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Growth and Yield Response of Okra (Abelmoschus esculentus (L.) Moench) Varieties to Weed Interference in South-Eastern Nigeria

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Growth and Yield Response of Okra (Abelmoschus esculentus (L.) Moench) Varieties to Weed Interference in South-Eastern Nigeria

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Abstract - Field Studies were conducted at the Federal University of Technology, Owerri, Nigeria to determine the influence of weed interference on the growth and yield of three okra (*Abelmochus esculentus* (L) Moench) varieties. Three varieties of okra (NHAe47-4, Lady's finger and V_{35}) were weeded using five weeding regimes (weedy check, unweeded till 5 weeks after sowing (WAS), weeding once each at 3 WAS and 4 WAS and weed free). The treatment combinations were laid out in a randomized complete block design with three replications. Plant height for okra varieties was in the decreasing order of Lady's finger < NHAe47-4 < V_{35} while leaf area was in the increasing order of NHAe47-4>V_{35}> lady's finger in both years. More flowers/plant were obtained from NHAe47-4 while the least number of flowers aborted were obtained from the Lady's finger. Among the weeded plots, NHAe47-4 produced the highest fresh fruit yield (23.63t ha^{-1} in 2007 and 22.96t ha^{-1} in 2008) which were not insignificantly different from the yields obtained from weed free plots that produced 24.20t ha^{-1} in 2007 and 22.13t ha^{-1} in 2008. Better weed control was obtained from NHAe47-4, 80.63% in 2007 and 76.97% in 2008 comparable with the weed free plots. From this result it can be concluded that okra variety NHAe47-4 weeded at 3 WAS seems more appropriate in this zone.

Keywords : Okra varieties, South-eastern Nigeria, weed interference, weed control efficiency, fruit yield.

I. Introduction

Okra (*Abelmochus esculentus* (L.) Moench) is one of the most important vegetables grown in the tropics. In Nigeria it is produced predominantly by peasant farmers usually in home gardens or in mixture with other cereal crops (Lombin *et al.*, 1988). It is grown for its young leaves and green pods. Okra seeds contain about 20% protein similar to amino acid composition of soybean protein and 20% oil (similar in fatty acid composition to cotton seed oil) (Siemonsma and Hamon, 2002). Okra flowers can be very attractive and sometimes used in decorating the living rooms (Schippers, 2000). The fruits are exported by some African and Caribbeancountries toEurope and America where there is a ready demand from the resident ethnic groups from tropical and sub-tropical countries including Indians, West Africans, Pakistanis and Surinamese (Adetula and Denton, 2003). The world production of okra as fresh fruit vegetable is estimated at 6 million t ha^{-1}. 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 (Adejonwo *et al.* 1989; Burnside, 1993; Dikwahal *et al.* 2006, Adeyemi *et al*, 2008). Whether grown as a sole crop or intercrop, the problem of weed interference still persists. Excessive weed growth is one of the most serious factors affecting the performance of crops generally and vegetables in particular. Such effects 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 factors. Substantial evidence has shown that when weeds interfere with vegetables like okra it affects their vegetative and reproductive growth. The time of weed removal is therefore as important as the removal itself.

William and Warren (1975) recorded 63% crop loss in okra as a result of weed competition in Brazil while Singh *et al* (1981) observed 76.5% loss in okra seed yield in unweeded plots. In Nigeria Adejonwo *et al* (1989) reported 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. It has also been noted that the critical period of weed competition in okra occured between 3 and 7 weeks after sowing (William and Warren, 1975). Adejonwo *et al.* (1989) reported that keeping the crop weed free until 3 weeks after sowing (WAS) depressed growth and yield of okra due to the adverse effect of susequent weed infestation while weed infestation until 3 WAS and thereafter keeping the plots weed-free had no adverse effect on okra plants. Okra varieties are sensitive to environmental changes (Thamburaj, 1982; Grubben, 1999; Ezeakume, 2004; Katung, 2007; Ijoyah *et al.*, 2009). Ijoyah *et. al* 2009, noted that NHAe47-4 provided a better yield during the

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wet season than in the dry season, whereas differences in yield were not significantly different in the wet and dry season with variety 'Ex – Ajia'. The use of crop variety is a means of reducing pest attack in okra production invariably leading to higher yield. Alegbejo (2003)observed that out of 15 okra varieties screened for resistance to okra mosaic virus genius Tymovirus (OMV) in Samaru, Nigeria, 2 cultivars NHAe47-4 and DA97/408 were moderately resistant while the other 13 were highly susceptible.The use of resistant varieties is an alternative to chemical pest control which is not readily avaliable to the peseant okra farmers and also means of reducing environmental pollution.The performance of a crop depends on an interplay of its genetic constitution, the environment under which it is grown and management practices adopted in the culture. The three okra varieties commonly cultivated in the South-Eastern Nigeria are NHAe 47-4, V_{35} and Lady's finger. The extent of crop loss to weed interference by these varieties may differ. This study was therefore carrried out to determine the response of these okra varieties to various periods of weed interference.

