



## INFLUENCE OF PLANT SPACING AND WEED CONTROL PRACTICES ON THE GROWTH AND YIELD OF OKRA (*Abelmoschus esculentus* (L) Moench) IN BADEGGI

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### ABSTRACT

Field study was conducted at the National Agricultural Extension Research and Liaison Service (NAERLS)/ABU Sub-station Badeggi, Niger State, Nigeria during 2024 cropping season to assess growth and yield of Okra (*Abelmoschus esculentus* (L) moench) in response to plant spacing and weed control. The treatments consisted of three (3) plant spacing (60 cm x 50 cm, 60 cm x 40 cm and 60 cm x 30 cm) and three (3) mulching practices (Dry grass mulch, Black polyethylene mulch, Sawdust mulch) and two (2) hoe weeding (at 3 and 7 Weeks after Sowing (WAS) and weed free plots were used as control. These were factorially arranged and laid out in a randomized complete block design with three replications. The mulching materials were applied before sowing seeds. A split application of NPK 15:15:15 was done at 2 and 6 WAS at the rate of 200 kg/ha by side placement. Analysis of Variance (ANOVA) for the data was carried out using GenStat 3 release 2005. Significant differences between means were estimated by the Least Significant Difference (LSD) at 5% level of significant. Result revealed that plant spacing were not significant in most of the parameters assessed. Plots mulched with black polyethylene mulch significantly ( $P < 0.05$ ) performed better than other weed control treatments in terms of lower number of weeds (0.92/0.5m<sup>2</sup>), lower weed biomass (2.67g/0.5m<sup>2</sup>), higher crop pod yields (0.39tons/ha) and higher plant height (63.33cm). Plant spacing and mulching with black polyethylene within the confines of the study was therefore recommended for higher Pod yield of Okra.

**Keywords:** Okra, Growth, Weed, Pod, Yield, Control.

### INTRODUCTION

Okra (*Abelmoschus esculentus* (L) moench) is an annual, herbaceous flowering plant in the Mallow family that originated from tropical and subtropical Africa and is natural to the West Africa (Adejonwo *et al.*, 2019). Okra is mainly cultivated for its young immature fruits and consumed as a vegetable, raw, cooked or fried in countries like Sudan, Egypt and Nigeria; it is also important in other tropical areas including Asian, central and South America often used as ingredient of soups and sauces. The fruits can be conserved by drying or pickling, the roasted seed is considered a coffee substitute; the leaves, flower buds, flowers and calyces can be eaten cooked as greens. In Nigeria, Okra is grown in both wet and dry season but attract a larger profit in the dry when the demand is often in excess with limited supplies. Okra is a good source of Vitamins, minerals, calories and amino acid found in seeds and compares favorably with those in poultry, eggs and Soybean. It is mostly grown for its young leaves and green pods (Edet and Etim, 2017). It is usually grown on small farm holdings in mixtures with staple food crops such as Maize, Yam, Cowpea and Pepper or with various Vegetable Crops (Odeleye *et al.*, 2005).

Mulching is a non-chemical method of covering the land surface with organic or inorganic materials. Mulches lowers the germination and development of weed seeds through mechanical & (Adejonwo *et al.*, 2019) and allelopathic effects (Olasotan *et al.*, 2017). It will also help to moderate microclimate, maintain moisture content in soil through reduced evaporation rate, sustain the activity of microorganisms and accelerate nutrient transformations in soil. Materials such as grasses, straw, green leaves, crop residue, sand and stones, sand plastics are used as mulches. In Nigeria, the limiting factors in Okra production and other Vegetables among others include weed management, tillage practice, low yielding varieties and sub-optimal planting density (Adeyemi *et al.*, 2018). Excessive weed growth is one of the most serious factors affecting the performance of crop generally and



vegetable in particular. Such effect may be direct or indirect and the degree of competition encountered by an individual crop depends among others on the spacing, fertility of the soil, species of weeds associated as well as other climatic factor (Odeleye *et al.*, 2005). It has been shown that when weeds interfere with Vegetable like Okra, it affects their vegetative and reproductive growth. In many agricultural systems around the world, competition from weed is one of the major factors reducing yield and farmers' incomes. It was reported in Nigeria that uncontrolled weed growth throughout the crop life cycle reduced Okra fruit yield between 88 and 90% compared with those kept weed free throughout the growth period (Adejonwo *et al.*, 2019). Therefore, for a profitable crop production, the bulk of labour requirement goes into weed control. Edet and Etim, (2010) reported that for fruits and vegetables, weeding alone accounted between 45-80% of the total cost of production. Tijjani-Eniola (2017) also reported that weed could cause yield losses ranging from 50-80%. Physical methods of weed control are laborious, tiresome and expensive due to increasing cost of labour, draft animal and implements (Sainudheen, 2017). In view of these facts, the objective of this study therefore was to assess the influence of plant spacing and different weed control methods on growth and yield of Okra at Badeggi, Niger State, Southern Guinea Savanna Agro ecological zone of Nigeria.

