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Effect of Plant Spacing and Weed Control Treatments on Growth and Yield of Okra (*Abelmoschus Esculentus* (L.) Moench) in Derived Savanna, Nigeria

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Keyword: Okra, growth, weed biomass, pod yield, weed control treatments.

Abstract
Field study was conducted at the Teaching and Research farm of Department of Crop Science, University of Nigeria Nsukka from May to July 2016 to investigate the growth and yield of Okra (Abelmoschus esculentus (L.) Moench) in response to plant spacing and weed control treatments. Three plants spacing (60 cm x 45 cm, 60 cm x 30 cm and 60 cm x 60 cm) and weed control treatments (Dry grass mulch, Black polyethylene mulch, Sawdust mulch), and Hoe weeding at 4 and 8 weeks after planting (WAP) and weed free plots were used as control. The experiment was laid out in a factorial arrangement in randomized complete block Design with three replications. It consisted of eleven (11) treatment combinations. The mulching materials were applied before sowing the seeds. A split application of NPK 15: 15: 15 was done at 2 and 6 WAP at the rate of 200 kg/ha by side placement. Analysis of variance (ANOVA) for the data was carried out using (Genstat 12.1 Discovery Edition). Significant differences between means were estimated by the least significant difference 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 ($0.92/0.5m^2$) lower weed biomass ($2.67g/0.5m^2$), higher crop pod yields (0.39

tons/ha) and higher plant height (63.33cm). plant spacing of 60 x 30cm and mulching with black polyethylene within the confines of the study was therefore recommended for pod yield production of okra.

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) is a widely cultivated fruit vegetable found in almost every market in Nigeria (Akoraoda *et al.,* 1985) and Africa (Schippers, 2000). In Nigeria, it ranks third in terms of consumption and production area following tomato and pepper (Ibeawachi, 2007). Okra is one of the most nutritious vegetables which contain an average of 1.9 g of protein 0.2 g of fat, 6.4 g carbohydrate, 0.7 g minerals and 1.2 g fiber per 100 g edible portion and energy value of 4550 Kcal/kg (Edet and Etim, 2010). It is mostly grown for its young leaves and green pods (Edet and Etim, 2010). It is usually grown on small farm holdings in mixtures with staple food crops such as yam, maize, cassava, cowpea and pepper or with various vegetable crops (Ayodele, 1983; Muoneke and Asiegbu, 1996; Olasotan, 2001; 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 (DenHollander *et al*., 2007) and allelopathic effects (Kruidhof *et al.*, 2008). 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 straw, grasses, green leaves, crop residues, sand & stones sand plastics are used as mulches.

In Nigeria, the limiting factors in Okra production and other vegetables among others include weed management, tillage practices, low yielding varieties and sub-optimal planting density (Adegonwo *et al.,* 1989; Burnside, 1993; Dikwahal *et al.*, 2006, Adeyemi *et al,* 2008). Excessive weed growth is one of the most serious factors affecting the performance of crops 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 (Iyagba *et al.,* 2012). It has been shown that when weeds interfere with vegetables 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 income. 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.,* 1989). Therefore, for a profitable crop production, the bulk of labour requirement goes into weed control. Usoroh (1995) reported that for fruits and vegetables, weeding alone accounted for between 45-80% of the total cost of production. Tijani-Eniola (2001) 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 animals and implements (Marwat *et al.,* 2008). In view of these facts, the present study was designed to investigate the effect of different weed control methods and plant spacing on the weed growth and yield of okra.

MATERIALS AND METHODS

The experiment was conducted at the teaching and research farm of the Department of Crop Science, University of Nigeria, Nsukka located at latitude $06^0 52`$N and longitude $07^0 24`$E and on altitude 477.2 m above sea level. The area is characterized by a bimodal rainfall pattern with peaks in June and September and a dry spell between mid-July and August. The site was characterized as tropical utisol of sandy loam texture. Before initiating the present study, the area used had been under fallow with mixed plant species for three years. The experiment was conducted between May and July, 2016. It was a factorial experiment arranged in a randomized complete block design with three replications. The treatments were three plant spacings (60cm x 60cm, 60cm x 45cm and 60cm x 30cm) and weed control treatments (sawdust mulch at the rate of 154.3 tonnes/ha, Black polyethylene film mulch and dried grass mulch at the rate of 37.5 tonnes/ha), Hoe weeding at 4 and 8 WAP (control 1) and weed free plots (control 2) (they were planted using the standard plant spacing for okra which is 60cm x 45cm). It gave eleven (11) treatment combinations.

