Bayero Journal of Pure and Applied Sciences, 6(1): 35 – 39
Received: January 2013
Accepted: May 2013
ISSN 2006 – 6996

THE EFFECT OF DIFFERENT LIGHT INTENSITIES (%) ON THE GRAIN YIELD COMPONENTS OF SOME VARIETIES OF COWPEA [(*Vigna unguiculata* (L.)(Walp)]

***[1]Fagwalawa L.D. and [2]Yakasai, M.T.**
[1]Department of Biology, [2]Department of Agricultural Economics and Extension, Kano University of Science and Technology, P.M.B 3244, Wudil, Kano, Nigeria
*Correspondence author

ABSTRACT
Nine varieties of cowpea [(Vigna unguiculata (L).(Walp)]belonging to 3 different maturing group namely, IT88DM345, IT89KD455, IT93K452-1 for early maturing group, Danila, IT90K277-2, IT89KD391 for medium maturing group and IAR 1696, Kannando, IT89KD288 for the late maturing group were grown under different light intensities (20%, 40% and 100%). The yield of the different varieties was assessed. All the varieties had greater yield at 100% followed by 40% and lastly 20%. However some varieties showed higher potential to produce more grain yield components under 20% light intensity than others. IT93K452-1, Danila, IT89KD391 and IT89KD288 showed higher grain yield component under 20% light intensity than others. Variety IAR 1696 did not produce pods under 40% and 20% light intensities. Kannannado did not produce pod under 20% light intensities.
Keywords: cowpea, light intensity, intercropping, yield, component.

INTRODUCTION

Cowpea *(Vigna unguiculata*(Walp) is an important food legume supplementing protein uptake in the majority of the populace that cannot afford taking expensive animal protein. Taking cowpea as food at least 3-4 times a week saves people from risk of heart and related diseases (Brazzino, 2002). The cultivation of cowpea dates back to ancient time started as inter crop with cereals (Blade *et al.,* 1997). Nowadays, majority of farmers practice intercrop farming system in cowpea production. The intercropping has become the cultural heritage of farmers and therefore it is difficult to stop them from the practice. Additional reasons are lacks of enough land to allow sole cropping and the fear of total failure.

Cowpea is a versatile crop cultivated between latitude 35^0N to 30^0S of the equator covering Asia and oceanic, Middle East, South Europe, Africa, Southern USA, Central and South America (Perino*et al*., 1993). The United States is the only developed country producing large amount of cowpea (Henshaw, 2008) Its ability to tolerate drought makes it a popular crop of semiarid regions of the tropics where other food legumes do not perform as well.

Nigeria is one of the world leading cowpea producing countries. Cowpea is unique in nitrogen fixation in the soil and does well even in very poor soils with pH range of 4.5, 9.0, organic matter <0.2% and a sand content of <85% (Singh and Sharma, 1996). It is a shade tolerant plant and can do well as intercrop with a number of cereals. It has different maturing varieties to conform to the needs of the farmers as well as to capacitate them for onward cultivation of other crops throughout the growing season. The grain yield production in the cowpea is affected by the intensity of competition in space, soil resources and light utilization. Dutta (2003) reported that light is very a important factor that is responsible for formation of chlorophyll, carbon assimilation and transpiration. As majority of the cowpea farmers grow it under intercrop, light becomes one of the limiting factors in the cowpea production. It is in view of this limiting factor, that this research was carried out with the aim of assessing the grain yield components of different cowpea varieties under different light intensities with the objectives that variety (ies) that produce high yield components under low light intensity will be identified for use to farmers in intercropping.

MATERIALS AND METHODS

The cowpea seeds were obtained from international institute of tropical agriculture (IITA), Kano. They were cleaned by removing broken ones, and those infested from other storage weevils like bruchids using sieving and hand picking. The cleaned seeds were planted under randomized complete block design. The planting was done on prepared blocks (plots)following rainfall which sufficiently moistened the soil (moisture depth of 3-10cm), for each variety, the seeds were planted at the rate of three seeds per hole at a conventional depth of 2-3cm. The planting was done on plots under 100%, 40% and 20% sunlight intensities. The block (plots) were labelled as block 1,2, and 3. Block 1 was under 100% light intensity and comprised of 9 sub plots (labelled as subplot 1 – 9(a)). Block 2 was under 40% light intensity, also comprised of 9 sub-plots 1 -9(b)). Block 3 was under 20% light intensity and comprised of 9 sub plots (labelled as subplot 1 – 9(c)).

The cowpea were planted in order of early maturing, medium maturing and late maturing cowpea variety in Block 1, medium maturing, late maturing early maturing cowpea varieties in Block 2 and early maturing, late maturing and medium maturing cowpea varieties in block 3. Wooden pegs were used in digging the holes and labelling the respective cowpea varieties, block and subplots planting spacing was maintained at intervals of 20cm between plants stands on ridges.

