Evaluation of Cowpea Genotypes (Vigna Unguiculata (L.) Walp) for some Yield and Root Parameters and their Usage in Breeding Programme for Drought Tolerance

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***Abstract*—**Cowpea production in water-limited environments is very often affected by constitutive genetic traits that allow maintenance of a high plant water status (dehydration avoidance) and supports yield under stress. Although high yield potential is the target of most crop breeding programs, on the other hand, high yield potential can contribute to yield in moderate stress environments. The present study was carried out at Kano University of Science and Technology Wudil Research Farm Gaya Kano State, to investigate the genetic variability of some yield and root parameters in 20 different cowpea varieties with the primary objective of evaluating biomass, and grain yield of 20 cowpea varieties. The experiment was laid out in a randomized complete block design (RCBD) and replicated three times. Traits indicative of drought tolerance during flowering and pod setting were noted and recorded. All the findings were subjected to a statistical analysis "analysis of variance (ANOVA). Two varieties ITO6K-128, IT07K-291-92 showed a significant difference (p>0.5) in terms of yield and root parameters as compared with others, this indicates its tolerance to drought. However Improved drought tolerance was attributed to simultaneous selection in well-watered environments and under carefully managed water stress at flowering and pod setting. Therefore, the two varieties can be recommended for production in drought prone areas of Kano State.

***Keywords*—** Genotypes, root parameters, breeding programme and genetic variability, Cowpea, *vigna unguiculata* [L] walp.

I. Introduction

COWPEA, *vigna unguiculata* [L] walp, is an important food legume and a versatile crop cultivated between 35 ^{0} N to 30 ^{0} S 0f the equator, covering Asia and Oceania, the middle East, southern Europe, Africa, southern USA, and central and south America[4, 14 and 25]. It is a drought-tolerant crop with better growth in warm climates, l. Cowpea has the unique ability to fix nitrogen even in very poor soil (PH range 4.5-9.0, organic matter <0.2% and a sand content of >85%). Also, it is shade-tolerant and, therefore, compatible as an intercrop with a number of cereals and root crops as well as with cotton, sugarcane, and several plantation crops. Couple with these attributes, its quick growth and rapid ground cover have made cowpea an essential component of subsistence agriculture in marginal lands and drier region of the tropics, where rainfall is scanty and soil is sandy with little organic matter. At the sometime, if early-maturing erect/semi-erect varieties are grown as a pure crop with required inputs, cowpea has the potential of yielding as high as cereals on a productivity per day basis [22] (Singh and Sharma 1996). [8]

Nigeria is one of developing countries of the world and majority of its populace depend on plant protein source. Cowpea as a legumes contain high percentage protein, however, the amount of cowpea produce in drier region of the country does not meet the protein requirement due to insufficient improved varieties available. The crop is a drought-tolerant with better growth character in warm climates. It is in line with this therefore, the project is undertaken to introduce improved cowpea varieties with high drought tolerance to the region.

The research aimed at evaluating root parameters of 20 different cowpea varieties with a view to reveal the crop ability to withstand drought conditions..

II. Material and Methods

The research was carried out at Kano University of science and Technology Wudil Farm in Gaya local government area between 2011/2012

Twenty cowpea varieties, namely, IT08K-215-2; IT07K302-10; IT4K291-35; IT7K-91-92; IT08K-243-1-5; IT08K-190-1; IT08K136-4; IT08K-193-18; IT07K-182-55; IT07K-322-40; IT07K-274-2-9; IT98K-491-4; IT07K-318-2; IT93K-4521; IT08K-187-14-1;IT08K187-38; IT08K-125-38; IT08K-126-42 IT08K266-2-1; IT06K-128; IT97K-499-35. They were all obtained from IITA Kano station. These genotypes had a wide range of variations due their different genetic background and were selected based on variability in terms of some yield and roots parameters.

The treatments were laid down in a completely randomized block design, which included 20 varieties of cowpea with three replications, making 60 entries in the experiment. Each

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replication had twenty plots of 5x1.5m size with row length of 5m and 5 numbers of rows per plot.

Germination tests were carried out to select a suitable planting material. Three seeds were planted per hole, and were later thinned to two plants per hill after germination. Plants were spaced at 75cm between rows and 20cm within rows. Weeds were controlled manually with hoe as and when necessary throughout the growing period of the crop.

N P K (10:15:15) was applied at 2 WAS and urea was applied at 4 WAS respectively. Nuvacron was applied at flower initiation while Cypermethrin was continuously applied fortnightly until pod maturity.

