²	1218.75 ⁶	634.38 ⁵	860.88	785.37
IT90K-76	-	1168.75 ⁸	790.63 ³	-	979.69
IFL-132	485 ³	1193.75 ⁷	-	839.38	-
IT 84s-2246	436 ⁵	1256.25 ⁴	633.75 ⁴	846.13	775.33
IT 90K-101	420 ⁶	2250 ¹	839.38	1335.00	1169.79
IT86D-721	466 ⁴	1581.25 ²	-	1023.63	-
LSD%	258	956.21	403.25		
CV%	36	50.62	38.81		

The superscript are the rankings of the average grain yield for each year.

The correlation analyses among agronomic traits for the three years were similar. So, only the analysis for one year is shown (Table 5 and 6). The relationships between the agronomic traits of short duration cultivars are shown on Table 5. A highly significant positive correlation ($r=0.90$) existed between number of pods/plant and peduncles/plant. Grain yield was highly significantly correlated with peduncles/plant ($r=0.55$) pods/plant ($r=0.44$),

seeds/pod ($r=0.41$). Among the medium duration cultivars, significant positive correlations existed between peduncles/plant and pods/plant, pod length and seeds/pod, days to flowering and pod length. Grain yield in the medium duration cultivars were only significantly correlated with pods/plant and peduncle/plant, giving r values 0.27 and 0.35, respectively at 0.05 level of significance.

Table 5. Correlation between agronomic traits of short duration cowpea cultivars 1993

	Pods/length	Peduncles/ plant	Pod plant	Seeds/ pod	Days to 50% Flowering	Days to 95% Maturity	100 Seeds weight	Yield
Pod Length	1.0000							
Peduncles/ Plant	0.2840	1.0000						
Pods/Plant	0.3106	0.9019**	1.0000					
Seeds/Pod	-0.0228	0.3086	0.2671	1.0000				
Days to 50% flowering	-0.0857	-0.1339	0.1256	-0.2689	1.0000			
Days to 95% Maturity	0.1582	0.1317	0.1039	-0.1560	-0.0036	1.000	1.0000	
100 seeds, weight	0.5113	0.0715	0.0368	-0.2744	-0.0738	0.7444**	0.744	1.0000
Yield	NS	**	**	**	NS	NS	NS	1.0000
	0.1702	0.5459	0.4351	0.4114	-0.2219	-0.1819	-0.2219	0.0359

NS = **Not Significant**
***** = **Significant at 0.05 level (0.312)**
****** = **Significant at 0.01 level (0.403)**

Table 6. Correlation between agronomic traits of medium duration cowpea cultivars 1993

	Pods/ Plant	Pod Length	Peduncles/ pod	Seeds/ pod	Days to 50% Flowering Weight	100 Seeds weight	Yield
Pod/Plant	1.0000						
Pod Length	0.2264	1.0000					
Peduncle/Plant	0.6375**	0.1767	1.0000				
Seeds/Pod	0.2581	0.3605**	0.374	1.0000			
Days to 50% flowering	-0.159	0.3264**	0.2231	0.2022	1.0000		
100 seeds weight	-0.1630	0.3105*	0.1858	0.2724	0.0507	1.0000	
Yield	0.2701*	0.1651	0.03513**	0.0553	-0.1769	0.2444	1.0000

* : *Significant at 0.05 level (r=0.250)*
 ** : *Significant at 0.01 level (r= 325)*

DISCUSSION

This study showed that majority of short duration cultivars attained 50 percent flowering between 45 and 46 DAP .Whereas, medium duration cultivars attained same, two days later, between 47 and 48 DAP. This was reflected in the number of days to 95 percent maturity which was attained about 4-5 days earlier in the short duration cultivars. The differences in number of days to flowering and maturity between the two maturity groups studied appear too close for a sharp distinction in the ecological zone where this investigation was conducted.

