SAVANNAH JOURNAL OF AGRICULTURE
ISSN 1597 - 9377

Volume 8(1); June, 2013

Response of Weeds and Pod Yield of Some Okra Cultivars to Weed Control Treatments

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Abstract

The selection of an appropriate cultivar is very important in crop improvement. In order to determine the effect of weed control treatment on pod yield of okra cultivars, a field experiment was carried out at the Teaching and Research farm, Federal University of Technology, Minna, in 2012 and 2013 rainy seasons. The experimental design was a factorial combination of three okra cultivars (NHAe 47-4, LD 88-1 and Jokoso) and two weed control treatments (hoe weeded at 3+6+9 WAS (with remoulding of ridges at 9 WAS) and a weedy check) arranged in a randomized complete block design with three replications. The results indicated that the most prevalent and important weed species of okra were *Brachiaria lata*, *Cyperus esculentus*,*Melochia corchorifolia*, *Setaria barbata*, *Digitaria horizontalis* and *Ageratum conyzoides*. Weed density and dry weight, as well as pod yield recorded did not vary between the cultivars. But hoe weeded plot at 3+6+9 WAS (with remoulding of ridges at 9 WAS) produced the lowest weed density and dry weight, as well as the highest pod yield of okra in both seasons. In the hoe weeded plot, green pod yield was increased significantly such that it was 67.7% over the weedy plot. Result of this study suggest that higher pod yield of okra could be achieved using either of the cultivar along with hoe weeding in the southern guinea savannah agro-ecological zone of Nigeria.

***Key Words*: Cultivar, Okra, Pod yield, Weeds and Weed control.**

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) is an annual vegetable widely grown and consumed in Africa and throughout the world (Schippers, 2000). It is a prominent fruit and leafy vegetable grown for domestic consumption of its highly nutritious immature leaves and fruits in Nigeria (Olabode *et al*., 2007). Its production is predominantly carried out by the small scale farmer’s usually in home gardens or in mixtures with other cereal crops (Lombin *et al*., 1988). Manual weeding remains the most popular weed control practice in Nigeria as well as in various parts of the world among farmers. Ideally manual weeding should control all weeds well; it however leads to the disturbance of the habitat which also leads to proliferation of weeds from the soil seed bank and a shift in the weed composition. Nevertheless, weed populations especially in cropped lands are rarely constant, but are in dynamic state of flux due to changes in climatic and environmental conditions, crop husbandry and the use of herbicide (Wibawa *et al*., 2009).

Weeds are one of the limiting factors reducing okra yield. Awodoyin and Olabode (2009) found that uncontrolled weeds accounted for 91% fresh pod yield reduction. Smith and Ojo (2007) also found that weed growth throughout the crop life cycle resulted in 88-93% fresh pod yield reduction. Conversely, Bukun (2005) noted that yield reduction due to weed – crop competition generally depends mainly on weed species present, their densities and the crop species. However, adoption of agronomic practices such as selection of a crop cultivar has the ability to decrease weed emergence and growth, and as well confer positive effects on crop biomass and yield (Shinggu *et al*., 2009). These authors further mentioned that faster canopy closure by crop plants can reduce weed germination, growth and establishment through shading. In the same vein, Ibrahim *et al*. (2009) reported shading effect as the major means by which crop plants suppress weeds.

Crop variety and manual weeding among several factors can interact strongly to cause changes in weed communities, as well as in crop growth and yield. Information on impact of agronomic practices such as crop cultivar and manual weeding as an integral part for developing integrated weed management in okra production is scanty. The current study was therefore carried out to assess the response of weeds and pod yield of okra cultivar to weed control treatment, in a southern Guinea savannah location of Nigeria.

Materials and Methods

Field experiments were carried out in the rainy seasons of 2012 and 2013 at the Teaching and Research farm of the Federal University of Technology, Minna (Lat. 9^{o} 37´N, Long. 6^{o} 33´E), 256 m above sea level. Minna is located in the southern Guinea savannah zone of Nigeria; and receives an average annual rainfall of 1209.7 mm, with mean annual maximum and minimum temperature of 33^{o}C and 22^{o}C, respectively (Climatemps.com, 2013).