II. Materials and Method

Two field studies were conducted at the Federal University of Technology Teaching and Research Farm, Owerri, Nigeria situated between Latitudes $5^0$20'N and $5^0$27'N and between Longtitudes 7^0E and $7^0$07'E in May, 2007 and 2008. The area has a bimodal rainfall with annual mean rainfall of 240 and 137mm in 2007 and 2008 respectively. There are two seasons: the wet season from April to October and dry season from November to March with a characteristic cold dry dust laden wind interval (harmattan) during the months of January through February.

Soil sample was collected before the planting, oven-dried, ground and sieved through 2mmsieve and the sand, silt and clay contents were determined by the Bouyoucos method (1951). The soil pH was determined using the pH-metre in a 1:2.5 soil/water ratio,total nitrogen content was by micro-kjedahl method (Jackson, 1962), total phosphorus was by Bray 1 method (Bray and KurtZ, 1945).Calcium (Ca) and magnesium (Mg) were determined by the Atomic Absorption Spectrophometer (AAS) and potassium (k) and sodium (Na) by flame emission photometry. The organic carbon was according to Walkey and Black (1934) and the present organic matter was estimated by multiplying the percent organic carbon with a factor 1.724. The soil has the following characteristics; pH (in H_{20})5.0, organic carbon 1.29%, Total N 0.24%; extractable P 4.94 mg Kg^{-1}, extractable K 0.11, Ca 1.62 and Mg 0.59 in cmol Kg^{-1}. Soilparticle size distribution was sand 47%, clay 31% and Silt 22%. The soil was classified as sandy ultisol (Ibe, 2005). The soils have low mineral reserves and are therefore of low fertility. Climatic data was obtained from the Federal University of Technology meterological unit, Owerri, Nigeria.

The land was ploughed each year and harrowed with the aid of tractor mounted impliments. Three varieties of okra were used: NHAe47-4, Lady's finger and V_{35}. NHAe47-4 bred by the National Horticultural Research Institute (NIHORT) Ibadan, Nigeria is characterized by early flowering with thick fresh pods, short to medium in height and with deeply lobed leaves and profuse branching were indicated to be positively geotropic (NIHORT, 1986). Lady's finger is an elite variety popular to the people of the South-Eastern Nigeria, is known to be early flowering, medium in heightwith nearly entire leaf margin and branches diagonally upwards at an angle of 45^0 with the main stem. Seeds were obtained from Imo State theAgricultural Development Project (ADP), Owerri, Nigeria. V_{35} is an adapted exotic variety with almost the same morphological features asthe NHAe47-4 was obtained from the National Horticultural Research Institute, Ibadan, Nigeria.

The seeds were treated with *Peperomie pellucida* leaf powder at 30g per 100 seeds as recommended by Ibe *et al.*(1998). Three seeds per hole of the varieties under trial were planted on May 26th in both years on the flat with a spacing of 0.6m x 0.3m between and within the rows respectively and later thinned to one plant/stand. The gross and net plot sizes were $12m^2$and $6m^2$ respectively.

A commercial formulation of NPK fertilizer (15-15-15)was applied at the rate of200kg ha^{-1} to the okra plots, in two equal doses at 2 and 6 WAS.There were five weeding regimes: weedy check, regular weeding up to 5 weeks after sowing (WAS),weeding once at 3 WAS,weeding once at 4 WAS and weed free. Treatments were arranged in a split plot design with variety as main plot factor and weeding regime as sub-plot factor with three replications giving a total of 45 plots. Insect pests were controlled by spraying with cypermetricin to check the incidence of insect pests that affect the leaves of okra plant.

