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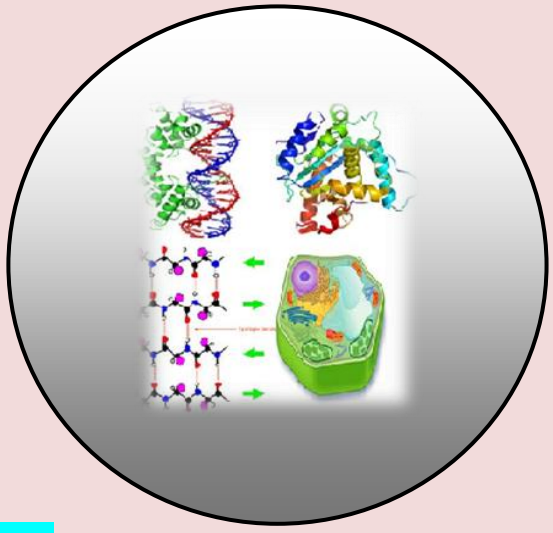

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Performance of Okra as Influenced by Location, Irrigation Frequency and Variety on Some Lowland Soils of Benue Valley of the Nigerian Southern Guinea Savanna

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ABSTRACT

The experiments were conducted on the Soils of Floodplains of Dura, Buruku and Mu River Basin, Makurdi Local Government Areas of Benue State. Three okra genotypes: YandevSerial-V_1, NH47-4-V_3 and the locally adapted genotype, Makurdi-V_2 were subjected to three irrigation frequencies:5day, 10day and 15day, each receiving 0.02m^3 of water per irrigation. Both vegetative and yield performance data were collected for 2011 and 2012 dry seasons irrigation farming. Homogenized combined data for the two years were subjected to analysis of variance using GENSTAT with means separated through Least Significant Different (0.05% level). Results showed that Makurdi (V_2) recorded higher values in plant height (37.33/45.67cm) compared to Yandev Serial-V_1 (25.83/25.00cm) and NH47-4-V_3(28.83/38.57cm) for Dura and Mu respectively. Makurdi (V_2) also produced the largest canopy fresh and dry weights at the lowest water stress, F_1 those were not significantly different from those at F_2 and F_3 to other genotypes. Although, no significant effect was observed between pod lengths and fresh fruit yield produced among irrigation intervals within the same variety, interaction between NH47-4 and 5day irrigation frequency resulted into highest fresh fruit yield (9.16tha^{-1}) and fresh biomass (1495g) at Dura. Makurdi (V_2) produced least yieldsat both locations (Dura-3.94 and Mu-5.34tha^{-1}). Mu is therefore, the best location to cultivate NH47-4 and Makurdiwhile Dura is best for site for Yandev Serial cultivation.
Key words: Soils, Genotypes, Irrigation, Okra and Cultivation.

INTRODUCTION

Okra (*Abelmoschus esculentus L.* Moench) a vegetative fruit is widely cultivated in parts of Nigeria and especially Benue state. Its short duration and production, indeterminate harvests, wide range of adaptations and ease of marketability perhaps appear to be responsible for its wide acceptance. Okra plays an important role in human nutrition.

It is grown majorly for its leaves and young pods which are frequently eaten as vegetables. Okra fresh immature pods and young leaves are used in soup preparation, mature pod contain mucilaginous substance used as plasma replacement or blood volume expander as well as in manufacture of paper (Majanbu *et al*; 1985). The mature stem of some okra varieties contains crude fibre beneficial in increasing intestinal paristalsis (Oyolu, 1980) while its seed has high edible oil content and quality protein due to high lysine content (Sarello *et al.*, 1980; Tindal, 1983). Okra also contains carbohydrates, protein and vitamin C in large quantity in addition to essential and non-essential amino acids which are comparable to that of soybean (Adeboye and Oputa, 1996).

Previous study conducted by Alfredo and Arturo (1999), pointed out that changes in weather affected the growth pattern and consequently, the productivity of okra. *Abelmoschus esculentus L.* Monech is an annual crop requiring warm growing condition (when rainfall was about 750mm and evenly distributed relative humidity of between 90 – 95% and maximum temperatures of about 28.9 – 29.2^{o} C and minimum temperatures of 17.9 – 19.8^{o} C). He reported that temperatures of between 25 to 40^{o} C for optimum growth and yield of okra.Okra is sensitive to low temperature and develops poorly below 15^{o} C according to Marsh (1992).

The WCA region accounts for more than 75% of okra produced in Africa, but the average productivity in the region is very low (2.5 t/ha) compared to the East (6.2 t/ha) and North Africa (8.8 t/ha) (FAOSTAT, 2008). Nigeria is the largest producer (1,039,000t) followed by Coted'Ivoire, Ghana and others (FAOSTAT, 2008).

Fruit vegetables like any other crop require increased productivity through the use of appropriate variety. The use of local varieties has become less attractive to farmers due to low yield and problems of pest and diseases affecting the performance of the crop.

