Effects of Sowing Dates on the Growth and Yield of Cowpea Varieties in Minna, Southern Guinea Savanna of Nigeria.

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Abstract
With climate change being experienced in recent times, there is the need to determine the most appropriate time to plant cowpea in the Guinea savanna agro-ecological zone of Nigeria which account for the major production of the crop in the country. A field trial was therefore conducted to determine the effect of sowing dates on the growth, biomass and grain yield of cowpea in Minna, the Southern Guinea savanna agro-ecological zone of Nigeria. The treatments consisted of nine sowing dates (planting at 2 weekly intervals from 19th May to 8th September, 2017) and three cowpea varieties (IT93K-452-1, Oloyin and Kanannado). Results obtained revealed that plants sown between 19th May and 28th July had significantly larger leaf area than those sown later. Plants sown on 2nd June had the highest number of branches which was at par with the value recorded in those sown on 19th May and 16th July. Plants sown on 28th July had the highest number of leaves while plants sown between 19th May and 2nd June had the longest vines. The widest stems were observed in plants sown on 19th May and they were significantly wider than the stem of plants sown after 14th of July. The least values for all the growth attributes were recorded in plants sown on 8th September. Kannanado and Oloyin plants sown on 19th May produced the highest biomass yield while IT93K-452-1 variety produced the highest biomass yield when sown on 2nd June. Kanannado variety had the highest grain yield when sown on 28th July. Oloyin and IT93K-452-1 varieties had their highest grain yield when sown on 19th May and 1st July. Significantly lower grain yield was obtained in the three varieties when sown after 11th August. Among the varieties, Kanannado had the highest biomass yield but the least grain yield while IT93K-452-1 had the highest grain yield.

Key words: *planting dates, cowpea varieties, growth, biomass yield, grain yield*

INTRODUCTION

Cowpea (*Vignaunguiculata* L. Walp.) is an important grain legume and a long time valued constituent of the traditional cropping systems in the semiarid tropics (Van Ek*et al*., 1997; Ayisi*et al*., 2000). It is an important food source in the tropics in general and Nigeria in particular, a valuable crop for farmers economic wellbeing (Ajetomobi and Abiodun, 2010). One of the most important factors determining the yield of cowpea is the right sowing date. In general, climate parameters such as temperature, rainfall, day length, wind, and non-climate factors such as pests, diseases, weeds, birds, economy of production are effective in selecting appropriate sowing date (Mazaheri and Majnoon, 2005). Of all these, rainfall is the major determinants of sowing dates in West Africa agriculture which is mainly rain fed. However, climate change facing the whole world and affecting Africa more seriously is changing rainfall pattern and shortening growth season to the extent that area earlier suitable for growing a particular crop may no longer be suitable (Lane and Jarvis, 2007). During the last 30 years, the climate of the West African Sahel has undergone various changes, especially in terms of rainfall (Van Duivenbooden*et al*., 2002; Roudier*et al*., 2011). As such, West Africa agriculture which is mostly rain fed is most vulnerable to the impact of climate change. Nigeria is one of the largest producer and consumer of cowpea which is mostly produced in the savanna region of the country. Farmers in this region are used to the traditional planting date of planting their cowpea just before dry