The experiment was arranged as a 3 x 2 factorial in a randomized complete block design and replicated three times. The factors were three okra varieties (NHAe 47-4, LD 88-1 and JOKOSO) and two weed control treatments (weed free-manually weeded at 3, 6 and 9 WAS (remoulding of ridges was carried out at 9 WAS); and weedy check). Gross plot size was 4 m x 3 m (12 m^2), while net plot size was 4 m x 1.5 m (6 m^2). Alley ways of 1 m and 0.5 m were left between the replicates and treatments respectively. NHAe 47-4 and LD 88-1 were obtained from the National Horticultural Research Institute, (NIHORT), Ibadan, while Jokoso was obtained from the Institute for Agricultural Research, (IAR), Samaru-Zaria, all in Nigeria. Variety NHAe 47-4 is known to be short to medium in height (45 cm tall), with profuse branching which are positively geotropic, leaves that are deeply lobed, early maturing (40-50 days to flower) and produces fruits which are dark-green, spiny and stout (Iyagba *et al*., 2012; Ayodele and Shittu, 2013). LD 88-1 is tall in height (1.5 m), flowers in 50 – 66 days (medium maturing), and produces smooth fruits which are deep-green, with good draw quality (Ayodele and Shittu, 2013). Jokoso is short (43 cm tall), produces stems which consist of erect axis and primary laterals, ovate leaves which are not very lobed, and elongated fruits which are not very ribbed with spines (Dikwahal, 2003).

Land was manually cleared and ridged at 75 cm apart. Seeds of each variety of okra were soaked in water for 24 h before sowing, in order to soften the hard seed coat and break dormancy. The seeds were sown on 19 May, 2012; and 24 May, 2013 at an intra – row spacing of 50 cm and later thinned to 2 plants/stand at two weeks after planting. Inorganic fertilizer was applied at 78 kg N, 67 kg P_2O_5 and 45 kg K_2O ha^{-1}. Basal dose of 45 kg N, all the dose of phosphorus and potassium were applied using NPK 15-15-15 and single super phosphate at 2 WAS. The remaining dose of 33 kg N ha^{-1} was applied at 4 WAS using urea as source. Weed control was manually carried out according to the specified treatment. Insect pests of okra were controlled with the application of Cypermethrin at 30 ml in 10 L of water anytime the insect pests were noticed on the leaves of the okra plant. Fresh green pods were harvested manually from the net plot twice at intervals of three days in a week. A quadrat of 0.50 m x 0.50 m was placed at two spots within each plot along a diagonal to collect weed samples at 3, 6 and 9 WAS. Weeds samples taken at 9 WAS were identified and counted by species using Akobundu and Agyakwa (1998) weed identification manual. To identify the major weed species of okra, the Importance Value Index (IVI) of the different weed species were computed using the following equation as described by Das (2008):

IVI = Relative frequency (R.F) + Relative density (R.Dn) + Relative dominance (R.Do)

where; Relative Frequency (R.F) = $\frac{\text{Number of occurrence of a species}}{\text{Sum /total of occurrence of all species}} \times 100$

Relative Density (R.Dn) = $\frac{\text{Total number of individuals of a species in all the quadrats}}{\text{Total number of individuals of all the species in all quadrats}} \times 100$

Dominance (Do.) and Relative Dominance (R.Do) were calculated as given below:

$$\text{Dominance (Do.)} = \frac{\text{Absolute density of a species}}{\text{Number of quadrats in which the species occured}} \text{ X } 100$$

$$\text{where, Absolute density} = \frac{\text{Total number of individuals of s species (in all quadrats)}}{\text{(Total number of quadrats studied) x (area in m}^2\text{ of a quadrat)}}$$

and;

$$\text{Relative Dominance (R.Do)} = \frac{\text{Dominance of a species}}{\text{Sum of dominance of all species}} \text{ X } 100$$

Weed density was recorded as the sum of all the species recorded at each sampling period and expressed in number/m^2. These samples were further bulked and oven dried at 70 ^{o}C to a constant weight and weighed to obtain the weed dry weight in grams per m^2 (g/m^2) and thereafter expressed in kilograms per hectare (kg/ha). The cumulative fresh green pods harvested within the net plot (grams per plot), were weighed and thereafter expressed in .tons per hectare (t/ha).