Harvesting was carried out at different stages of pod maturity for all the twenty varieties involved in the research work. The matured plants were harvested when most of the pods were dried. The harvested pods were sun dried; before they were hand threshed avoid damaging the seeds. [27]

Field observations were conducted and the following characters were measured and counted at maturity: yield and root parameters, plant height, number of leaves per plant, number of pod per plant, pod length, number of seed per pod, weight of 100seeds, root length, number of root/plant, root diameter, root weight number of leaves per plant. All the data collected were subjected to analysis of variance (ANOVA) according to Steel and Terrie (1985).

III. Results

The experiment was conducted to evaluate some yield and root parameters in 20 cowpea genotypes under the conditions of Kano University of Science and Technology Farm, Gaya for between 2011 and 2012 rainy seasons. The findings of the study are presented in tables 1, 2 and 3.

A significant difference at P= 0.05 was observed among all the 20 varieties (see table 1.) In terms of germination percentage. The highest seed viability was recorded in favour of variety IT98k-491-4, IT06k-128 and IT7K-187-18 and the less germination percentage was observed in variety IT08K-18714-1 and IT07K-318-2.

There was a significant difference in 18 varieties (see table 1.) in terms of number of leaves and the variety with the highest number of leaves was discovered to be variety IT08K-206-2-1. While the variety IT4K-499-35 was found to have the lowest number of leaves. The plant height among 13 varieties (table 1.) shows a significant difference (p>0.05) and variety IT07K-291-92 has the least plant height.

Also there was a significant increase in number of branches per plant with 14 varieties as indicated in (table 2) and 6 six varieties did not produce significant change in number of branches per plant. However, there was no significant difference (p>0.05) observed among all the 20 varieties (see table 2.) in terms of number flowers per plant.

A significant increase was observed among 19 varieties as indicated in (table 2.) in terms of number of pods per plant. However the highest number of pods was observed with variety IT06K-128 and the lowest number of pods was recorded in favour of variety IT98K-491-4.K.

Variety IT08K-126-42 was observed to have the highest number of seeds per pod. While the least number of seeds was recorded in favour of variety IT08K-126-42.

Similarly 18 varieties produced significant increase in 100 seed weight as indicated in (table 2.).Variety IT07K-291-921 produced the highest 100 seed weight while the least 100 seed weight was observed with variety IT07K-302-10.

Number of root per plant among 18 varieties (table 3) shows a significant difference (p>0.05) and variety IT97-K-499-35. There was a significant difference (p>0.05) among 12 varieties in terms of root length as indicated in table 3 and variety IT07K-318-2 has the least root length. All the 20 varieties (table 3) shows significant difference (p>0.05) in terms of root diameter and variety IT07K-318-2 has the lowest root diameter.

IV. Discussion

The result from the analysis of variance has shown that the mean square for genotypes were significant for some of characters studied. Large variability was observed for root length, number of root, root diameter, number of pod per plant, pod length, 100 seed weight, plant height, number of leaves, number of branches, number of flower, in descending order. As shown in (table 3) the performance of different varieties involved in the trail was significantly different for root diameters . IT07K-18718, gave significantly high mean. As reported by Karkannava et – al (1991) []roots with high diameters are drought tolerance.

TABLE 1
THE QUANTITATIVE CHARACTERS OF 20 COWPEA VARIETIES

Variety	germination %	No, of leaves	plant height
IT08K-215-2	4.40	94.8	44.53
IT07K-302-10	96.80	87.8	43.30
IT4K-499-35	91.47	73.0	41.13
IT07K-291-92	88.00	78.8	40.47
IT08K-243-1-5	96.27	89.5	44.27
IT08K-190-1	87.47	91.7	46.87
IT08K-136-4	91.20	81.9	47.83
IT08K-193-18	93.87	91.5	48.17
IT07K-187-18	98.40	92.5	45.33
IT07K-322-40	89.33	88.6	55.17
IT07-274-2-9	93.60	89.8	44.30
IT98K-491-4	100.00	88.2	54.47
IT07K-318-2	87.47	84.7	45.40
IT93K-452-1	90.93	79.7	54.90
IT08K-187-14-1	86.93	97.5	47.00
IT08K-125-38	93.60	83.9	51.63
IT08K-126-42	91.20	92.3	52.33
IT08K-206-2-1	89.87	109.3	54.27
IT06K-128	9.47	94.9	49.80
IT97-K-499-35	95.47	98.2	53.43
L s d	2.602	NS	NS
SE±	1.285	15.86	6.072

P>0.05

The wide range in the data observed for most of the traits and the significant mean square obtained have shown the presence of genetic variability for the traits studied. This indicates that these traits can be improved through breeding. High genetic variation was obtained for 100seed weight, number of pod per plant and number seed per pod. As shown

in (table 2). The performance of different varieties involved in the study was significantly different in relation to grain yield. IT06K-128, IT07K-291-92 gave significant different in number of pod per plant and 100seed weight and higher plant mass of plant than the other varieties. In the other hand IT98K-49-4 was found to give the significant different for percentage germination as indicated in (table 1). This suggests that selection for these characters would be effective for further selection and improvement. Ogunbodede and Fatula (1985) [, 1 and 2] who reported high broad sense heritability the level of genetic variability observed for different characters would be useful for breeding varieties of cowpea for high yield.