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season sets in; this has not been delivering the expected yield. The potential yield of the crop is 1.50 – 3.00 t ha^{-1} depending on the variety (Asiwe, 2007) but yield obtained by farmers in Nigeria is averaged at 450 kg ha^{-1}(Omotosho, 2014). Inappropriate planting date has been identified as one of the factors responsible for the low yield obtained on farmer's field (Kyei-Boahen, 2017).This has a devastating consequences for the poor-resource farmers who depend mainly on rain fed agriculture (Van Duivenboodenet *al*., 2002). Production of cowpea was predicted to fall up to 30% by 2025 (Van Duivenbooden*et al*., 2002).Various strategies should be employed to lessen this potential loss and increase the productivity of the crop. In a research by Ajetomobi and Abiodun (2010), earlier sowing date beyond traditional dates was suggested. This is already a pointer to the fact that planting cowpea close to onset of dry season may not be the best. Asante *et al*., (2001) investigated the impacts of sowing dates in reducing yield losses due to insect attack in the Northern Guinea Savanna of Nigeria. The authors reported that elite cowpea lines had higher grain yield when planted between mid-June and mid-July without insecticide protection, whereas a local variety included in the study produced higher grain yield when planted between late July and early August. Determining the best sowing date for cowpea in the face of climate change with cultivar and location specific information will secure Nigeria's relevance as one of the major producer of cowpea. This study was therefore carried out to determine the effects of sowing dates on the growth and yield of cowpea varieties (with different maturity period) in Minna, southern Guinea savanna agro ecological zone of Nigeria.

MATERIALS AND METHODS

The experiment was carried on a farmer's field in Minna, southern Guinea savanna agro ecological zone of Nigeria. The geographical positioning system (GPS) value of the farm is N $09^0 31.203$ and E $06^0 27.678$. It was a factorial combination of nine planting dates (planting at two weeks interval) viz: 19th May, 2nd June, 16th June, 1st July, 14th July, 28th July, 11th August, 25th August, and 8th September and three cowpea varieties viz: Kanannado (late maturing), Oloyin (medium maturing) and IT93K-452-1 (early maturing). The 18 treatment combinations were laid out in a randomized complete block design with three replications. Plants received 20 kg P ha^{-1} and 20 kg K ha^{-1} at planting using single super phosphate and muriate of potash as the sources respectively. The gross plot size was $11.25m^2$ (3.75 x 3m) while the net plot size was $6.75m^2$. Data were collected from the net plot. Intra and inter-row spacing of 20 x 75cm was maintained except for Kanannado variety in which 30 x 75cm was maintained because it was a prostrate variety. Data were collected on number of leaves, vine length, stem diameter, leaf area at 7 weeks after planting, number of branches, shoot biomass and below ground biomass yield at 50% flowering and pod yield, number of seed per pod, pod length, 100 seed weight, shelling percentage and grain yield at maturity. Meteorological data were obtained from the Geography Department, Federal University of Technology, Minna.

Data collected on all parameters were subjected to analysis of variance using statistical analysis system (SAS) and means were separated using Duncan Multiple range test at P=0.05

RESULTS

Effect of planting dates on the growth attributes of three cowpea varieties

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Plants sown on 28thJuly had significantly higher number of leaves (78.73 leaves) followed by those sown between 2nd of June and 1st July (48.34 - 50.50 leaves). From 11th July, number of leaves reduced significantly as the planting date advanced with the least recorded in plants sown on 8th September (19.66). Kanannado variety produced significantly higher number of leave (54.76 leaves) compared to Oloyin (50.06 leaves) and IT93K-452-1 (50.17 leaves) varieties that were statistically at par (Table 1).

The leaf area of plants sown on 19th May, 2nd June, 1st and 14th of July were similar (183.49 – 196.34 cm^2) but significantly higher than those obtained in the remaining sowing dates. Leaves of plants sown between 11th August and 8th September were the smallest (82.80 - 92.77 cm^2). Though Kanannado leaves were larger, there was no significant difference between leaf area of the three varieties at 7 WAS (Table 1).

Plants sown on 2nd of June produced the longest vine (219.10 cm). This was followed by those sown on 19th May and 11th August which had similar vine length (172.93 and 176.34 cm respectively). The shortest vine was recorded in those planted on 8th of September (38.11 cm) Kanannado variety had the significantly longest vine (130.15 cm) and the values obtained in Oloyin (115.05 cm) and IT93K-452-1 (112.85 cm) were at par (Table 1).

Plants sown on 19th May, 2nd June, 16th June and 14th July had similar but statistically higher stem diameter (1.56 cm) compared to those sown from 28th July up to 8th September. There was no significant difference between the stem diameters of the three varieties (Table 1).

