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Effects of Plant Spacing on the Growth and Yield of African Egg Plant (*Solanum macrocarpon*) in the Northern Guinea Savannah of Nigeria

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Abstract

Field experiments were conducted to determine the effect of planting spacing on the growth and yield of African eggplant (*Solanum macrocarpon*) in Institute of Agricultural Research, Ahmadu Bello university (IAR/ABU) Teaching and Research farm Zaria, Kaduna State in 2017 and 2018 cropping seasons. The experiment consists of five treatments (Planting spacing 80 × 20cm, 80 × 50cm, 100 × 50cm, 100 × 60cm and 120 × 70cm inter and intra row spacing respectively, replicated four times laid out in randomized complete block design. Data were collected on both growth and yield parameters. The data were analyzed using analysis of variance (ANOVA) procedure. Results showed that close row spacing of 80cm × 20cm significantly reduced number of leaves and branches per plant and gave taller plant. Plant spacing of 100cm × 60cm gave higher growth parameters (leaves, branches, dry matter biomass and their growth rate and fruit yield per plant) fruit yield per hectare was however, higher in narrow inter and intra rows of 80cm × 50cm. Based on the findings of this study, eggplant should be cultivated at a spacing of 100cm × 80cm (inter and intra row spacing for optimum growth and fruits yield in Zaria location of Northern Nigeria.

Keywords: Eggplant, Spacing, Growth and Yield

Introduction

African eggplant (*Solanum macrocarpon*) belongs to solanaceae Family. It is a tropical fruits and leafy vegetable crop depending on the prevailing environmental conditions. When cultivated in humid tropics it will survive for many seasons thus described as perennial plant but in semi-arid or dry weather conditions, it behaves as annual plant due to moisture deficit that accelerate its senescence (Abdullahi et al 2013). In Nigeria, the Hausa called it "Yalo", "Anara" in Igbo; 'Igbagba' in Yoruba (Schippers 2000). The leaves and fruits have high economic importance. They are used as food (eaten raw or cooked) as vegetables. In North western part of Nigeria especially Katsina, Gusau, Kebbi, Zangare and Sokoto states, both the young green leaves and fruits are used for soup, stew, sauce or in making African salad (Abubakar 2017). Emma Okafor (2017) reported that in many traditional cultures, garden egg including African eggplant fruits represent fruitfulness and blessings and are offered in ceremonies, marriage, child naming /dedication and social events as a symbol of goodwill and acceptance of visitors. African eggplant leaves root and fruit have high variety of medicinal values. The roots are used in traditional medium to treat bronchitis, asthma, wounds, abdominal worms and stomach disorders (Guama, 2010). Abdullahi *et al.*, 2013 observed that leaves of eggplant are used to cure boils, stomach and throat pains. The unripe young green fruits are used as laxative for cardiac diseases and to relieve toothache. Despite the high economic importance of African eggplant, there are a lot of literature on the cultural techniques such as data of planting, soil nutrient requirement and other requirement needed for optimum growth and yield. Therefore, this study was carried out to determine the ideal planting distance (inter and intra-row spacing) for optimum growth and fruit yield of African eggplant (*Solanum macrocarpon*)

Materials and Methods

Field experiments were conducted in the Institute of Agricultural Research farm Ahmadu Bello University Zaria in 2017 and 2018 cropping seasons. Zaria is located at latitude 11°11'N and longitude 7°38'E and altitude of 650m above sea Level. The experimental site was cleared and ploughed on 3rd April, 2017 and 2018. The experiment design was a randomized complete block design {RCBD} in four replications. Treatments were five planting spacing 80cm × 20cm, 80cm × 50cm, 100cm × 50cm, 100cm × 60cm and 120cm × 70cm inter and intra row spacing respectively. There were sixteen (16) plots and each plot measured 6m × 6m given an area of 36m². Eggplant (*Solanum macrocarpon*) seeds were collected from IAR/ABU Zaria. The variety eggplant seed is called Samaru (ESM 31) the seeds were sown in the nursery to raise seedling for three weeks before transplanted to the experimental plots. Transplanting of eggplant (*Solanum macrocarpon*) was done at the rate of one seedling per stand according to the schedules spaces (80 × 20cm, 80 × 50cm, 100 × 50cm, 100 × 60cm, and 120 × 70cm inter and intra row spacing respectively for both 2017 and 2018 cropping seasons. Data were collected on number of leaves, branches per plant, leaf area index (LAI) at 6, 8, and 12 weeks after planting (WAP). The number of fruits per plant, fresh fruit yield per hectare (t/ha) fruit, dry weight (g) were collected and analysis

Data collected were analyzed using analysis of variance (ANOVA) procedure for randomized complete block design experiments as described by Gomez and Gomez (1984). Fishers least Significant Difference (F-LSD) at 5% probability level was used to separate treatment means for statistical significance as described by Snedecor and Cochran (1967).