Ojanuga *et al.* (1996) stated that wetland soils were grossly underutilized in Nigeria for any kind of purpose, especially in the drier guinea savanna where wetland is avoided for permanent Agriculture. However, dry season vegetable irrigation farming of okra, pepper, tomatoes and onion reportedly gave higher yields than wet season farming (Idoga and Egbe, 2012). As widely grown as the crop is, either as home garden or for commercial purposes, scanty information exists in Nigeria on the most productive variety, optimal water requirement (irrigation frequency) and preferred soil type for optimal productivity. Therefore, there is need to assess the performance of okra under these conditions.

MATERIAL AND METHODS

Experiment was conducted on the soils of Dura Floodplains in Buruku LGA (Lat. 07^{0} 22.986'N and Long. 009^{0} 12.158'E) and Mu River Basin, Makurdi LGA, (Lat. 07^{0} 45.693'N and Long. 008^{0} 37.483'E) of mid-section of the Benue Valley between February and March during the dry seasons in 2011 and 2012. The aim was to assess the performance of Okra as affected by Location, Variety and Irrigation Intervals.

A factorial experiment with treatments consisting three Varieties (Yandev Serial-V_1MAKURDI-V_2 and NH47-4- V_3) and three Irrigation Intervals (5, 10 and 15day) was laid out in Randomized Complete Block Design (RCBD) and replicated three times. A parcel of land (9m x 9m) was cleared, ploughed, crumbs were broken and leveled and 2mx2m beds manually prepared. Three to four (3-4) seeds were planted on the 15th and 19th February, 2011 and 2012 respectively at 45cm x 50cm spacing and thinned to two (2) plants/hole weeks later. Water Pump was used to channel water into irrigation channels constructed between the beds and directed into appropriate bed at 0.2m^{2} (5cm depth) per irrigation interval. NPK 15:15:15 was band applied at 20g per stand (50kg/ha) at week two after first weeding while second weeding was done at instance of weeds appearance. Insect infestation was treated with Delthrin 10EC (Img/l). Two stands (4 plants) were chosen in each bed for the following: plant height was taken weekly by metre ruler; plant canopy (as width of the broadest section of the plant multiplied by its vertical height to peak) at week 9 using a metre ruler;

fresh pod weight was weighed using weighing balance at each harvest. Two plant stands were uprooted, weighed fresh then dried to constant weight using weighing balance.

Homogenized data for the two years (2011 and 2012) were combined and analysis of variance conducted using GENSTAT Release 4.24 DE (GENSTAT, 2012) software and means separated using Fisher's Least Significant Difference (F-LSD = 0.05%).

RESULTS AND DISCUSSION

From the results contained in Tables 1, there were significant location, varietal and irrigation frequencies variations in the growth and yield and yield attributors' traits. Plants onUAM soils performed better in plant height (32.13cm) and canopy (1286cm^2) while Dogowas a better site for plant dry biomass (60.37g) and pod length (8.46cm).No drastic differences exist between fruit yields in the two locations. Variations in the performance of these traits may be attributed to the heterogeneity of these soils and varieties.

Table 1. Main Effect of Location, Variety And Irrigation Frequency on Vegetative and Yield.

Components of Okra at Dura Floodplains and Mu River Basin in Mid- Section of Benue Valley							
Treatment	**Symbol**	**PTHT**	**PTCPY**	**PTFW**	**PTDW**	**PTPDLT**	**FFTYD**
Unit		**(cm)**	**(cm^2)**	**(gm)**	**(gm)**	**(cm)**	**(tha^{-1})**
Location	**L**	**LOCATION**					
Dura	**1**	27.78	1286	254	60.37	8.46	6.78
Mu	**2**	32.13	1028	226	51.21	7.84	6.74
LSD	**(0.05)**	0.83	55.30	96.60	1.83	0.15	0.39
VARIETY	**V**	**VARIETY**					
YS	**1**	23.64	964	232	54.75	8.32	7.19
MKD	**2**	37.06	1216	285	56.54	8.16	5.17
NH47-4	**3**	29.16	1291	203	56.08	7.98	7.92
LSD	**(0.05)**	1.01	X	118.40	2.24	0.19	0.48
IRR. REG.	**F**	**IRRIGATION FREQUENCY**					
5day	**1**	32.51	1349	242	61.03	8.28	7.27
10day	**2**	28.93	1182	285	58.64	8.22	6.72
15day	**3**	28.42	940	194	47.71	7.96	6.29
LSD	**(0.05)**	1.01	137.70	118.40	2.24	0.19	0.48
CV	**%**	1.2	4.1	17.6	0.4	7.5	3.2

Key: Dura = Dura Floodplains, Mu = Mu River Basin; YS=Yandev Serial - V_1, MKD=Makurdi - V_2, NH47-4 - V_3; IRR.

REG. = Irrigation Regimes; PTHT = Plant Height, PTCPY = Plant Canopy, PTFW = Plant Fresh Weight, PTDW = Plant Dry Weight, PTPDLT = Plant Pod Length and FFTYD = Fresh Fruit Yield.
NH47-4 yielded the highest fruits (9.16/8.53tha^{-1}) at F_1 on both soils. Its highest yield on the Dura soils was similar to the Yandev Serial at F_2, F_1 andF_3 (8.41, 8.15 and 8.08tha^{-1}).