Plants sown on 2nd June, 19th May and 16th June produced similar but significantly higher number of branches compared to the number of branches recorded in plants sown on 8th September. Kanannado variety produced significantly higher number of branches compared to those of Oloyin) and IT93K-452-1 that were at par (Table 1).

Effect of planting dates on the biomass yield of three cowpea varieties

Figure 1 shows the interaction effect of planting date and variety on shoot biomass yield of cowpea. Kanannado variety had the highest biomass yield (15 t ha^{-1}) when planted on 19th May. This was followed by the yield obtained in plants sown on 1st July (10.63 t ha^{-1}) which was at par with the shoot biomass yield obtained in plants sown on 16th June (8.65 t ha^{-1}). Plants sown between 11th August and 8th September had the least biomass yield (1.04 - 2.92 t ha^{-1}). Oloyin variety sown between 19th May and 16th June had significantly higher biomass yield (5.61 – 7.97 t ha^{-1}) than those sown between 14th July and 8th September which had similar low shoot biomass yield (1.11 – 2.99 t ha^{-1}). IT93K-452-1 plants sown on 2nd June had the highest shoot biomass yield (8.72t ha^{-1}). This was at par with the value obtained in plants sown on 19th May (8.03 t ha^{-1}). IT93K-452-1 plants sown after 1st July had similar low shoot biomass yield (1.15 - 3.53 t ha^{-1})

Table 2 shows the below ground biomass weight of three cowpea varieties sown at different planting date. In Kanannado variety, plants sown on 2nd June had the highest below ground biomass weight (15.02 g/plant) which was at par with the value recorded in plants sown on 19th May (14.64 g/plant) and 28th July (11.84 g/plant). The value recorded in plants sown between 16th June and 14th July were intermediate and similar (8.86-10.38 g/plant). The least values in Kanannado variety was recorded in plant sown on 8th September (1.70 g/plant) which was at par with the value recorded in plants

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sown on 25th August (4.88 g/plant) and 11th August (3.52 g/plant). In Oloyin and IT93K-452-1 varieties, plants sown on 19th May, 2nd June and 1st July had the highest below ground biomass yield compared to plants sown between 14th July and 8th September which had similar but lower below ground biomass yield. In the three varieties, plants sown on 8th September had the least below ground biomass yield.

Effect of planting dates on the grain yield attributes of three cowpea varieties

Generally, plants sown on the 25th August produced the longest pods (16.48 cm). This was however at par with values obtained in other planting dates except those planted between 16th June and 14th July which had the shortest pods (13.40 – 14.74 cm). Pods of Kanannado variety were the longest (16.65 cm) and the values obtained in Oloyin (14.92 cm) and IT93K-452-1 (14.71 cm) were at par (Table 3).

Plants sown on 19th May, 2nd June, 16th June, 28th July, 11th August 25th August and 8th September produced significantly heavier seeds compared to those sown on 1st and 14th July. Kanannado seeds were the heaviest (19.77 g). This was followed by Oloyin seeds (16.50 g) and IT93K-452-1 that had the least weight. (13.87 g) (Table 3).

Plants sown on 2nd June had the highest shelling percentage (32.75 %). This was followed by plants sown on 11th August (25.76 %) which had similar values with the shelling percentage obtained in plants sown on other planting dates except those sown on 19th May which had the least value (17.23%). There was no significant difference between the shelling percentage of the three varieties (Table 3).

Plants sown on 19th May, 2nd June, 16th June, 1st July, 28th July and 11th August produced similar but higher pod yield (kg ha^{-1}) compared to those sown on other dates. The least pod yield was obtained in plants sown on 25th August and 8th September (449.0 and 505.0 kg ha^{-1} respectively). IT93K-452-1 variety had the highest pod yield (1,637.5 kg ha^{-1}), followed by Oloyin (1,261.4 kg ha^{-1}) and Kanannado variety had the least pod yield (508.7 kg ha^{-1}) respectively (Table 3).