Results and Discussion

Plant spacing significantly ($P \leq 0.05$) influenced the growth and yield of African eggplant (*Solanum macrocarpon*). Number of leaves and branches per plant increased significantly ($P \leq 0.05$) with increase in plant spacing 80-20cm intra and 100-50cm inter –row spacing respectively (Table 1). There were more number of leaves and branches per plant in the wider inter and intra-row spacing than the narrow spacing. The highest number of leaves (74.3) in 2017 and (74.4) in 2018 and branches 15.4 in 2017 and 15.0 in 2018 at 12 WAP respectively were recorded in wider row spacing of 120cm × 70cm in the two cropping seasons of 2017 and 2018. This could be due to positive effect of wider intra-row spacing where there is minimum competition for growth resources between plants Mani *et al.*, 2000. Plant height and leaf area index decreased significantly in wider row spacing than in closer spacing (Table 1). Closer spacing with narrow intra-row spacing resulted in taller plants with high leaf area index. This could be due to the high plant population which resulted in high competition for growth resources. The views agree with that of Mani 2017 who reported significant increase in plant height and LAI in narrow intra-row spacing of the eggplant. The effect of plant row spacing significantly influenced yield and components of African eggplants. (Table 2) Fruit yield per plant were higher in wider intra-row spacing than in narrow row spacing. Fresh fruit per plant increased with increasing inter and intra row spacing from 20-80cm and from 50-100cm inter row spacing. But did not show significant difference beyond 100 and 120cm respectively in the two seasons. Similar results by Idoko *et al.*, (2017) also recorded significant increase in yield and yield component of eggplant.

Results showed that on hectare basis, fruit yield was significantly ($p \leq 0.05$) higher in narrow inter and intra-row spacing than in wider row spacing. The highest eggplant yield per hectare of 16.16 t/ha in 2017 and 15.16 t/ha in 2018 were obtained in a narrow row spacing of 80 × 20cm in 2017 and 2018 cropping seasons respectively.

The higher fruit yield per hectare recorded in narrow row spacing in this study could be due to the fact that narrow rows has closer spacing with more plants per plot each contributing to the total yield per plot; thus resulting in higher yield per hectare than wider rows plots. This result agrees with Idoko *et al* (2017) who reported higher yield per hectare in narrow intra row than wider row spacing.

It has been observed from this study that plant spacing significantly affected the growth and yield of African eggplant (*Solanum macrocarpon*). Plant spacing 100 × 60cm gave higher growth parameters (leaves, number of branches, dry matter biomass and their growth rates and fruit yield per plant in Zaria, Northern Guinea Savannah Agro-ecological region.

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Table 1: Effects of spacing on the number of leaves, branches per plant, leaf area index and vine length 6, 8 and 12 weeks after planting on African eggplant (*Solanum macrocarpon*) in 2017 and 2018 cropping seasons.

Plant Spacing (cm)	No. of Leaves per Plant			Leaf Area (cm ²) per Plant			No. of branches per Plant			Plant Height (cm)		
	WAP			WAP			WAP			WAP		
	6	8	12	6	8	12	6	8	12	6	8	12
2017 Cropping Season												
80 × 30cm	8.21	14.32	18.13	13.43	23.67	35.27	1.1	2.2	3.1	17.6	34.2	84.2
80 × 50cm	9.33	17.12	21.4	19.23	34.52	42.16	1.3	3.1	4.2	15.4	31.3	63.4
100 × 50cm	19.1	25.3	46.2	32.16	49.85	69.67	3.0	4.5	11.1	14.3	25.2	32.7
100 × 60cm	23.4	28.1	51.3	63.54	79.32	89.58	3.5	5.1	13.1	12.2	23.5	35.7
120 × 70cm	24.1	31.3	63.1	74.3	96.4	78.4	3.6	5.3	15.4	10.3	20.7	31.3
LSD (P < 0.05)	1.2	1.6	3.2	1.4	4.5	12.6	0.10	0.3	1.2	0.5	1.4	8.3
2018 Cropping Season												
80 × 30cm	7.15	15.41	22.21	15.24	25.17	36.8	1.1	2.1	3.2	18.4	36.1	86.3
80 × 50cm	8.41	17.22	28.54	18.43	47.52	46.4	1.3	3.1	4.1	16.3	33.2	58.7
100 × 50cm	18.3	24.5	46.5	35.4	47.3	70.4	3.1	4.6	12.1	187.5	287.4	57.4
100 × 60cm	21.2	29.3	52.1	70.1	82.1	86.4	3.4	5.2	13.4	170.1	265.1	49.2
120 × 70cm	23.5	32.4	62.5	73.4	91.9	79.7	3.7	5.4	15.3	155.3	241.1	47.4
LSD (P < 0.05)	1.1	1.4	3.2	1.3	3.3	10.4	0.01	0.3	1.1	4.2	5.4	7.3