Data collected on weed density, dry weight and pod yield were subjected to analysis of variance, using the General Linear Model (GLM) procedure of Statistical Analysis System (SAS Institute, 2002). Differences between the treatment means were separated using the Least Significant Difference (LSD) at 5% level of probability.

Results

Weed flora composition

The experimental field was infested with 29 weed species comprising of 7 grasses, 20 broadleaved and 2 sedges in 2012 (Table 1). *Cyperus esculentus* (IVI=44.6) appeared as the most important weed species followed by *Commelina benghalensis* (IVI=43.1), *Euphorbia heterophylla* (IVI=25.6), *Dactyloctenum aegyptium* (IVI=23.9), *Brachiaria lata* (IVI=23.7), *Ageratum conyzoides* (IVI=20.5), *Digitaria horizontalis* (IVI=18.0), *Setaria barbarta* (IVI=16.3), *Portulaca oleracea* (IVI=13.6) and *Melochia corchorifolia* (IVI=11.8). However, in 2013, a total of 34 weed species were recorded in all the plots; such that *Digitaria horizontalis* (IVI=48.4) appeared as the most important weed species followed by *Synedrella nodiflora* (IVI=39.8), *Stachytapheta jamaicensis* (IVI=30.6), *Paspalum scrobiculatum* (IVI=18.5), *Leucas martinicensis* (IVI=14.3), *Melochia corchorifolia* (IVI=14.1), *Setaria barbata* (IVI=13.8), *Ageratum conyzoides* and *Cyperus esculentus* each with (IVI=10.8) and *Brachiaria lata* (IVI=10.1) (Table 2).

Weed density and dry weight

Weed density was significantly influenced by crop variety at 6 WAS in 2012 only, and by weed control treatments at 6 WAS in 2012 and 9 WAS in both years (Table 3). The infestation of mid season emerged weeds was least with variety LD 88-1, although similar to NHAe47-4 only. Furthermore plants in the hoe weeded plot had the least weed population compared to the weedy plot at 6 and 9 WAS in both years, respectively. Weed dry weight accumulated did not differ significantly between the crop varieties except at 9 WAS in 2013 (Table 4). In this case, NHAe47-4 reduced weed dry matter production more than LD88-1 only.

Similarly weed dry weight differed significantly between weed control treatment at 6 and 9 WAS in 2012 and 2013, such that the hoe weeded plot consistently and most effectively reduced the weed dry matter accumulated than the weedy plot.

Pod yield

Pod yield was not significantly different between the crop varieties; but weed control treatment had a significant influence on this parameter in both years and the average of both years (Table 5). In this case plants in the hoe weed plot produced 62.2, 76.7 and 67.7% more pods than the weedy plot in 2012, 2013 and the combined mean, respectively.

Table 1: Importance value index of weed species encountered in okra under the influence of variety and weed control treatment at 9 WAS in 2012.