Plants sown on the 19th May, 16th June, 1st July, 28th July and 11th August, produced similar but higher grain yield (kg ha^{-1}) compared to those sown at other dates. IT93K-452-1 variety produced significantly the highest grain yield (1,257.90 kg ha^{-1}) followed by Oloyin (975.34 kg ha^{-1}) and Kanannado had the least (389.22 kg ha^{-1}) (Table 3).

Figure 2 shows the interaction between planting date and variety on grain yield of cowpea. In Kannanado variety, plants sown on 28th July had the highest grain yield (997.99 kg ha^{-1}). The value was at par with the grain yield of plants sown on 11th August (637.34 kg ha^{-1}). The least grain yield in Kanannado variety was obtained in plants sown on 14th July (114.94 kg ha^{-1}) which was at par with the grain yield of plants sown on 19th May, 1st July, 25th August and 8th September. Oloyin variety sown on 19th May had the highest grain yield (1506.11 kg ha^{-1}) and the value was at par with the grain yield obtained in plants sown on 1st July, 16th June, 14th July and 11th August. The least grain yield in Oloyin variety was obtained in plants sown on 8th September (365.15 kg ha^{-1}) which was at par with the value obtained in plants sown on 25th August (429.67 kg ha^{-1}). In IT93K-452-1 variety, plants sown on 19th May had the highest grain yield (2013.50 kg ha^{-1}) which was at par with the value obtained in plants sown on 1st July (1927.11 kg ha^{-1}). The least grain yield in IT93K-452-1 variety was obtained in plants sown on 25th

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August and 8th September (486.79 and 570.82 kg ha^{-1} respectively).

DISCUSSION

The significantly lower biomass and grain yield obtained in the three varieties at late sowing (25th and 8th September) in this study could be attributed to the lower amount of rainfall the plant sown late received. Plants sown on August 25th received 208 mm rainfall and those sown on 8th September received lesser amount. This is low compared to the minimum of 400 mm and well distributed rainfall required for optimum growth and productivity of cowpea. Rainfall stopped early in 2017 cropping season with the last rainfall experienced on October 19th in the study area compared to earlier years where rainfall was still experienced till November. This confirms that climate change is becoming a serious threat to crop productivity even in the study area. Morakinyo and Ajibade (1998) asserted that both the amount and distribution of rainfall affect the productivity of cowpea. This could be a pointer to farmers in the southern guinea savanna that the traditional practice of planting cowpea late (till September) may not be worthwhile again. Ezeaku*et al*. (2015) confirms that climate change has caused significant modification of cropping seasons in different regions. The results obtained in this study corroborates the findings of Ezeaku*et al*. (2015) who reported that late planting dates of cowpea gave significantly lower yield than early planting date in the derived savanna of Nigeria. Yannick *et al.* (2014) similarly reported that late sowing led to slower growth and lower yield of cowpea. Mojaddam and Nouri (2014) reported that delay in sowing of cowpea decreased the length of vegetative and reproductive growth stages and reduces the grain yield of cowpea. Sreelatha *et al.* (1997) attributed the decrease in grain yield obtained in delayed sowing to the fact that plants' vegetative stage faces intense heat of the season which resulted in decreased vegetative growth stage, production of fewer vegetative organs, decreased assimilation, early flowering, increased in loss of flowers and infertility, and decrease in grain yield components in french bean. The significant differences in the growth and yield performance of the three varieties in response to planting dates could be attributed to the genetic differences in the varieties. Akande (2007) reported that planting dates and climatic factors of a place interacts with cultivar and its trait thereby affecting crop productivity. In contrast to the other two varieties, Kanannado variety sown on 19th May yielded low (175.51 kg ha^{-1}) compared to the maximum yield recorded in the same variety when sown on 28th July (997.99 kg ha^{-1}). This could be attributed to the long days to maturity and photoperiod sensitivity of the variety. The vegetative phase of Kanannado plants sown early was prolonged and vigorous at the expense of the reproductive phase. This is evident in the significantly higher biomass yield of Kanannnado plants sown early (15.27 t ha^{-1}) compared to the grain yield (0.18 t ha^{-1}) obtained. This confirms the report of Dudge*et al*. (2009) who reported that when cowpeas are planted early, photosensitive varieties will not flower but grow very leafy and yield may be reduced. This further shows the importance of planting cowpea at the most appropriate time. The significantly highest grain yield obtained in IT93K-452-1and Oloyin plants sown on 19th May (2013. 50 and 1506.11 kg ha^{-1} respectively) in this study allays the fear of farmers that cowpea cannot be planted early in the southern guinea savanna.IT93K-452-1and Oloyin sown on 19th May matured before the peak of