Growth and yield parameters determined were plant height, leafarea, number of flowers produced and aborted, fresh fruit yields, weed density, weed dry weight and weed control efficiency. Weed density was measured by a 1x1mquadrat thrown at random and the weed species within the quadrat counted. Weed control efficiency was calculated based on the method suggested by Bhattacharya and Mandal (1988) as follows:

$$\frac{\text{Dry weed weight (DWT) of unweeded control - DWT of treatment}}{\text{DWT of unweeded control.}} \times 100$$

The data collected were subjected to analysis of variance (ANOVA) and means compared using the Duncan Multiple Range Test (DMRT) at a probability level of 5% according to Gomez and Gomez (1984).

III. Results and Discussion

a) Growth parameters

The result of the growth parameters of the three okra varieties and the weed interference duration in 2007 and 2008 are presented in Tables 1 and 2. The growth parameters were significantly affected by the okra variety and the different weeding regime. In both years, Lady's finger was significantly taller than the other two varieties. This is in conformity with the growth habits of the cultivars already stated. NHAe47-4 produced significantly larger leaves, more flowers formed and aborted than the rest of the cultivars. Adejonwo *et al.* (1989) observed insignificant growth parameters of V_{35}, TAE-30 and TAE -38 varieties of okra during the dry season while Majanbu *et al.* (1988) reported significant growth characters of NHAe47-4 and white velvet tested under rain fed conditions at Samaru. This is in line with the finding of Majanbu et al. (1988) indicating that the season of planting okra plays an important role in determining the growth characters of okra variety.

Duration of weed interference significantly affected okra growth parameters. The unweeded okra plots produced the shortest plants, smallest leaf size and number of flowers produced. Plant height and leaf size from the unweeded plots were not significantly different from plots weeded at 4 WAS or kept weed free till 5 WAS. This indicates that weed interference till 4 WAS had an adverse effect on these growth parameters. The result further showed that in both years keeping weeds in okra plots beyond 3 WAS led to a higher flower abortion which could possibly affect fruit formation negatively. This once again proof that the critical period weed interference is up to 3 WAS. This in agreement with the earlier report of Adejonwo *et al.* (1989) that allowing okra plots to experience weed interference beyond 3 WAS will have adverse effect on okra plants. This is also in line with the report of Scott *et al.* (1979), Ayeni and Oyekan (1992) and Dada and Fayinminnu (2007), that most crops have certain range of tolerance to weed competition and length of period in which they are required to be weed free. Allowing weeds to interfere with crops longer than necessary have always caused yield reduction in crops.

IV. Fruit Yield

In both years fruit yield parameters of okra were significantly influenced by the various cultivars (Tables 1 and 2). Fruit yield of NHAe47-4 was higher than the other varieties. While there was no statistical difference in fresh fruit yield/plant between NHAe47-4 and Lady's finger but in fruit yield/hectare, NHAe47-4 and V_{35} in 2007 and 2008 produced more fruits than lady's finger. Yields of NHAe47-4 and V_{35} did not differ significantly. The better performance of NHAe47-4 and V_{35} among other factors can be attributed to the larger leaf area of both varieties. Ibe *et al.* (2005) recorded a higher utilization efficiency of NHAe47-4 than V_{35} and Lady's finger. NHAe47-4 bred by NIHORT produced higher yield than V_{35} an exotic variety having the same morphological features as that of NHAe47-4 and is well suited to our environment. This is further buttressed by the larger leaf sizes produced by these cultivars which enabled them to produce greater assimilates during their photosynthetic activities. Crop yield in 2007 was generally higher than that of 2008. This is attributed to the poor rainfall experienced in 2008.

V. Weed Control

The prevalent weed types at the experimental site in 2007 and 2008 was dominated by Asteraceae, Cyperaceae, Euphorbiaceae, Poaceae and to a lesser degree Urticaceae and Verbenaceae families (Table 3).

Weed dry weight, weed density and weed control efficiency significantly affected the performance of the okra cultivars (Table 4). NHAe47-4, however, had a better weed control (80.63 and 76.97% in 2007 and 2008 respectively) invariably would lead to less competition from the weeds for growth resources on the field. Allowing the weeds to stay longer with the crops led to higher quantity of weeds produced and subsequently lower weed control ability.

There was no significant difference in weed control efficiency obtained by weeding at 3 WAS (75.13 and 74.47% in 2007 and 2008 respectively) and keeping weed free till harvest. Furthermore, it was observed that there was no significant difference in weed density from the unweeded plots and keeping the plots weed free till 5 WAS. This might suggest that allowing the plots weed free till 5 WAS had accumulated enough growth resources for the weeds to grow vigorously after this period.