DETERMINATION OF GRAIN YIELD COMPONENTS

A total of 6 plot each comprising of 9 subplots measuring $9m^2$ each were used. At maturity, five cowpea plants from each variety and light intensity were randomly selected and the pods harvested, the average pod number was taken as pod/plant. Number of seeds/pod was obtained by breaking 10 pods to release the seeds content and by taking the average number of seeds. For the total number of pods and seeds and the seed weight per plot, pods from all the cowpea plants in each variety and light intensity in the 2 subplots each of $9m^2$ were harvested, counted and weighed. There, the pods were broken to release the seeds content which were counted and weighed.

The overall results were analysed using analysis of variance (ANOVA) through program of Genstat 5 second edition for windows computer analysis.

RESULTS

The results obtained showed that the grain yield components in all the varieties were higher under 100% intensity followed by 40% and lastly 20% intensity (Table 1-6).

Under 20% light intensity varieties of 452-1 from early maturing, Danila and 391 from medium maturing and 288 from late maturing showed higher grain yield components. Varieties 1696 and Kanannado did not produce any pod under 20% light intensity. Under 40% light intensity, 452-1 from early maturing, Danila medium maturing and Kanannado from late maturing showed higher pod/plant while 345 and 455 from early maturing, 277-2 from medium maturing and Kanannado from late maturing showed higher seed/pod. Variety 1696 failed to produce pod under 40% light intensity. Mean number of pods produced under 40% was higher in 345, 277-2 and 288, while mean seed number was higher in 452-1, Danila and Kanannado varieties 452-1, 277-2 and showed higher pod and seed dry weight under 40%. Pod and seed dry weight under 100% were higher in 345, 277-2 and 1696. Total number of pod was found to be higher in 345, 277-2 and 1696 while total number of seed was higher in 345, Danila and 1696 under 100% light intensity.

Pod/plant production was higher in 345, Danila and 1696 while seed/pod was higher in 345, 277-2 and Kanannadounder 100% light intensity (Tables 1, 2, 3, 4, 5 and 6). The statistical analysis confirmed level of differences in teraction between the varieties and the system and between the varieties themselves. The level of difference was obtained at 1 % level of probability, therefore, the result of the analysis revealed L.S.D at 1% level SED and CV**%.**The result of the pod/plant was not found significant (P≤.001) of all level of interaction. The seed/pod was found to be significantly different at all level of interactions (P.≥001). With regards to number of pods and number of seeds significant differences occurred at the number of interaction between systemised varieties (P.≥001) while for pod and seed weight interaction between systems and varieties did not show significant difference (P≤.001).

Table 1: Number of pod/plant of cowpea varieties as affected by the changing light percentages

Different light intensities %			
Variety	**100**	**40**	**20**
IT88DM345	10.5	2.00	1.00
IT89KD455	11.0	4.00	1.00
IT93K452-1	10.0	6.00	2.50
Danila	9.50	5.50	2.00
IT90K277-2	8.50	4.50	1.00
IT89KD391	5.50	5.00	2.00
IAR 1696	2.50	0.00	0.00
Kannanado	2.00	2.00	0.00
IT89KD288	3.00	1.50	1.00
Mean	6.94	3.39	1.28
Grand Mean	3.87	8	
Lsd = 4.328	S.E = 2.204	CV% = 56.9	

Table 2: Number of pods produced of some cowpea varieties at different light intensities.

	Different light intensities %		
Variety	**100**	**40**	**20**
IT88DM345	51.00	20.50	15.00
IT89KD455	50.00	19.00	8.00
IT93K452-1	42.50	18.00	16.00
Danila	36.50	22.00	25.00
IT90K277-2	60.50	25.50	10.50
IT89KD391	53.00	22.50	13.00
IAR 1696	118.00	0.00	0.00
Kannanado	108.00	6.50	0.00
IT89KD288	87.00	9.50	8.50
Mean	67.40	15.00	10.90
Grand Mean	31.40	8	
Lsd = 1.7075	S.E = 0.2724	CV% = 83.3	

Table 3: Number of seed/pod produced by the cowpea varieties as affected by the changing light percentages

	Different light intensities %		
Variety	**100**	**40**	**20**
IT88DM345	8.50	6.50	4.50
IT89KD455	5.00	6.50	6.00
IT93K452-1	6.00	6.00	6.50
Danila	6.50	6.50	5.00
IT90K277-2	7.50	8.00	5.00
IT89KD391	8.50	6.50	6.50
IAR 1696	8.50	0.00	0.00
Kannanado	8.50	7.00	0.00
IT89KD288	9.00	4.50	4.50
Mean	7.56	6.28	4.44
Grand Mean	3.87		
Lsd = 4.534	S.E = 2.332	CV% = 55.995	