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raining season because they are day-neutral and relatively early maturing especially IT93K-452-1 variety compared to Kanannado variety. However, it is important to note that the pods of plants sown early were picked more frequently as soon as they mature after which they were dried as against the farmers' practice of harvesting all the pods at the same time when all the pods mature. This was to prevent rottening of the pods which account for the major grain yield loss in early sown cowpea This actually may be laborious but it may be compensated by the high yield obtained.

Conclusion

The highest biomass yield in the three varieties was obtained when plants were sown early. Kanannado plants sown on 28th June had the highest grain yield while IT93K-452-1and Oloyin plants sown on 19th May had the highest grain yield which was at par with the values obtained when sown on 1st July. This study has confirmed that the traditional planting date used by farmers in the study area is not delivering the potential yield of cowpea. It can therefore be recommended that photoperiod sensitive and late maturing varieties like Kanannado should be planted around 28th July and day-neutral and early to medium maturing varieties like IT93K-452-1 and Oloyin varieties can be planted around 19th May (as soon as rain gets well established) or around 1st July for maximum grain yield. Planting after 11th August is not recommended in the study area if similar rainfall pattern is experienced. It is therefore important that farmers are adequately informed about accurate weather predictions before the onset of farming season to guide them appropriately on when best to plant.

REFERENCES

Ajetomobi, J., and Abiodun, A. (2010). Climate change impacts on cowpea productivity in Nigeria. *African Journal of Food, Agriculture, Nutrition and Development*, *10*(3).

Akande S. R. (2007). Genotype by environment interaction for cowpea seed yield and disease reactions in the forest and derived savanna agroecologies of South-west Nigeria. *America –Eurasian Journal. Agri. Environ. Sci* 2,63-68.

Asante, S. K., Tamo, M., and Jackai, L. E. N. (2001). Integrated management of cowpea insect pests using elite cultivars, date of planting and minimum insecticide application. *African Crop Science Journal*, *9*(4), 655-665.

Asiwe J. A N (2007). Needs assessment of co wpea production practices, constraints and utilization in South Africa. *African Journal of Biotechnology* 8(20), 5383-5388.

Ayisi K. K. ,Nkgapele R. J. and Dakora F. D. (2000). Nodule formation and function in six varieties of cowpea (Vignaunguiculata L. Walp.) grown in a nitrogen rich soil in South Africa. *Symbiosis,* 28, 17-31.

Dugje, I. Y., Omoigu, L. O., Ekeleme, F., Kamara, A. Y and Ajeigbe H. (2009). Farmers' guide to cowpea production in West Africa. IITA Ibadan Nigeria. ISBN 979-131-332-3. www.iita.org/c/document

Ezeaku E., Mbah B. N. and Baiyeri K. P. (2015).Planting date and cultivar effects on growth and yield performance of cowpea (*Vignaunguiculata*(L.) Walp). *African*

Journal of Plant Science, 9(11), 439-448

Kyei-Boahen S. S., Chikoye D. and Abaidoo R. (2017). Growth and yield responses of cowpea to inoculation and phosphorus fertilization in different environments. *Frontier in Plant Science* 8, 464.