Interactive effects between the okra varieties and duration of weed interference were significant (Tables 5 and 6). The lowest okra yields were obtained in weed infested plots till harvest in each of the cultivars. At the early stage of crop growth, both weed and okra nutrients demand are usually met, but as growth progresses, the nutrients supply normally falls short of demand resulting in competition. The plots with better weed control also resulted into higher fruit yield. Ibe *et al.* (2008) had reported that increasing the mulching rate of siam weed in okra led to a better weed control and higher crop yield.NHAe47-4 had a better weed control not significantly different from the weed free plots and performed better than the rest of the cultivars when weeded at 3 WAS. This is due to a reduced competition for resources like nutrients, water and light. The reverse was the case of the unweeded plots with lower weed control and consequently a reduction in crop yield. This

is in agreement with the finding of Fabro and Rhodes (1980) that high weed infestation brings about severe competition for light which will reduce the stomata number, photosynthetic ability of the crop and ultimately the yield. The non weeding would have a shading effect and also a reduction in the photosynthetic ability of the okra. There was higher performance of the cultivars generally at 3 WAS apart from the weed free plots. This is perhaps because nutrients are made available to the crop throughout the growth stages with little or no competition by weeds at this weeding regime. Dada and Fayinminni (2007) suggested that the weeding possibly coincides with the phase when nutrients needed for metabolic processes are made available and utilized to manufacture food. This therefore showed that efficient uptake and utilization of applied nutrients for okra growth, development and yield is a function of the timing of weed infestation and cultivar type.

VI. Conclusion

The work revealed that NHAe47-4 with weeding carried out at 3 WAS is better for the growth and yield of okra in South-Eastern Nigeria. This will be advantageous on the poor resources farmers who are the major food producers in this zone of the country.

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Table 1 : Effect of okra varieties and weed interference duration on growth parameters and yield in 2007

Treatments:	Plant height at harvest (cm/plant)	Leaf area/ plant/(cm^2)	No. of flowers formed/plant	No. of flowers aborted/plant	Fresh fruit wt/plant(g)	Fruit yield (tha^{-1})
Okra – Cultivars						
NHAe47-4	71.2b[2]	38.2a	13.7a	2.4a	28.62a	23.63a
Lady's finger	86.7a	33.4b	11.6b	1.9ab	23.93a	20.48b
V_{35}	68.9b	36.1a	13.4a	2.2a	19.46	22.94a
Mean	75.6	35.9	12.9	2.17	24.00	22.35
SE (±)	9.7	2.4	1.11	0.2	4.6	1.7
Weed Interference duration						
Weedy check	33.8c	18.2b	6.7c	3.1a	1.08d	6.72d
Weed infested for 3WAS[1]	61.0b	34.6a	11.3a	2.3b	18.06b	22.16a
Weed Infested for 4 WAS	37.1bc	29.9b	8.9b	3.2a	14.79b	13.98b
Weed free until 5 WAS	46.9b	22.1b	7.2b	3.3a	3.80c	10.24c
Weed free until harvest	69.2a	38.2a	13.4a	2.4b	21.21a	24.20a
Mean	49.6	28.6	9.5	2.9	11.79	15.46
SE (±)	15.2	8.4	2.8	0.3	8.98	7.53

Table 2 : Effect of okra varieties and weed interference duration on growth parameters and yield in 2008

Treatment:	Plant height at harvest (cm/plant)	Leaf area plant/ (cm^2)	No. of flowers formed/plant	No. of flowers aborted/plant	Fresh fruit wt/plant (g)	Fruit yield (tha^{-1})
Okra – Cultivars						
NHAe47-4	70.0b[2]	36.7a	12.8a	2.4a	26.46a	22.96a
Lady's finger	86.3a	32.2b	10.6b	1.8b	22.81a	19.38b
V_{35}	68.6b	36.1a	12.6a	2.2a	18.63b	22.34a
Mean	74.97	35.0	12.0	2.13	22.63	21.56
SE (±)	8.03	1.99	0.9a	0.25	3.22	1.56
Weed Interference duration						
Weedy check	33.6bc	17.96	5.8c	3.0a	1.05d	6.24c
Weed infested for 3WAS[1]	60.4a	33.8a	10.4a	2.2b	17.26b	20.43c
Weed Infested for 4 WAS	36.7b	28.4ab	8.5b	3.1a	14.07b	13.73b
Weed free until 5 WAS	46.2b	20.7b	6.9b	3.2a	3.29c	9.54c
Weed free until harvest	48.8a	36.2a	12.6a	2.0b	19.33a	22.12a
Mean	49.14	27.4	8.84	2.7	11.00	14.41
SE (±)	13.55	9.79	2.44	0.50	7.44	6.11