Weed species	NHAe47-4 + weedy	NHAe47-4 + weed free	LD88-1 + weedy	LD88-1 + weed free	JOKOSO + weedy	JOKOSO + weed free	Mean
Grasses							
Brachiaria lata (Schumach) C.E. Hubbard	30.8	15.5	37.1	22.0	22.6	14.0	23.7
Cynodon dactylon (L.) Pers.	0.0	0.0	0.0	12.6	0.0	0.0	2.1
Dactyloctenum aegyptium (L.) P. Beauv.	22.1	13.0	18.8	42.1	9.2	38.4	23.9
Digitaria horizontalis Willd	49.9	0.0	17.1	7.7	33.3	0.0	18.0
Paspalum scrobiculatum L.	0.0	0.0	11.2	0.0	15.1	0.0	4.4
Pennisetum polystachion (L.) Schult.	0.0	0.0	0.0	0.0	0.0	29.2	4.9
Setaria barbata (Lam.) Kunth	30.8	25.7	0.0	0.0	22.6	18.4	16.3
Broadleaved							
Ageratum conyzoides L.	0.0	35.1	0.0	75.5	12.5	0.0	20.5
Boerhavia diffusa L.	0.0	0.0	7.5	0.0	0.0	0.0	1.3
Calopogonium mucunioides L.	0.0	0.0	0.0	0.0	5.2	0.0	0.9
Commelina benghalensis L.	47.3	53.4	33.1	20.0	35.0	69.6	43.1
Crotalaria retusa L.	0.0	10.3	0.0	0.0	0.0	0.0	1.7
Euphorbia heterophylla L.	29.9	25.4	30.6	74.7	18.2	24.6	25.6
Hyptis spicigera Lam.	0.0	0.0	15.0	0.0	0.0	0.0	2.5
Ipoemoea triloba L.	0.0	0.0	17.6	7.7	0.0	0.0	4.2
Leucas martinicensis (Jacq.) Ait. f.	0.0	7.8	0.0	0.0	12.5	0.0	3.4
Melochia corchorifolia L.	27.8	7.0	25.4	0.0	10.5	0.0	11.8
Mimosa pudica L.	9.4	0.0	7.5	0.0	6.1	0.0	3.8
Mormodica charantia L.	0.0	0.0	0.0	0.0	12.2	0.0	2.0
Physalis angulata L.	0.0	0.0	22.5	0.0	0.0	0.0	3.8
Portulaca oleraceae L.	9.4	7.8	22.8	16.8	15.2	9.7	13.6
Scoparia dulcis L.	0.0	0.0	0.0	0.0	0.0	7.5	1.3
Spigelia anthelmia L.	22.6	0.0	0.0	0.0	0.0	0.0	3.8
Stachytapheta jamaicensis (L.) Vahl.	0.0	0.0	15.0	0.0	0.0	0.0	2.5
Synedrella nodiflora Gaertn	0.0	7.8	0.0	0.0	9.2	0.0	2.8
Tridax procumbens L.	4.5	0.0	0.0	0.0	6.1	18.4	4.8
Vernonia galamensis (Cass.) Less	0.0	0.0	7.5	0.0	15.4	27.0	8.3
Sedge							
Cyperus esculentus L.	13.8	81.4	17.7	67.7	52.8	34.2	44.6
Mariscus flabelliformis Kunth.	0.0	0.0	0.0	7.7	0.0	9.7	6.0
Total	300	300	300	300	300	300	300

Table 2: Importance value index of weed species encountered in okra under the influence of variety and weed control treatment at 9 WAS in 2013.

Weed species	NHAe47-4 + weedy	NHAe47-4 + weed free	LD88-1 + weedy	LD88-1 + weed free	JOKOSO + weedy	JOKOSO + weed free	Mean
Grasses							
Brachiaria lata (Schumach) C.E. Hubbard	5.5	11.8	3.4	11.9	21.8	6.0	10.1
Cynodon dactylon (L.) Pers.	0.0	12.2	0.0	22.2	0.0	15.8	8.4
Dactyloctenum aegyptium (L.) P. Beauv.	3.7	0.0	0.0	0.0	9.4	0.0	2.2
Digitaria horizontalis Willd	15.7	78.0	17.1	86.2	45.8	47.2	48.4
Eleusine indica Gaertn	0.0	19.3	0.0	0.0	0.0	0.0	3.2
Paspalum scrobiculatum L.	9.6	31.5	27.2	14.1	9.0	19.3	18.5
Rottboellia cochinchinensis (Lour.) Clayton	18.4	0.0	11.0	17.5	10.1	0.0	9.5
Setaria barbata (Lam.) Kunth	0.0	0.0	45.3	0.0	14.6	23.0	13.8
Broadleaved							
Ageratum conyzoides L.	28.0	0.0	15.0	0.0	14.6	7.2	10.8
Calopogonium mucunioides L.	2.6	5.9	8.9	4.5	5.9	0.0	4.7
Commelina benghalensis L.	3.9	5.9	7.3	14.7	7.4	4.8	7.3
Corchorus olitorius L.	0.0	5.9	0.0	0.0	0.0	0.0	1.0
Desmodium scorpiurus (Sw.) Desv.	5.3	0.0	0.0	0.0	6.2	8.4	3.3
Eclipta alba (Linn.) Hassk.	13.1	0.0	10.6	0.0	6.3	7.2	6.2
Euphorbia heterophylla L.	13.6	0.0	0.0	9.3	17.8	16.3	9.5
Euphorbia hirta L.	2.6	0.0	0.0	0.0	2.8	0.0	0.9
Hyptis spicigera Lam.	0.0	0.0	12.4	9.3	9.7	8.4	6.6
Ipoemoea triloba L.	2.6	5.9	3.4	0.0	0.0	0.0	2.0
Leucas martinicensis (Jacq.) Ait. f.	17.6	0.0	9.0	12.0	21.6	25.3	14.3
Ludwigia decurrens Walt.	3.7	19.3	0.0	0.0	3.1	9.6	6.0
Melochia corchorifolia L.	7.9	0.0	15.0	0.0	28.4	13.3	14.1
Mimosa pudica L.	0.0	0.0	0.0	5.5	0.0	0.0	0.9
Scoparia dulcis L.	15.0	0.0	3.4	0.0	4.7	4.8	4.6
Sida acuta Burm	0.0	0.0	0.0	0.0	2.8	0.0	0.5
Spigelia anthelmia L.	0.0	0.0	0.0	0.0	3.5	0.0	0.6
Stachytapheta jamaicensis (L.) Vahl.	23.0	14.9	62.6	18.9	14.8	49.7	30.6
Synedrella nodiflora Gaertn	73.1	40.6	31.5	40.5	33.9	19.3	39.8
Tephrosia pedicellata Bak.	0.0	0.0	4.3	0.0	0.0	0.0	0.7
Tridax procumbens L.	2.6	0.0	8.1	0.0	0.0	0.0	1.8
Vernonia galamensis (Cass.) Less	0.0	0.0	0.0	0.0	2.8	0.0	0.5
Sedge							
Cyperus esculentus L.	3.2	34.9	4.7	7.3	0.0	14.5	10.8
Kyllinga bulbosa Beauv.	6.3	13.7	0.0	25.9	0.0	0.0	7.7
Kyllinga erecta	0.0	0.0	0.0	0.0	3.1	0.0	0.5
Kyllinga pumila	2.6	0.0	0.0	0.0	0.0	0.0	0.4
Total	300	300	300	300	300	300	300