A piece of land measuring 27 m long by 8 m wide with an area of $216m^2$ was ploughed, harrowed and made into beds. The prepared land was marked out into three blocks of 27 m x 2 m each. Each block was divided into 11 plots of 2 m x 2 m. The crop was planted using the different plant spacing. Each block was separated by 1 m pathway. Basal application of decomposed poultry manure was incorporated into the soil at 10 kg/plot using a garden fork. The treatments were applied two days before the seeds were sown. The black plastic mulch was laid before planting while the planting was done through openings made on it at specified spacing. Clemson spineless variety of okra was used for the study. They were sown three per hold and later thinned down to one per hill two weeks after emergence; two middle plants were used as the sampling unit from which data were taken. Fertilizer (N. P. K. 15: 15: 15) was added to each plot in split doses at the rate of 200 kg/ha at the 2^{nd} and 6^{th} weeks after planting using side placement method.

Weeding was done accordingly with hoes on the plots requiring weeding. Harvesting of the vegetable was done using sharp knife. Weed identification, density and biomass were determined within two quadrats (0.5 m^2) randomly thrown twice in each plot at 2 weekly intervals. The weeds within each quadrat were harvested at soil level and oven dried at 70^0C for 48 hours. Data collected on the crop included plant height, stem girth, number of branches per plant, number of leaves per plant and number of pods per plant. The yield data was taken at four days interval starting from when they stated having mature fruits till the end of the experiment.

The data on weed infestation and weed density were collected from each unit at 30, 45 and 60 days after planting (DAP) using a quadrat of 0.5 m^2 placed randomly at two different spots in the plots. The weed flora within each quadrat were identified and counted. The acquired data was analyzed using Genstat statistical package. The means were separated using the Fisher's least significant difference (LSD).

Results and Discussion

A total of eleven (11) weed species within eight (8) families were identified during the study period (Table 1). The most important weed species found in other weed control treatments are *Calopogonium muconoides, mimosa pudica, Pancium* maximum while *Cyperus rotundus* was mostly found in black polyethylene mulch. Hoe-weeded plot recorded higher weed species diversity than 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 result of the findings of Derksen *et al.,* 1994, Buhle *et al.,* 1997, and Leeson *et al.,* 2000 that the farming practices influence the species composition of weed communities in arable field. The different composition of weeds found in the experimental field was due to favourable climatic conductive environmental conditions for their growth.

Weed Density and Weed Biomass

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 planting (DAP), hoe weeded plot consistently recorded significantly ($P<0.05$) higher weed density compared with weed free plots. Weed density recorded with the plots that are weed free at 30 days after planting (DAP) was statistically similar to that recorded in sawdust mulch but significantly ($P<0.05$) lower than that recorded in black polyethylene mulch. Again, hoe-weeded plots recorded significantly ($P<0.05$) higher weed biomass (23 g/05 m^2) at 60 DAP which was significantly higher than what was recorded in the other weed control treatments. The least weed biomass (2. 67g/0.5m^2) was recorded in plots mulched with black polyethylene. The result of the findings is in agreement with the reports of Shrivastava *et al.,* 1994 and Osadebe *et al.,* 2015, that

black plastic mulch reduced weed infestation considerably. Ngouajio *et al.,* (2008) also reported complete elimination of weeds with the use of black polyethylene mulch. Sannigrahi and Borah (2002) also reported the effectiveness of black polyethylene sheet in controlling weeds of okra. Sainudheen (2000) also reported similar result and according to him, no weed growth was observed in okra under polyethylene mulch except a few which germinated through the holes made for sowing the seeds.

Plant spacing did not show any significant effect on the morphological parameters at 4 and 8 WAP (Table 3). Among the weed control treatments, black polyethylene mulch plots recorded significantly ($P<0.05$) higher plant height at 4 WAP (30.56 cm) which was comparable with that obtained from grass mulch (28.64 cm) and weed free plots (25. 08 cm), while the least was obtained in the sawdust mulch plots (23.14 cm) which is statistically similar to that obtained from hoe weeded plots (23.83 cm). The stem girth following the same trend as the result obtained in plant height. The highest number of branches was recorded by plots with black polyethylene mulch (1.22 cm) 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 hoe weeded plots (1.00 cm). At 8 WAP, plots with black polyethylene mulch recorded significantly higher values for plant height (64.33 cm), stem girth (11.78 cm), number of branches (2.06) and number of leaves (23.56) while the least values 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. Ali and Khan (2008) reported significant effect of mulches on the number of branches per plant in okra plant. Also, Hamidreza et al., (2012) and Masarirambi *et al*., (2013) 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 of the study were also consistent with the findings of Matsenjwa (2006) who reported that both plastic and organic mulch increased plant height of field bean under similar conditions. Also, Kundu *et al.,* (2006) and Goswami and Saha (2006), reported that mulched plants grow taller and had a greater number of branches than unmulched plants. Rajablarijiani *et al.* (2012) observed an increase on the number of branches and leaves for the plants grown with plastic mulch compared to bare soil.