Table 4: Number of seed of some cowpea varieties at different light intensities

	Different light intensities %		
Variety	**100**	**40**	**20**
IT88DM345	449	155	47
IT89KD455	317	125	45
IT93K452-1	279	195	92
Danila	404	142	118
IT90K277-2	311	116	56
IT89KD391	312	140	84
IAR 1696	102	0	0
Kannanado	825	46	0
IT89KD288	830	43	36
Mean	528	107	54
Grand Mean	3.87		
Lsd = 431.1	S.E = 221.1	CV% = 96.30	

Table 5: Mean pod dry weight (g) produced by the cowpea varieties as affected by the changing light percentages

	Different light intensities %		
Variety	**100**	**40**	**20**
IT88DM345	58.10	17.40	11.00
IT89KD455	39.30	13.90	5.00
IT93K452-1	52.80	20.70	15.80
Danila	75.60	23.00	22.00
IT90K277-2	93.50	39.40	9.90
IT89KD391	29.80	20.70	13.30
IAR 1696	301.80	0.00	0.00
Kannanado	215.00	10.00	0.00
IT89KD288	177.10	7.60	7.00
Mean	116.00	17.00	9.50
Grand Mean	3.87		
Lsd = 96.15	S.E = 47.75	CV% = 100.5	

Table 6: Mean Seed Dry Weight (g) produced by the cowpea varieties as affected by the changing light percentages

	Different light intensities %		
Variety	**100**	**40**	**20**
IT88DM345	42.80	13.60	4.70
IT89KD455	28.90	9.80	2.80
IT93K452-1	40.90	29.80	12.80
Danila	56.50	17.00	15.70
IT90K277-2	74.90	29.90	7.80
IT89KD391	64.10	17.10	11.30
IAR 1696	252.00	0.00	0.00
Kannanado	163.00	9.70	0.00
IT89KD288	147.70	6.10	5.50
Mean	96.70	14.80	8.50
Grand Mean 40.00			
Lsd = 74.44	S.E = 37.78	CV% = 94.40	

DISCUSSION

The reduction of grain yield in the cowpea varieties under 20% and 40% light intensities is in conformity with findings of Singh et al., (1997) who reported that effect of shading is most serious in the branch initiation stage delaying and reducing the number of branches, since the leaves which become the source and pods which become the sink grow on the branches, the final grain yield in the shaded cowpea plant is reduced. The literature also reported that shading in the grain filling stage reduces final seed yield. The cowpea under intercropping produces a reduced grain yield (Perino et al., 1993).Dutta (2003) also reported that light is very important factor that is responsible for the formation of chlorophyll, carbon assimilation and transpiration. The significance of the research also goes along way in showing the implication of reduced light intensities in the intercropping system. It is obvious that intercropping system of 1:1 (one row of cereal for one row of cowpea) reduces more light reaching the cowpea plant than system of 2:2, 1:4 and 2:4, this is because the roofing provided by the cereals leaves onto the cowpea plant is more intensified in the system of 1:1 due to the closeness of the cereals stand and their leaves. Farmers faced with shortage of land, fair to total failure should adopt system of cropping (intercropping) that minimizes light competition or allows sufficient utilization of light by the cowpea partner as well.In conformity, Blade et al., (1997) reported 2:4 systems as to have found solution to problems of root and shade competition giving high yield for both plants. Therefore the systems of 2:4 and 1:4 are the best systems of cropping for the cowpea production under intercropping.

Varieties like IT93K452-1, Danila, IT89KD391 and IT89KD288 showed adaptation for grain yield production under reduced light intensity and are recommended for intercropping.

CONCLUSION

In conclusion, reduced light intensities reduces cowpea grain yield. It could be recommended that varieties IT93K-452-1, Danila, IT89KD391 and IT89KD228 are best for cultivation under shade or intercropping while varieties IT88DM455, IT89KD455, IT90K277-2, Kanannado and IAR1694 are best for cultivation in open places or sole cropping.

REFERENCES

Blade, S.F., Shetty, V.R., Terao, T. and Singh, B.B. (1997). Recent development in cowpea cropping systems research In: Advances in cowpea production. (eds)

Brazzino, A.L. (2002): Daily Trust of Tuesday, 4th December, 2002. 2 (85):27

Dutta, A.C. (2003) Botany for Degree Students. Revised edition published in India PP.291, 292 & 293

Henshaw, F.O (2008) Varietal differences in physical Characteristics and proximate composition of cowpea (*Vigna unguiculata*) *World J. Agric. Sci* 4(3)

Perino, P.T., Shagurosky, M., Esquivel, H.w. and Hammer, K. (1992): The Cultivated races of V. unguiculata in Cuba. Feddes Bulletin, 35:28-31.

Singh, B.B., Mohan, R., Daniel, K.E. and Kackain, L.E.N. (1997): Advances in cowpea production. (eds) IITA, Ibadan, Nigeria and Japan International Research Centre for Agricultural Science (JIRCAS), Tsukuba Ibraka, Japan. 31:240-247.

Singh, B.B. and Sharma, B. (1996): Restructuring cowpea for higher yield. *Indian Journal of Genetics*, 56:389-405.