Table 3: Effect of crop variety and weed control treatment on weed density in okra in 2012 and 2013

Treatment	2012 3 WAS	2012 6 WAS	2012 9 WAS	2013 3 WAS	2013 6 WAS	2013 9 WAS
	(Number/m^2)					
Variety (V)						
NHAe 47-4	38.1	37.8	33.6	34.2	30.3	88.2
LD 88-1	35.3	34.5	36.9	35.8	20.7	57.5
JOKOSO	35.4	43.7	37.7	33.5	23.2	57.2
LSD (0.05)	7.1	7.6	7.7	14.3	12.2	40.6
Significance	NS	*	NS	NS	NS	NS
Weed control (W)						
Weedy	36.4	47.7	40.7	37.8	29.6	109.9
Hoe weeded	36.1	29.6	31.5	31.2	19.9	27.3
LSD (0.05)	5.7	6.2	7.0	11.7	10.5	52.3
Significance	NS	*	*	NS	NS	**
Interaction						
V x W	NS	NS	NS	NS	NS	NS

NS – not significant *significant at p≤ 0.05 **significant at p≤0.01

Table 4: Effect of crop variety and weed control treatment on weed dry weight of okra in 2012 and 2013

Treatment	2012 3 WAS	2012 6 WAS	2012 9 WAS	2013 3 WAS	2013 6 WAS	2013 9 WAS
	(kg/ha)					
Variety (V)						
NHAe 47-4	69	1016	524	51	353	646
LD 88-1	53	809	571	43	280	1025
JOKOSO	49	793	784	61	273	673
LSD (0.05)	31	496	371	37	180	357
Significance	NS	NS	NS	NS	NS	*
Weed control (W)						
Weedy	62	1490	913	62	425	1414
Hoe weeded	52	256	340	41	179	149
LSD (0.05)	26	447	335	31	161	292
Significance	NS	*	*	NS	*	**
Interaction						
V x W	NS	NS	NS	NS	NS	NS

NS – not significant *significant at p≤ 0.05 **significant at p≤0.01

Table 5: Effect of crop variety and weed control treatment on green pod yield of okra in 2012, 2013 and combined mean