Lane, A., and Jarvis, A. (2007). Changes in climate will modify the geography of crop suitability: agricultural biodiversity can help with adaptation. *SAT eJournal* 4(1), 1-12.

Mazaheri D and Majnoon Hosseini N (2005). *Fundamental of Farming* (Tehran University Press) 320.

Mojaddam M. and NouriN. (2014). The effect of sowing date and plant density on yield and yield components of cowpea.*Journal of Fundamental and Applied Life Sciences 4 (3), 461-467.*

Morakinyo J. R. and Ajibade S. R. (1998). Effect of seasons and genotype x season interaction on vegetative and yield parameters of cowpea (*Vignaunguiculata* L. Walp) Nigeria J. Sci. 32,21-25.

Omotosho, S. O. (2014). Influence of NPK 15-15-15 fertilizer and pig manure on nutrient dynamics and production of cowpea, *Vignaunguiculata*L. Walp. *American Journal of Agriculture and Forestry* 2(6), 267-273.

Roudier , P., Sultan, B., Quirion, P., and Berg, A. (2011). The impact of future climate change on West African crop yields: What does the recent literature say? *Global Environmental Change*, 21(3): 1073-1083.

Sreelatha D., Rao K. L., Veeraraghavaiah R. and Padmaja M. (1997). Physiological variations in French bean cultivars as affected by sowing dates. *Annals of Agricultural Research* 18, 111-114.

Van Duivenbooden N., Abdoussalam S. and Ben Mohamed A.. (2002) "Impact of climate change on agricultural production in the Sahel–Part 2. Case study for groundnut and cowpea in Niger." *Climatic Change* 54, 349-368.

Van Ek G. A., Henriet J., Blade S. F. and Singh B. B. (1997). Quantitative assessment of traditional cropping systems in the Sudan savanna of northern Nigeria II. Management of productivity of major cropping systems. *Samaru J. Agric. Res*., 14, 47-60.

Yannick U. S., Kidiata M., Patrick A. K, Luciens N. K, and Louis B. L. (2014). Effects of planting dates and spacing on growth and yield of cowpea (*Vignaunguiculata* L. Walp) in Lubumbashi, DR Congo. *International Journal of Innovation and Applied Studies* 6 (1), 40-47.

Table 1: Effects of planting dates on the growth attributes of cowpea varieties

Planting date	Number of leaves	Leaf area (cm^2)	Vine length (cm)	Stem Diameter (cm)	Number of branches
19th May	42.27c	183.49ab	172.93bc	1.56a	4.58ab
2nd June	50.50b	191.06ab	219.10a	1.45ab	5.29a
16th June	40.43b	152.20c	151.36c	1.49a	4.40abc
1st July	48.34b	196.34ab	76.36ef	1.29bc	3.74bcd
14th July	26.34e	198.65a	54.14fg	1.52a	3.40de

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28th July	78.73a	179.00b	100.55d	1.30bc	3.56cd
11th August	33.15d	92.77d	176.34b	1.19c	4.35bc
25th August	25.53e	90.57d	85.25de	1.27c	3.60cd
8th September	19.66f	82.80d	38.11g	1.14c	2.59e
SE ±	1.72	6.20	8.08	0.06	0.32
Variety (V)					
Kanannado	54.76a	157.04	130.15a	1.35	4.94a
Oloyin	50.06b	147.46	115.05b	1.36	3.49b
IT93K-452-1	50.17b	151.12	112.85b	1.36	3.41b
SE ±	0.10	3.58	4.67	0.03	0.18
P x V	NS	NS	NS	NS	NS

Means with dissimilar alphabets within the same attribute and factor are significantly different using DMRT at P=0.05, NS- Not significant at P=0.05