## **MATERIALS AND METHODS**

### **Study Site**

The Study was conducted at the National Agricultural Extension Research and Liaison Service (NAERLS)/ABU Sub-station Badeggi, Niger State during Cropping Season of 2024. Badeggi is located between 9°45'N and Longitude 6°7'E with an altitude of 420 cm above Sea Level (Ijagba *et al.*, 2018).

### **Treatments and Experimental Design**

The treatments consisted of three (3) plant spacing (60 cm x 50 cm, 60 cm x 40 cm and 60 cm x 30 cm) and three (3) mulching practices (Dry grass mulch, Black polyethylene mulch, Sawdust mulch) and two (2) hoe weeding (at 3 and 7 Weeks after Sowing (WAS) and weed free plots were used as control. These were factorially arranged and laid out in a randomized complete block design with three replications.

The gross plot size was 45m long by 20m wide with an area of 900m<sup>2</sup> was ploughed, harrowed and made into beds. The prepared land was marked out into three blocks of 45m x 2m each. Each block was divided into 15 plots of 3m X 3m. Two to three seeds per hole were sown, later thinned to one plant per stand at about 10 days after sowing (DAS) (Finisa, 2017) using the different plant spacing. Each block was separated by 1m and the distance between plots was 0.5m. The treatments were applied two days before seeds were sown, the black plastic mulch was laid before sowing while the sowing was done through openings made on it at specified spacing. Zaria Local Variety of Okra was used for the study; two middle plants were used as the sampling unit from which data were taken fertilizer (NPK 15:15:15) was added to each plot in split doses at the rate of 150kg/ha at 3rd and 6th weeks after sowing using side placement method. Weeding was done accordingly with hoe on the plots requiring weeding. Weeds identification, density and biomass were determined within two quadrats (0.5m<sup>2</sup>) randomly thrown twice in each plot at 2-weeks intervals. The weeds within each quadrat were harvested at soil level and then dried at 70°C for 48 hours.

### **Data Collection**

Data on weed infestation and weed density were collected from each sampling unit at 30, 45 and 60 days after sowing (WAS) using a quadrat of 0.5m<sup>2</sup> placed randomly at two different spots in the plots. The weed flora within each quadrat were identified and counted.

Data collected on the crop included plant height was determined by measuring on the tagged plant from the ground to the tip of the plant using metre rule. Plant height was measured from the ground to the tip of the plant using a meter rule. Number of branches, per plant was determined by counting all the branches on the tagged plants. Stem girth were collected at two weeks interval. Number of leaves per plant was obtained by counting all functional leaves per plant on the tagged

plants. Number of pods per plant was obtained by counting all the pods on the pods on the tagged plants.

**Grain yield (kg/ha)** was calculated using the formula:

$$\text{Plot yield (kg)} \times \frac{10,000}{\text{Plot size in square metre}}$$

The yield data was taken at four-day intervals starting from the fruiting stage until the end of the experiment.

### Statistical Analysis

Data collected were subjected to analysis using the Genstat Statistical Package. The means were separated using Fisher's Least Significant Difference (LSD).

## RESULTS AND DISCUSSION

### Weed Infestation

A total of eleven (11) weed species within eight (8) families were identified during the period (Table 1). The most important weed species found in other weed control treatments were *Calopogonium mucunoides*, *Mimosa pudica*, and *Panicum maximum*, while *Cyperus rotundus* was mostly found in black polyethylene mulched. Hoe weeded plot recorded higher weed species diversity than in other weed control treatments. This is an indication that the weed flora composition was being altered by the weed control practices studied. This agrees with the findings of Derksen *et al.*, 2014 and Leeson *et al.*, 2015 that the farming practices influence the species composition of weed communities in arable crop field. The different composition of weed found in the experimental field was due to favorable climatic conducive environmental conditions for their growth.

**Table 1:** Weed Species Infesting the Experimental Plots of *Abelmoschus esculentus* and their Preponderance

S/N	Scientific Name	Family	Lifecycle	Morphology	Severity
1	<i>Ageratum conyzoides</i> Linn	Asteraceae	Annual	Broadleaf	***
2	<i>Calopogonium mucunoides</i> Desv	Fabaceae	Annual	Broadleaf	***
3	<i>Mimosa pudica</i> Linn	Mimosoideae	Annual	Broadleaf	***
4	<i>Phyllanthus amarus</i> Schum & Thonn	Euphorbiaceae	Annual	Broadleaf	**
5	<i>Amaranthus spinosus</i> Linn	Amaranthaceae	Annual	Broadleaf	*
6	<i>Commelina benghalensis</i> Linn	Commelinaceae	Annual	Grass	*
7	<i>Panicum maximum</i> Jacq.	Poaceae	Annual	Grass	***
8	<i>Cyperus rotundus</i> Linn	Poaceae	Annual	Grass	**
9	<i>Eleusine indica</i> Gaertn	Poaceae	Annual	Grass	**
10	<i>Cyperus rotundus</i> Linn	Cyperaceae	Perennial	Sedge	***