Plant spacing gave non-significant effect 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 (11.84 cm), average number of pod/plot (23.08), average pod weight (68.0 g) and yield (0.42 tons/ha) while plant spacing of 60 x 60cm 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 (2.73 mm), average pod length (11.54 cm),

average number of pods per plot (22.45), average weight of pod (66.20 g) and yield (0.39 tons/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 weed free plots. The above results are corroborated with the findings Singh and Kamal (2012) and Hatami *et al.* (2012), 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 (1999) 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.

Conclusion

It is concluded from the study that the use of black polyethylene mulch and planting distance of 60 x 30 cm 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 adopted for maximum yield in okra production.

References

Adejonwo, K. O., Ahmed, M. K., Lagoke, S. T. O. and Kari-Kari, S. K. (1989). Effect of variety, nitrogen and period of weed interference on growth and yield of Okra (Abelmoschus esculentus). *Nigeria Journal of Weed Science* 8: 73-75.

Adeyemi, O. R., Smith M. A. K. and Ojeniyi, S. O. (2008). Effect of land preparation techniques on weed control effectiveness in Okra (Abelmoschus esculentus (L.) Moench). *Nigerian Journal of Weed Science* 21: 72-83.

Akoroda, M. O., Ayin, O. A., and Tijani, I. O. A. (1985). Edible fruit productivity and harvest duration of Okra in Southern Nigeria. *Tropical Agric (Trinidad)* 63(20): 110-112.

Ali, S. and Khan, I. A. (2008). Effect of different mulches on weed flora and yield of Okra (Abelmoschus esculentus (L). M. Sc thesis of Department of Weed Science, the University of Agric. Peshawar pp. 1 – 51.

Ayodele, O. J. (1983). Yield response of Okra (Abelmoschus esculentus (L.) Moench) to N. P. K. fertilizer. NIHORT Training Guide pub. On Okra production.

Buhler, P. D., Hartzler, R. G. and Forcella, G. (1997). Implications of seed band dynamics to weed management. *Weed Sci.* 45: 329 – 336.

Burnside, O. C. (1993). Weed science the stepchild. *Weed Technology* 7: 515-518.

Derksen, D. A., Thomas A. G., Lafond, G. P. Loeppky, H. A., Swanton, C. I. M. (1994). Impact of Agronomic practices on weed communities: fellow within tillage systems. *Weed Sci* 42: 184 – 197.

Dikwahal, H. D., Haggi, P. T. and Aliyu, L. (2006). Effect of sowing date and plant population density on growth and yield of two Okra (Abslmoschus esculentus L.) varieties in the Northern Guinea Savanna of Nigeria. *Nigerian Journal of Horticultural Science* 11: 56-62.

Edet, G. E. and Etim, N. A. (2010). Economic Analysis of Okra production: A case study of Ivo Local government area of Ebonyi State. *Nig. J. Agric. Food and Environ*. 6(12): 99-103.

Genstat, (2003). Genstat for Windows Relase for 4.23 A. E. Discovery Edition. DSN International LTD., Hamel Hempstead, UK.

Goswami, S. B. and Saha, S. (2006). Effect of Organic and Inorganic mulches on soil moisture conservation, weed suppression and yield of elephant foot yam (Amorphophallus Paeoniifolius) *Indian J. Agron.* 51(2): 154-156.

Hamidreza, R., Ramin, R. and Farzad, H. (2012). Using coloured plastic mulch in Tomato (Lycopersicon esculentum L.) under Agroclimatic conditions of Peshawar, Pakistan, *Pak. J. Weed Sci. Res*. 10(3-4): 157 – 160.

Hatami, S., Nourjon, A., Henareh, M., and Pourakbar, L. (2012). Comparison effects of different methods of black plastic mulching and planting patterns on weed control, water use efficiency and yield in tomato crops. *International Journal of Agric. Science* 2(10): 928-934.