Table 3 : Cumulative weed flora composition of the experimental site in 2007 and 2008

Weed types	Plant family	Growth form	Degree of occurrence
Amaranthus spinosus	Amaranthaceae	ABL	XX
Celosia loxa	Amaranthaceae	ABL	XX
Ageratum conyzoides	Asteraceae	ABL	XX
Aspilia africana	Asteraceae	PBL	XX
Chromoleana odorata	Asteraceae	PBL	XXX
Tridax procumbens	Asteraceae	ABL	XX
Commelina benghalensis	Commelinaceae	PSB	XX
Commelina diffusa	Commelinaceae	PSB	XX
Cyperus rotundus	Cyperaceae	PS	XXX
Cyperus tuberosus	Cyperaceae	PS	XX
Euphorbia heterophylla	Euphorbiaceae	ABL	XXX
Phyllantus amarus	Euphorbiceae	ABL	XX
Mimosa pudica	Leguminosae	PBL	X
Sida acuta	Malvaceae	PBL	X
Boerhavia diffusa	Nyctaginaceae	PBL	XX
Axonopus compressus	Poaceae	PG	XXX
Cynodon dactylon	Poaceae	PG	X
Eleusine indica	Poaceae	AG	XX
Eragrostis atrovirens	Poaceae	PG	XX
Paspalum conjugatum	Poaceae	PG	XX

Panicum maximum	Poaceae	PG	X
Sporobolus pyramadalis	Poaceae	PG	XX
Talinum triangulare	Portulacaceae	PBL	XX
Diodia scandiens	Rubiaceae	PBL	X
Mitracarpus villosus	Rubiaceae	ABL	XX
Physalis angulata	Solanaceae	ABL	X
Laportea aestuans	Urticaceae	ABL	XX
Starchytapheta cayenensis	Verbenaceae	PBL	XX

Table 4 : Effect of okra varieties and weed interference duration on weed dry weight, weed density and weed control efficiency in 2007 and 2008

Treatments:	Weed dry weight (kg ha^{-1})		weed density (no/m^2)		weed control efficiency (%)	
	2007	2008	2007	2008	2007	2008
Okra – Cultivars						
NHAe47-4	91b	111b	20c	23b	80.63a	76.97a
Lady's finger	163a	180a	26a	26a	65.32b	62.66b
V_{35}	154ab	166b	23b	24a	67.23	65.56b
Mean	136	152.33	23	24.33	71.06	68.40
SE ($\pm$)	25.32	19.92	2.45	2.16	3.3	2.5
Weed Interference duration						
Weedy check	530a	582a	33a	33a	-	-
Weed infested for 3WAS[1]	518b	526b	14b	15b	75.13a	74.47a
Weed Infested for 4 WAS	524b	540b	17b	18b	51.41bc	50.98bc
Weed free until 5 WAS	556a	577a	26a	28a	24.40c	23.83c
Weed free until harvest	0c	0c	0c	0c	100a	100a
Mean	293.60	359.00	18	18.80	62.74	62.32
SE ($\pm$)	38.31	38.10	11.22	11.44	28.02	28.18

Table 5 : Interaction between okra varieties and weed interference duration on growth parameters and yield in 2007

Treatments:	Plant height at harvest (cm/plant)	Leaf area/ plant/(cm^2)	No. of flowers formed/plant	No. of flowers aborted/plant	Fresh fruit wt/plant(g)	Fruit yield (tha^{-1})
NHAe 47-4 weedy check	48.4c	22.4b	7.1c	3.4a	1.58d	6.94de
Weed infested for 3 WAS	70.3b	36.6a	12.3a	2.2b	26.84a	23.42a
Weed infested for 4 WAS	63.8b	31.8b	10.7b	3.1a	22.45a	18.34b
Weed free until 5 WAS	51.6bc	26.4b	8.8b	3.5a	5.01c	11.44c
Weed free until harvest	73.4b	40.2a	14.3a	2.2b	29.12a	24.62a
Lady's finger weedy check	54.2bc	23.4b	6.7c	3.2a	1.30d	6.34e
Weed infested for 3 WAS	90.9a	35.6a	11.8b	2.8ab	18.24b	18.86b
Weed infested for 4 WAS	72.4b	32.6ab	10.6b	3.4a	17.04b	15.34c
Weed free until 5 WAS	62.6b	26.3b	8.2b	3.5a	4.23c	10.03d
Weed free until harvest	97.3a	39.1a	14.3a	2.6ab	22.16a	19.65b
V_{35} weedy check	46.4c	22.7b	6.8c	3.3a	1.64d	6.69d
Weed infested for 3 WAS	69.80	36.8a	12.6a	2.7ab	23.85a	21.26a
Weed infested for 4 WAS	50.6bc	31.3b	10.2	3.3a	21.14b	16.31b
Weed free until 5 WAS	48.4c	25.3b	7.9c	3.7a	6.04c	9.73c
Weed free until harvest	72.0b	38.4a	14.6	2.5b	26.56a	23.39a
Mean	64.8	28.8	10.5	3.0	15.14	15.68
SE (±)	15.5	1 4.1	2.6	0.64	10.60	6.48