Variety V_2 produced the highest plant (37.06cm).The outstanding plant height of Makurdi, V_2 was attributed to the tall nature of this variety. Its plant canopy was similar to that of V_3 while V_1 and V_3 fresh fruit yields(7.19/7.92tha^{-1})were significantly higher compared to that of V_3 (5.17tha^{-1}).

Irrigating at 5day frequency resulted into higher plant (32.51cm), larger plant canopy (1349cm^2), drybiomass (61.03g) and fresh fruit yield (7.27tha^{-1}). The least fresh fruit yield produced at 15day interval was not better than that at 10day irrigation interval while irrigation at 15day gave the least values in almost all traits compared to other irrigation intervals. Khalih (2004) found that all okra genotypes showed significant differences for most traits under irrigation regimes (10, 30, 45 days).

Table 2. Interaction Effect of Location, Variety and Irrigation Frequency on Vegetative.

AND YIELD OF OKRA AT DURA FLOODPLAINS AND MU RIVER BASIN IN MID-SECTION OF BENUE VALLEY								
VARIETY	**LOCT.**	**FREQ.**	**PTHT**	**PTCPY**	**PTFM**	**PTDM**	**PTPDLT**	**FFTYD**
V	**L**	**F**	**(cm)**	**(cm^2)**	**(gm)**	**(gm)**	**(cm)**	**(tha^{-1})**
1	**Y**	**A**	**N D**	**E V**	**S**	**E R**	**I A**	**L**
		1	25.83	1038	226.0	58.50	8.30	8.15
	Dura	**2**	23.65	973	224.00	54.33	8.19	8.41
		3	22.00	950	192.80	46.17	8.09	8.08
		1	25.00	932	240	49.17	8.44	6.37
	Mu	**2**	22.67	964	198.20	36.50	8.15	6.40
		3	22.33	930	214.00	42.00	8.42	5.68
2	**M**		**A**	**K**	**U**	**R**	**D**	**I**
		1	32.20	1311	307.70	78.17	8.23	3.94
	Dura	**2**	33.13	1279	288.20	75.50	8.31	3.95
		3	37.33	1240	249.50	52.50	8.33	3.94
		1	45.67	1078	155.70	51.17	7.97	5.79
	Mu	**2**	38.17	962	129.50	37.50	8.00	5.85
		3	41.67	1043	132.0	39.09	8.09	5.34
3	**N**		**H**	**4**	**7**	**-**	**4**	
		1	27.00	1089	286.20	70.50	8.66	8.53
	Dura	**2**	25.33	946	241.70	58.67	9.12	7.42
		3	28.83	925	178.50	40.67	8.56	6.93
		1	38.57	1495	208.30	61.33	8.09	9.16
	Mu	**2**	30.80	1157	197.30	53.50	7.52	8.27
		3	24.33	861	114.30	58.50	5.90	7.19
LSD	**0.05%**		**2.49**	**337.20**	**289.90**	**5.49**	**0.46**	**1.17**
Cv	**%**		**1.2**	**4.1**	**17.6**	**0.4**	**7.5**	**3.2**

Key: LOCT =Location: Dura = Dura Floodplain, Mu = Mu River Basin; Freq. = Irrigation Frequency; PTHT = Plant Height, PTCPY = Plant Canopy, PTFM = Plant Fresh Mass, PTDM = Plant Dry Mass, PDLT = Pod Length and FFTYD = Fresh Fruit Yield.

Interaction between location, variety and irrigation frequency is presented in Table 2. The results revealed the outstanding plant height of Makurdi-V_2 (45.67cm) over other cultivars (25.83/ 38.57cm) which may be attributed to the tall nature of variety.

Muhammed *et al.,* (1998) observed similar trend in the heights of Chickpea (*Cicer arietinum*) varieties at Kadawa Irrigation Station ABU. Makurdi-V_2 (1311cm^2) at Dura and NH47-4-V_3 (1495cm^2) at Mu produced the largest canopies as against V_1 (1038) and V_3 (1089cm^2) canopies produced at Dura. This may be attributed to the more favorable soils for those cultivars whereas; no significant differences were recorded in the fresh biomass across the locations.

Dry biomass seems to decrease with increase water stress across locations in all varieties. The trend indicates that capacity of all cultivars toward water in take is directly proportional to their water loss irrespective of location. There were no significant differences in the lengths of pods except in V_3 which produced the longest pod (9.12cm) and shortest pods (7.52cm) at moderate water stress (F_2) on Dura and Mu soils respectively. This is in disagreement with Hassan *et al.,* (2011).

Makurdi produced the least fruit yields that were not significantly different among the frequencies of the same site. This may be an indicator that fruit yields of some okra varieties are never drastically affected by irrigation frequencies. This is in conformity with the findings of Abagyeh (2015).

CONCLUSION

Considering that farmers main interest are vested in the fresh fruit yields of the vegetables, Dura soils are best for the cultivation of NH47-4 and Makurdi, Mu soils are best suited for the cultivation of Yandev Serial; NH47-4 is the best variety of okra to be cultivated on the two soils while irrigating at the 10day interval is less laborious and more economical.

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