Generally, the short and medium duration cultivars matured at about the same time, between 81 and 93. This study shows that some cultivars that flowered early

e.g. IT 89KD - 374 (46DAP) had a long grain filling and maturity period of 45 days while a late flowering cultivar like IAR 48 (49DAP) had the shortest maturity period of 37 days (Tables 1 & 2). Similar observation was noted in the short duration cultivars where IFL - 132 was among the earliest to flower but had a long maturity. period of 47 days. Similar observation was noted for IT 85D - 3577 and IT 86D - 719. Such cultivars with short maturity periods should be recommended for this location and others for locations with longer maturity periods. The average yield difference between the two maturity groups is not much. The post flowering maturity period is a major difference between

the two maturity groups because of the striking difference in the grain filling periods. Most short duration cultivars had their maturity periods 35 - 39 days after flowering except for cultivars IT 85D - 3577, IT 86D - 719 and IFL - 132 that had 46 - 47 days as their post flowering or pod filling periods. Similarly, the pod filling periods of two of the medium duration cultivars IT 87D - 590 - 5 and IAR 48W was 37 - 39 days. The pod filling period of other cultivars in the group was 41 - 45 days. Consequently, there is a need to reclassify some of the cultivars. The maturity period of the cultivars were similar. This is advantageous in that harvesting operation can be done once or twice thereby reducing labour and time traditionally spent over prolonged harvesting of Cowpea cultivars like Ife-Brown.

Generally, the differences in the earliness to flowering were not reflected in the number of pods per plant produced and on days to 95 percent maturity. Thus, IT 90k - 76 which flowered 46DAP matured 83 DAP while IT 85D - 3577 that flowered 45 DAP matured 83 DAP. This is in agreement with the observation of Alofe and

Amusan (1982) who reported that TV x 1193 - 93 which was one of the cultivars that flowered late was one of the earliest to mature. These results confirm the findings of Wien and Ackah (1978) that pod development period varied among cowpea cultivars. The average grain yield of medium maturing cultivar ranged between 776kg/ha for ART 91 - 1 to 916kg/ha for IT 89KD - 374 over the three year period. The ranking of the average grain yield over the three year period suggests that the performance of each variety differ from year to year. The best three variables differ in each year.

This study showed significant variations, among the medium duration cultivars evaluated in pod length, seeds per pod and peduncles per plant. This indicates significant varietal differences among the cultivars. Similar observations were noted by Singh and Mehndiratta (1969).

Correlation coefficients among the agronomic traits of short duration cultivars showed that grain yield had significant positive correlation with peduncles per plant, pods per plant and seeds per pod. This suggests that grain yield could be improved by selecting for these characters.

Seeds per pod was negatively correlated with seed size (measured as 100 seed weight) in both maturity groups. This association is not totally unexpected since it appears reasonable that as more seeds are produced per pod, the average seed size should decrease because of competition among seeds for food reserves. For these varieties, selection for seed size alone may likely be at the expense of seeds per pod and vice versa. Although the negative association existing between these two characters was not strong, simultaneous improvement of both traits will be made more difficult because of this unfavourable correlation.

The number of pods per plant and peduncles per plant showed significant positive correlation with grain yield for both short and medium duration cultivars, suggesting that these traits could be selected for when high yield is the objective.

Seeds per pod was significantly correlated with grain yield in short duration cultivars but negatively correlated with yield in medium duration cultivars. The relationship

between peduncles/plant and pods/plant is also worthy of note. Plants with many peduncles tended to bear more pods. The association between seeds/pods and length is significant in medium duration cultivars ($r=0.36$). This is expected as the longer the pod, the more the number of seeds. However, the relationship is not significant in short duration cultivars.

CONCLUSION

Early and Medium duration cultivars evaluated showed little differences in number of days to flowering and maturity. Late flowering cultivars were found to have a short pod filling and maturity period within both maturity groups. Such cultivars with short pod filling and maturity periods are recommendable for this location. Average grain yield ranged between 720 (L-72) to 1160 kg/ha (k - 39) among Medium duration cultivars while a yield range 606.3 kg/ha (IT 85D - 3577) to 1169.8 kg/ha (IT 90k - 101) was noted for the early duration cultivars.

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