Table 6 : Interaction between okra cultivars and weed interference duration on growth parameters and yield in 2007

Treatments:	Plant height at harvest (cm/plant)	Leaf area/ plant/(cm^2)	No. of flowers formed/plant	No. of flowers aborted/plant	Fresh fruit wt/plant(g)	Fruit yield (tha^{-1})
NHAe47– 4 Weedy check	47.2c	21.8b	6.3c	3.2a	1.53cd	6.82de
Weed infested for 3WAS	69.1b	35.6a	11.4a	2.2ab	26.30a	22.92a
Weed infested for 4 WAS	63.6b	30.4a	9.8b	3.0a	21.74a	17.87b
Weed free until 5 WAS	50.6c	24.3b	7.40c	3.4a	4.89c	10.34d
Weed free until harvest	72.4b	38.3a	13.9a	2.0ab	27.20a	23.40a
Lady's finger Weedy check	53.7c	20.6b	6.0c	3.2a	1.27cd	6.02e
Weed infested for 3 WAS	88.2a	33.8a	11.0b	2.6ab	18.12b	17.86b
Weed infested for 4 WAS	70.1b	30.1a	9.4b	3.3a	15.88b	14.26c
Weed free until 5 WAS	61.4b	24.1b	7.0b	3.4a	3.98c	19.06b
Weed free until harvest	96.4a	36.5a	13.5a	2.5a	20.42a	18.44b
V_{35} Weedy check	45.3c	21.6b	6.0c	3.2a	1.46cd	6.24de
Weed infested for 3 WAS	68.3b	35.3a	11.0b	2.6ab	22.06a	19.98ab
Weed infested for 4 WAS	49.8c	30.1a	9.8b	3.2a	19.82b	15.69c
Weed free until 5 WAS	46.8c	24.25	7.6bc	3.6a	4.21c	9.47d
Weed free until harvest	70.6b	37.9a	13.8a	2.4ab	24.63a	22.40c
Mean	63.57	33.78	11.68	3.0	14.23	14.72
SE (±)	14.72	15.26	9.46	0.13	2.51	1.57

Table 7 : Interaction between okra cultivars and weed interference duration on weed dry weight, weed density and weed control efficiency in 2007 and 2008

Treatments:	Weed dry weight (kg ha^{-1})		weed density (no/m^2)		weed control efficiency (%)	
	2007	2008	2007	2008	2007	2008
NHAe47– 4 Weedy Check	590a	625a	32a	32	-	-
Weed infested for 3WAS	103e	118e	12d	14cd	82.54a	81.12a
Weed infested for 4 WAS	263d	275d	14cd	16c	55.42b	56.00b
Weed free until 5 WAS	415bc	430bc	24b	25b	29.66c	31.20c
Weed free until harvest	0f	0f	0e	0e	100a	100a
Lady's finger Weedy check	630a	642a	38a	38a	-	-
Weed infested for 3 WAS	197d	220d	12d	12d	68.73a	68.85b
Weed infested for 4 WAS	358c	373c	18c	20c	43.17b	41.90c
Weed free until 5 WAS	460b	483b	28a	27b	26.98c	24.77cd
Weed free until harvest	0f	0f	0e	0e	100a	100a
V_{35} Weedy check	604a	625a	35a	36a	-	-
Weed infested for 3 WAS	122e	134e	19c	19c	79.82a	78.56a
Weed infested for 4 WAS	268d	281d	14cd	14cd	55.63b	55.04b
Weed free until 5 WAS	504b	528b	26ab	25b	16.55d	15.52e
Weed free until harvest	0f	0f	0e	0e	100a	100a
Mean	275.60	316.40	18.13	18.5	62.73	62.32
SE (±)	63.35	50.86	12.00	12.11	43.71	29.90