**Key:** \*=Less severe, \*\* = Severe, \*\*\* = Most severe

### Weed Density and Weed Biomass

Table 2 presented result of the weed density and weed biomass. The result indicated that, plant spacing did not significantly influence weed infestation considerably but it manifested in both density as well as biomass of weeds (Table 2). At 30 to 60 days after sowing (DAS), hoe weeded plot consistently recorded significantly ( $P < 0.05$ ) higher weed density compared with free plots. Weed density recorded with the plot that are weed free at 30 Days after sowing (DAS) was statistically similar to that recorded in Sawdust mulch but significantly ( $P < 0.05$ ) lower than that recorded in black polyethylene mulch. The least weed biomass ( $2.67\text{g}/0.5\text{m}^2$ ) was recorded in plot mulched with black polyethylene. The result of the findings is in agreement with the report of Edet and Etim, 2010) that black plastic mulch reduced weed infestation considerably. Ngouajio *et al.*, 2018 also reported complete elimination of weeds with the use of black polyethylene mulch. Sannigrahi and Borah (2016) reported complete elimination of weeds with the use of black polyethylene mulch also reported the effectiveness of black polyethylene sheet in controlling weeds of Okra. Olasotan, (2017) also reported a similar result and according to him no weeds growth was observed in Okra under polyethylene mulch except a few which germinated through the holes made for sowing seeds.



### **Influence of Plant Spacing and Weed Control Practices on the Growth of Okra**

Result of the influence of plant spacing and weed control on the growth of Okra is presented in Table 3. The result revealed that, plant spacing did not showed any significant influence on the Morphological parameters at 4 and 8 Weeks after sowing (WAS). Among the weed control treatments, black polyethylene mulch plots recorded significantly ( $P < 0.05$ ) higher plant height at 4 WAS (30.56cm) which was comparable with that obtained from grass mulch (28.64cm) and weed free plots (25.08cm), while the least was obtained in the sawdust mulch plots (23.14cm) which is statistically similar to that obtained from hoe weeded plots (23.83cm). The stem girth followed the same trend as the result obtained in plant height. The highest number of branches was recorded by plots with black polyethylene mulch (1.22cm) which was statistically similar to that recorded in grass mulched plots (1.17cm) and weed free plots (1.17cm) while the least was recorded in the hoe weeded plots (1.00cm). At 8 WAS, plots with black polyethylene mulch recorded significantly higher values for plant height (64.33cm), stem girth (11.78cm), number of branches (2.06cm) and number of leaves (23.56) while the least value for these parameters were consistently recorded by the hoe weeded plots. The increased plant height in mulched plants was possible due to better availability of soil moisture and optimum soil temperature provided by the mulches. Olasotan, (2017) reported significant effect of mulches on the number of branches per plant in Okra plants. Hamidreza *et al.* (2012) observed that plants grown with mulch had higher plant height, stem diameter and leaf area when compared with no mulch or weedy plots. The findings of the study were also consistent with the findings by Matsenjwa (2016) who reported that both plastic and organic mulch increased plant height of field bean. Under similar conditions, Kundu *et al.*, (2016) and Goswam and Saha (2017) reported that mulched plants grew taller and had more number of branches than unmulched plants. Rajablarijani *et al.* (2016) observed an increase on the number of branches and leaves for the plant grown with plastic mulch compared to bare soil.



**Table 2:** Influence of Plant Spacing and Weed Control Practices on Weed Density and Weed Biomass on Okra

Treatments	Weed density (No./0.5m <sup>2</sup> )			Weed Biomass (g/0.5m <sup>2</sup> )		
	Days after planting					
	30	45	60	30	45	60
<b>Plant spacing (cm)</b>						
60 x 30	1.33	1.04	1.67	8.20	4.56	8.0
60 x 40	1.22	1.33	1.70	9.60	5.56	8.89
60 x 50	1.44	1.41	1.70	10.10	5.89	9.44
F-LSD(0.05)	N.S	N.S	N.S	N.S	N.S	N.S
<b>Weed control treatments</b>						
Grass mulch	2.04	1.85	2.37	15.78	8.56	11.67
Black polyethylene mulch	0.59	0.63	0.93	1.89	1.11	2.67
Sawdust mulch	1.37	1.30	1.78	9.67	6.33	10.00
Weed free	1.27	1.45	2.78	2.67	2.33	3.33
Hoe weed at 4 & 8 WAP	3.22	2.00	3.78	26.33	17.67	23.00
F-LSD(0.05)	0.30	0.80	0.26	1.66	1.62	1.39