Table 2: Effect of spacing on leaf and stem dry weight (g) per plant and their growth rates at 6, 8 and 12 weeks after planting on African egg plant (*Solanum macrocarpon*) in 2017 and 2018 cropping seasons.

Plant Spacing (cm)	Leaf dry weight per plant			Stem dry per plant			Leaf Rate (g/m ² /day)			Stem Growth Rate g/m ² /day)		
	WAP			WAP			WAP			WAP		
	6	8	12	6	8	12	6	8	12	6	8	12
2017 Cropping												

Season												
80 × 20cm	4.23	7.38	12.47	2.16	10.57	17.45						
							1.05	2.43	3.25	0.04	1.04	2.07
80 × 50cm	5.37	7.71	16.32	2.75	14.35	18.31	1.08	2.78	3.91	0.09	1.09	2.39
100 × 50cm	5.68	8.15	49.87	2.95	18.14	39.85	1.10	4.75	6.3	0.14	1.13	2.84
100 × 60cm	6.11	26.73	53.33	3.16	22.35	43.47	1.21	5.24	7.3	0.19	1.46	3.45
120 × 70cm	6.46	29.95	61.25	3.55	26.11	49.63	1.36	6.11	9.4	0.23	2.25	4.65
LSD (P < 0.05)	0.2	2.3	4.2	0.42	1.3	1.51	0.01	0.22	0.53	0.01	0.01	0.02
2018 Cropping Season												
80 × 20cm	3.41	7.14	13.13	2.08	12.46	16.68	1.04	2.37	3.28	0.03	1.03	2.5
80 × 50cm	4.76	7.84	15.89	2.69	16.22	21.24	1.08	4.25	14.21	0.12	1.16	2.27
100 × 50cm	5.32	8.14	50.10	2.87	19.34		40.95	1.13	4.81	17.11	0.31	1.31
								1.42	5.14	19.31	0.62	1.54
100 × 60cm	15.85	27.01	53.41	3.21	23.14	44.11	1.41	6.13	23.58	0.93	2.28	4.36
120 × 70cm	19.47	29.81	60.59	3.62	26.24	50.32	1.41	6.13	23.58	0.93	2.28	4.36
LSD (P < 0.05)	0.6	2.3	4.3	0.4	1.3	1.62	0.01	0.21	0.54	0.01	0.01	0.02

Table 3. Effect of spacing on the yield and yield components of African eggplant (*Solanum macrocarpon*) in 2017 and 2018 cropping seasons

Plant Spacing (cm)	No. of Fruits per Plant	Fresh Fruit weight per Plant (g)	Fruit Dry weight per Plant (g)	Fresh Fruit yield per Hectare (t/ha)
2017 Cropping Season				
80 × 20cm	13.3	78.72	34.83	16.142
80 × 50cm	15.8	121.31	42.15	12.563
100 × 50cm	19.4	137.3	63.45	10.531
100 × 60cm	24.3	162.2	72.13	8.461
120 × 70cm	32.4	212.4	89.78	6.387
LSD (P < 0.05)	3.1	7.3	6.2	0.51
2018 Cropping Season				
80 × 20cm	12.2	69.48	29.78	15.163
80 × 50cm	16.1	129.26	46.31	11.211
100 × 50cm	21.3	141.35	67.77	10.311
100 × 60cm	27.2	172.25	75.43	8.243
120 × 70cm	35.33	247	85.64	5.434
LSD (P < 0.05)	3.2	6.4	6.4	0.52