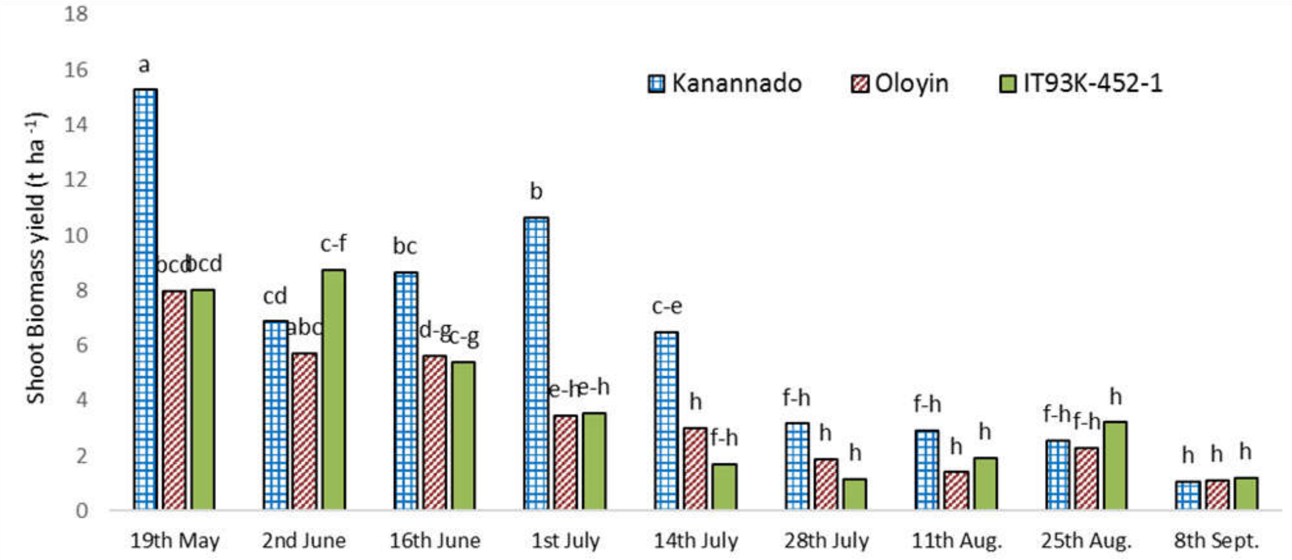

Figure 1: Shoot biomass yield of three cowpea varieties sown at different planting date

Means carrying similar alphabets are not significantly different according to DMRT at P=0.05

Table 2 : Below ground biomass weight (g/plant) of three cowpea varieties sown at different planting date

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	Variety		
Planting date	Kanannado	Oloyin	IT93K-452-1
19th May	14.64a	8.19b-e	8.44b-e
2nd June	15.02a	6.35d-g	7.39c-f
16th June	10.38bc	5.80d-h	5.66d-i
1st July	9.20bcd	5.88d-h	5.96d-h
14th July	8.68b-e	3.83f-j	2.19hij
28th July	11.844ab	3.36g-j	2.87g-j
11th August	3.52f-j	3.90f-j	3.85f-j
25th August	4.88e-j	2.27hij	3.38g-j
8th September	1.70j	2.26hij	1.88ij
SE+		1.38	

Means with dissimilar alphabets are significantly different using DMRT at P=0.05, SE- standard error of the mean.

Table 3 : Grain yield attributes of cowpea varieties as affected by planting date