**Note:** N.S = Not significant, WAP=weeks after planting



**Table 3:** Influence of Plant Spacing and Weed Control Practices on the Morphological Parameters of Okra at 4 and 8 WAP

Treatments	Plant height (cm)	Stem girth (cm)	Number of branches	Number of leaves	Plant height (cm)	Stem girth (cm)	Number of branches	Number of leaves
Plant spacing (cm)								
60 × 30	28.20	4.67	1.14	7.50	61.30	10.56	1.81	20.75
60 × 40	26.20	4.47	1.08	7.17	60.70	9.67	1.78	21.05
60 × 50	27.90	4.44	1.19	6.94	59.10	9.67	1.86	21.92
F-LSD <sub>(0.05)</sub>	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
Weed control treatments								
Grass mulch	28.64	4.31	1.17	5.61	62.58	10.4	1.97	22.58
Black polyethylene mulch	30.56	5.28	1.22	8.94	63.33	11.78	2.06	23.56
Sawdu mulch	23.14	4.00	1.03	7.06	54.19	7.69	1.42	17.61
Weed free	25.08	4.08	1.17	5.83	58.83	9.50	2.00	20.92
Hoe weed at 4 & 8 WAP	23.83	3.67	1.00	6.25	47.00	6.00	1.17	13.67
F-LSD <sub>(0.05)</sub>	5.94	1.02	0.11	1.57	4.92	0.93	0.29	2.29



### **Influence of Plant Spacing and Weed Control Practices on the Yield Parameters of Okra**

Result as presented in Table 4 shows the influence of Plant Spacing and Weed Control on the Yield of Okra. The result indicated that, plant spacing gave non-significant influence on the average pod diameter and average number of pod/plot. However, Plant spacing of 60 x 30cm gave significantly ( $P<0.05$ ) higher average pod length (11.84cm), average number of Pod/plot (22.08), Average pod Weight (68.03g) and yields (0.42tons/ha) while Plant spacing of 60 x 50cm consistently recorded significantly lower values for these yield parameters. Among the weed control treatment, black polyethylene mulch consistently gave significantly ( $P<0.05$ ) higher average pod diameter (2.73mm). Average pod length (11.54cm), average number of Pod per plot (22.45), average Weight of Pod (66.20g) and yield (0.39tons/ha) which was statistically similar to those obtained in other mulched plots while hoe weeded plots gave consistently significantly ( $P<0.05$ ) lower values for these parameters when compared with free plots. The above results are corroborated with the findings Singh and Kamal (2012) and Hatami *et al.* (2018) who reported that higher yield in tomato was obtained in black polyethylene mulch than the other mulch materials used. Mahadeen (2014) had also reported positive effect of black polyethylene sheet mulching on yield of Okra. Rahman and Shadeque (2019) also observed higher Okra production with black polyethylene mulch and suggested that the least competition from weeds and uniform moisture conservation throughout the growing season might be responsible for better performance of Okra under black polyethylene sheet.



**Table 4:** Influence of Plant Spacing and Weed Control Practices on Yield Parameters of Okra

Treatments	Average pod diameter	Average pod length	Number of Pod/plot	Number of pod/plant	Average weight of pod/plant(g)	Yield (tons/ha)
Plant spacing (cm)						
60 × 30	2.67	11.84	23.08	5.00	68.00	0.42
60 × 40	2.68	11.30	19.19	4.41	60.50	0.30
60 × 50	2.60	10.54	18.76	3.83	50.90	0.28
F-LSD <sub>(0.05)</sub>	N.S	1.16	N.S	1.39	15.46	0.10
Weed control treatments						
Grass mulch	2.64	10.98	19.78	3.89	55.80	0.30
Black polyethylene mulch	2.73	11.54	22.45	4.74	66.20	0.39
Sawdust mulch	2.58	11.15	18.80	4.61	57.40	0.31
Weed free	2.59	10.33	16.96	4.83	38.30	0.23
Hoe weed at 4 & 8 WAP	2.55	10.10	15.29	4.00	30.70	0.19
F-LSD <sub>(0.05)</sub>	0.13	1.14	4.26	1.67	14.15	0.09

N. S = Not significant



## CONCLUSION AND RECOMMENDATION

It is concluded from the study that the use of black polyethylene mulch and planting spacing of 60 x 30cm reduced weed density and weed biomass and also increased the yield of Okra as compared to other mulch materials used and other weed control methods employed. Therefore, it should be recommended for maximum yield of Okra production in Badeggi, Niger State; Southern Guinea Savanna Ecological Zone.

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