Ibeawachi, I. K. (2007). Intercropping: A food production strategy for resource poor farmers. *Nature & Science*, 5: 46-49.

Iyagba, A. G, Onuegbu, B. A. and Ibe, A. E. (2012). Growth and yield response of Okra (Abelmoschus esculentus (L.) Moench). Varieties of weed interference in South-Eastern Nigeria. *Global J. Sci. frontier Res*. 7(1): 23-31.

Kundu, D. K, Singh, R. and Chowdury, R. S. (2006). Effect of rice straw mulch and irrigation on nutrient availability in soil and tuber yield of sweet potato (Ipomea batatas L.) in Coastal Orissa. In: Naskar, S. K., Nedunchezhiyan, M., Rajasekhara, R. K., Sivakumar, P. S., Ray R. C., Misra, R. S. and Mukherjee, A. (eds.), Root and tuber crops: in nutrition food security and sustainable environment. Regional Centre of CTCRI, ICAR, Bubaneswar. Pp 177 – 122.

Leeson, J. Y., Sheard, J. W., Thomas, A. G. (2000). Weed communities associated with arable Saskat Chewan Farm management systems. *Can. J. Plant Sci*. 890: 177 – 185.

Mahadeen, A. Y., (2014). Effect of polyethylene black plastic mulch on growth and yield of two summer vegetable crops under rainfed conditions under Semi-arid region conditions. *Am. J. Agric. Biol. Sci*. 9(2): 202-207.

Marwate, K. B., Muhammad, S., Zahid Hussain, B. and Haroon-ur-Rashid, (2008). Study of various weed management practices for weed control in wheat under irrigated conditions. *Paksitan Journal of Weed Science Research*. 14(1-2): 1 – 8.

Masarirambi, M. R., Mndzebele, M. E., Wahome, P. K. and Oseni, T. O. (2013). Effect of white plastic and sawdust mulch on "Savoy: Baby cabbage (Brassica Oleracea var. bullata) growth, yield and soil moisture conservation in summer in Swaziland. *American Eurasian J. Agric and Environ Sci.* 13(2): 261-268.

Matsenjwa, N. V. (2006). Influence of mulch on Ecological and Agronomic Characteristics of field bean (Phaseolus vulgaris L.) in Luyengo. Unpublished B. Sc. Agricultural Dissertation University of Swaziland, Luyengo, Swaziland.

Muoneke, C. O. and Asiegbu, J. E. (1996) Evaluation of growth and yield advantage of okra and cowpea sown in mixture, pp 100-105. In Adedoyin S. and A. Ayelaagbe (Eds.) Proceedings of 14th Hort. Soc. Of Niger. Conference Held at Ago-Iwoye.

Ngouajio, M., Auras, R., Fernadndez, R. T., Rubino, M. Counts, J. W. and Kijchavengkul, T. (2008). Field performance of aliphatic-aromatic copolyester biodegradable mulch films in fresh market tomato production system. Hrt. Technology 18: 605-610.

Odeleye, F. O, Odeleye, M. O., Dada, O. A. and Olayeye, A. O. (2005). The response of Okra to varying levels of poultry manure and plant population density under sole cropping, *Journal of food, Agriculture & Environment* 3(3, 4): 68-74.

Olasotan, F. O. (2001). Optimum population density for Okra (Abslmoschus esculentus (L) Moench) in a mixture with cassava (Marihot esculentus) and its relevance to rainy season-based cropping system in south-western Nigeria. *J. of Agric. Sc*. 136:207-214.

Osadebe, V. O., Echezona, B. C. and Bakare, S. O. (2015). Effect of weed control treatments and cutting frequency on weed dry matter and biomass in relation to the growth and yield of fluted pumpkin. *Journal of Tropical Agriculture, food, environment and Extension* 14(2): 1 – 8.

Rahma, N. and Shadeque, A. (1999). Comparative efficacy of mulches with or without a herbicide on growth and yield of Lady's finger (Abelmoschus esculentus (L.) Moench var, Vijaya). *J. Agric. Sc. Soc*. 12: 123-127.

Rajablarijiani, H. R., Hassankhan, F. and Rafezi, R. (2012). Effect of coloured plastic mulches on yield of tomato and weed biomass. *International Journal of Environmental Science and Development*, 3(6): 590-593.