Planting date	Pod length (cm)	100 seeds weight (g)	Shelling	Pod yield (kg ha^{-1})	Grain yield (kg ha^{-1})
19th May	16.08ab	17.20a	17.23d	1493.5a	1231.70a
2nd June	15.36abc	17.32a	32.75a	1245.3ab	840.80b
16th June	14.74bcd	16.95ab	24.14b	1311.7ab	1004.90ab
1st July	14.06cd	15.76b	22.25bc	1512.0a	1185.10a
14th July	13.40d	13.95c	21.17bcd	1003.2b	793.60b
28th July	16.31a	17.74a	18.74cd	1280.8ab	1036.90ab
11th August	16.30a	17.54a	25.76b	1372.2a	1003.60ab
25th August	16.48a	17.06ab	21.93bcd	449.0c	392.60c
8th September	16.11ab	16.92ab	24.92b	505.0c	378.20c
SE+	0.49	0.50	1.72	123.72	99.62
Variety (V)					
Kanannado	16.65a	19.77a	22.99	508.7c	389.22c
Oloyin	14.92b	16.50b	22.78	1261.4b	975.34b
IT93K-452-1	14.71b	13.87c	23.86	1637.5a	1257.90a
SE+	0.28	0.28	8.07	71.44	57.52
P x V	NS	NS	NS	NS	*

Means with dissimilar alphabets are significantly different using DMRT at P=0.05, SE- standard

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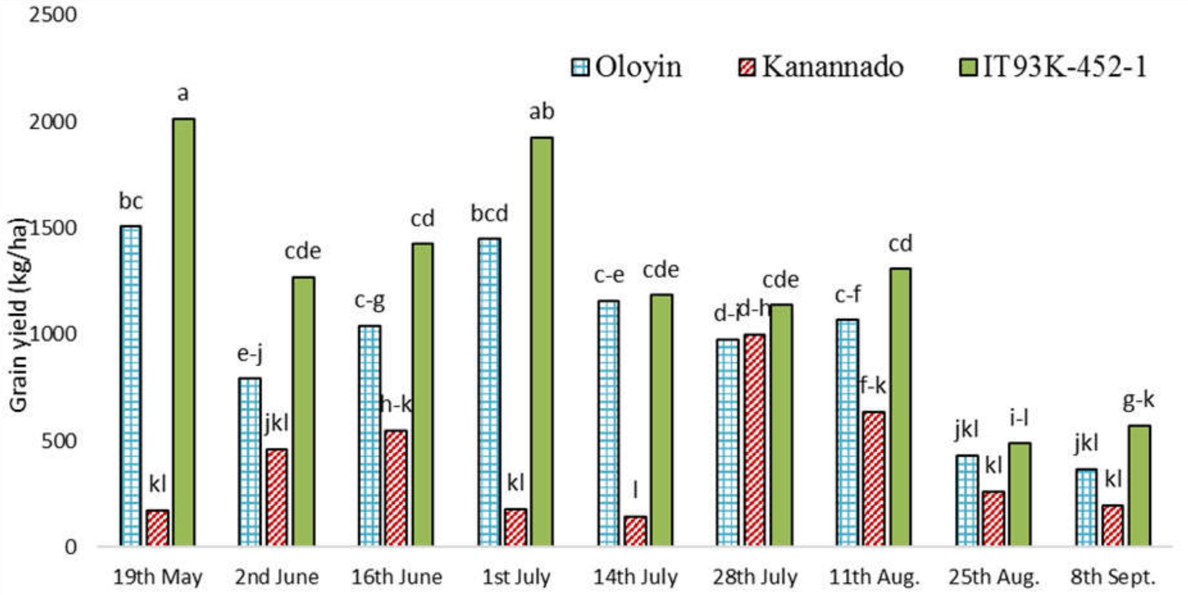

Figure 2: Interaction effect of planting date and variety on grain yield of cowpea

Means carrying similar alphabets are not significantly different according to DMRT at P=0.05

Table 4: Monthly meteorological data for 2017 cropping season

Months	Total Rainfall (mm)	Relative Humidity **(%)**	Min. Temp. **(°C)**	Max. Temp. **(°C)**
May	172.80	67.17	24.52	36.60
June	171.00	72.74	23.60	30.05
July	243.00	76.74	23.17	31.00
August	210.40	81.78	22.21	30.69
September	130.20	73.62	21.24	30.66
October	24.40	75.60	21.25	33.26
November	0.00	49.49	19.50	36.45

Source: Department of Geography, Federal University of Technology, Minna

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