TABLE II
THE YIELD PARAMETERS IN 20 COWPEA VARIETIES

Varieties	NB	NF	NP/plant	NS/pod	W100seed	PL
IT08K-215-2	34.20	13.4	122.7	10.10	18.17	15.10
IT07K-302-10	37.73	13.5	146.7	10.03	15.07	15.93
IT4K-499-35	38.17	14.5	99.3	9.57	19.23	14.30
IT07K-291-92	32.10	13.6	164.7	10.30	21.73	15.40
IT08K-243-1-5	41.93	15.8	140.0	10.67	15.37	15.87
IT08K-190-1	36.07	15.3	134.3	9.17	15.53	14.77
IT08K-136-4	39.43	17.8	157.3	10.50	16.20	16.50
IT08K-193-18	43.67	16.9	132.7	9.07	18.70	15.93
IT07K-187-18	39.07	13.2	139.7	10.17	17.80	14.07
IT07K-322-40	41.97	16.0	110.3	8.97	15.67	15.83
IT07-274-2-9	37.80	13.9	150.0	10.37	17.80	15.43
IT98K-491-4	39.23	21.7	214.7	9.57	18.47	17.63
IT07K-318-2	40.43	13.3	123.6	10.33	19.23	15.47
IT93K-452-1	33.87	20.6	85.0	9.87	17.07	15.67
IT08K-187-14-1	36.07	17.4	136.3	10.07	16.50	14.70
IT08K-125-38	37.97	14.0	159.3	10.70	19.10	16.30
IT08K-126-42	40.53	13.8	168.7	8.73	15.43	16.03
IT08K-206-2-1	37.53	18.5	197.0	10.07	17.57	13.77
IT06K-128	41.70	25.9	238.7	9.63	21.27	14.40
IT97-K-499-35	41.87	21.3	151.0	10.03	17.67	15.27
L s d	NS	NS	51.63	NS	1.96	NS
SE±	3.933	26.23	25.50	1.050	0.969	1.075

P>0.05
Key:
NB = Number of branches
NF =Number of flowers
NP =Number of pods
NS =Number of seeds
PL =pod length

TABLE III
THE VARIABILITY OF ROOT PARAMETERS OF 20 COWPEA VARIETIES

Varieties	No of root	root length	root diameter
IT08K-215-2	38.80	12.90	2.067
IT07K-302-10	27.51	14.20	4.133
IT4K-499-35	28.08	12.87	3.500
IT07K-291-92	33.21	15.97	2.200
IT08K-243-1-5	29.90	13.87	4.233
IT08K-190-1	41.31	14.50	3.800
IT08K-136-4	21.54	17.20	1.500
IT08K-193-18	30.20	14.30	2.000
IT07K-187-18	37.16	15.77	4.600
IT07K-322-40	28.12	17.83	3.000
IT07-274-2-9	34.40	15.40	2.233
IT98K-491-4	31.20	13.47	4.333
IT07K-318-2	20.80	12.00	3.500
IT93K-452-1	16.40	15.50	4.500
IT08K-187-14-1	19.70	14.33	2.167
IT08K-125-38	27.60	15.67	3.333
IT08K-126-42	15.00	12.83	2.933
IT08K-206-2-1	26.32	15.17	3.333
IT06K-128	17.30	16.03	2.500
IT97-K-499-35	14.40	13.97	3.500
L s d	NS	NS	0.721
SE±	3.087	2.627	0.356

P>0.05

V. CONCLUSION

The experiment was conducted at Kano University of science and Technology Wudil Research Form Gaya Kano State during the 2012 wet season to study the genetic variability of some yield and root parameters of 20 cowpea varieties. All 20 varieties treated under the same condition revealed the potential of producing high grain yield. However ITO6K-128, ITO7K-291-92 performed better than the other varieties in term of number of pod per plant and 100 seed weight. On the other ITO7K-18718, has significant highest root parameter an indication of drought tolerance. Therefore it can be concluded that ITO7K-18718 is the best suited variety to the area in terms of some drought tolerance. While for higher yield varieties IT06K-128, IT07K-291-92 and IT98K-491-4 were discovered to be more productive in term of seed viability and grain yield. Therefore these varieties can be recommended to farmer in the area for boosting Agricultural production.

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