Sainudheen, K. (2000) Integrated weed management in Okra (Abelmoschus esculentus (L) Moench) M. Sc. (Ag) thesis, Kerala Agricultural University, Thrissur, Pp 97.

Sanmigrahi, A. K., and Borah, B. V. (2002). Influence of black polyethylene and organic mulches on tomato (Lycopersicon esculentum Mill) and Okra (Abelmoschus esculentus (L) Moench) production in Assam Veg. Sci. 29(1): 92-93.

Shravastava, P. K., Parikh, M. M., Sawani, N. G. and Raman, S. (1994). Effect of drip irrigation and mulching on tomato yield. *Agricultural water management* 25: 179-184.

Singh, A. K. and Kamal S. (2012). Effect of black plastic mulch on soil temperature and tomato yield in mid hills of Garhwal Himalayas. *Journal of Horticulture and Forestry* 4(4): 78-80.

Tijani-Eniola, H. (2001). Influence of intra-row spacing and weed regime on the performance of Cowpea (viga unguiculata (L) Walp) *Nigerian J. of Weed Science* 14: 11 – 15.

Usoroh, N. J. (1995). Effective weed control strategies for fruit and vegetable production in Nigeria. Paper presented at National Workshop on farming systems for sustainable production of fruits and vegetables held at NIHORT, Ibadan, Nigeria.

Table 1: Weed species infesting the experimental plots of *Abelmoschus esculentus* and their preponderance

S/N	Scientific Name	Family	Lifecycle	Morphology	Weed Severity
1	*Ageratum conyzoides* Linn	*Asteraceae*	Annual	Broadleaf	**
2	*Calopogonium muconoides* Desv.	*Fabaceae*	Annual	Broadleaf	***
3	*Mimosa pudica* Linn	*Mimosoideae*	Annual	Broadleaf	***
4	*Phyllantus amarus* Schum & Thonn	*Euphorbiaceae*	Annual	Broadleaf	**
5	*Amaranthus spinosus* Linn	*Amaranthaceae*	Annual	Broadleaf	*
6	*Commelina bengahalensis* Linn	*Commelinaceae*	Annual	Grass	*
7	*Panicum maximum* Jacq.	*Poaceae*	Annual	Grass	***
8	*Cynodon dactylon* Linn	*Poaceae*	Annual	Grass	**
9	*Eleucine indica* Gaertn	*Poaceae*	Annual	Grass	**

10	*Cyperus rotundus* Linn	*Cyperaceae*	Perennial	Sedge	**

* = Less severe, ** - Severe, *** = Most severe

Table 2: Main effect of plant spacing and weed control treatments on weed density and weed biomass of okra

	Weed density (No./0.5m^2)			Weed Biomass (g/0.5m^2)		
	Days after planting					
Treatments	30	45	60	30	45	60
Plant spacing (cm)						
60 x 30	1.33	1.04	1.67	8.20	4.56	8.0
60 x 45	1.22	1.33	1.70	9.60	5.56	8.89
60 x 60	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
Weed control treatments						
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	2.33	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

No = Number, N. S., = Not significant, WAP = weeks after planting

Table 3: Main effect of plant spacing and weed control treatments on the morphological parameters of okra at 4 and 8 weeks after planting

	4th week				8th week			
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 x 30	28.20	4.67	1.14	7.50	61.30	10.56	1.81	20.75
60 x 45	26.20	4.47	1.08	7.17	60.70	9.67	1.78	21.05
60 x 60	27.90	4.44	1.19	6.94	59.10	9.67	1.86	21.92
F-LSD$_{(0.05)}$	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	10.40	1.97	22.58
Black polyethylene mulch	30.56	5.28	1.22	8.94	63.33	11.78	2.06	23.56
Sawdust 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(0.05)	5.94	1.02	0.11	1.57	4.92	0.93	0.29	2.29

N.S = Not significant, WAP = weeks after plant

Table 4: Main effect of plant spacing and weed control treatments on the yield parameter of Okra

Treatments	Average pod diameter	Average pod length	Number of pod/plant	Number of pod/plant	Average weight of pod/plant(g)	Yield (tons/ha)
Plant spacing (cm)						
60 x 30	2.67	11.84	23.08	5.00	68.00	0.42
60 x 45	2.68	11.30	19.19	4.41	60.50	0.30
60 x 60	2.60	10.54	18.76	3.83	50.90	0.28
F-LSD$_{(0.05)}$	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$_{(0.05)}$	0.13	1.14	4.26	1.67	14.15	0.09

N.S = Not significant