	Green pod yield (t/ha)		
Treatment	2012	2013	Combined mean
Variety (V)			
NHAe 47-4	2.3	1.1	1.7
LD 88-1	1.7	0.8	1.2
JOKOSO	2.7	0.8	1.7
LSD (0.05)	0.9	0.6	0.6
Significance	NS	NS	NS
Weed control (W)			
Weedy	1.7	0.4	1.0
Hoe weeded	2.8	1.3	2.1
LSD (0.05)	0.9	0.5	0.5
Significance	*	*	*
Interaction			
V x W	NS	NS	NS

NS – not significant, *significant at p≤ 0.05

Discussion

The variation in weed flora composition and species observed in this study could be a reflection of the weed seed bank of the experimental site. For example, six weed species were among the most important and common in all the crop varieties and weed control treatments in both seasons in this study; such that two were broadleaved, eight grasses and one sedge, respectively. Awodoyin and Olubode (2009) similarly found that the most important weed species of okra among the dicotyledons (broadleaved) weeds was *Synedrella nodiflora*; and among the monocotyledons (grasses) was *Panicum repens*. The hoe weeded plot which produced better weed control resulted in higher pod yield. This result suggest that manual weeding contributed to reduction in severe weed interference, which might have led to a decrease in intra-plant competition for growth resources between the weed species and the okra varieties. Smith *et al*. (2009) obtained similar higher pod yield production of okra in hoe weeded treatment plots.

Conclusion

This study revealed that the most important weeds associated with okra were *B. lata, S.barbata, D. horizontalis,C. esculentus, M. Corchorifolia* and *A. conyzoides*. Any of the three varieties of okra (NHAe47-4, LD88-1 or JOKOSO) with two hoe weeding at 3+6 WAS and remoulding at 9 WAS recorded the highest pod yield of okra by 67.7% over the weedy plot; and is therefore suggested for adoption in the study area.

References

Akobundu, I.O. and Agyakwa, C.W. (1998). A Handbook of West African Weeds. IITA, Ibadan, Nigeria. 564p.

Awodoyin, R.O. and Olubode, O.S. (2009). On field assessment of critical period of weed interference in okra (*Abelmoschus esculentus* (L.) Moench) field in Ibadan, a rainforest-savanna transition eco-zone of Nigeria..*Asian Journal of Food and Agro-Industry*. Special Issue, S288-S296.

Ayodele, O.J. and Shittu, O.S. (2013). Consideration of cost and returns to nitrogen fertilization in okra production. *Elixir Agriculture*. **57**:14412-14416.

Bukun, B. (2005). Critical periods for weed control in cotton in Turkey. *Weed Research*. **44**:404-4012.

Climatemps.com (2013). Climate of Minna, Nigeria Average Weather. Accessed on 2 November, 2013; from www.minna.climatemps.com.

Das, T. K. (2008). Weed Science Basics and Applications. Jain Brothers, New Delhi, India. 901pp.

Dikwahal, H.D. (2003). Response of two okra varieties to sowing date and plant population. Unpublished M.Sc. Thesis, ABU, Zaria, Nigeria.pp.78.

Ibrahim, M. R., Nasir, I. H. And Ahmed, A. (2009). Genetic relatedness among *Achillea fragrantissima* populations using amplified fragment length polymorphism (AFLP) markers. *Dirasat Agricultural Sciences*. **36**: 89-99.

Iyagba, A.G. and Onuegbu, B.A. and Ibe, A.E. (2012). Growth and yield response of okra (*Abelmoschus esculentus* (L.) Moench) varieties to weed interference in south-eastern Nigeria. *Global Journal of Science Frontier Research in Agriculture and Veterinary Sciences* **12**(7):23-31.

Lombin, G.,Yayock, J.Y. and Owonobi, J. J. (1988). Crop Science and Production in Warm Climates. Onazi, O.C. (ed.). Macmillan Publishers Ltd., London. pp.214-216.

Olabode, O.S., Ogunremi, S., Akanbi, W.B., Adesina, G.O. and Babajide, P. A. (2007). Evaluation of *Tithonia diversifolia* (Hemsl.) A. Gray for soil improvement.*World Journal of Agricultural Sciences.* **3**:503-507.

SAS (2002). Statistical Analysis System for Windows, Version 9.0. SAS Institute Incorporated, Cary, North Carolina, USA.

Schippers, R. R. (2000). African Indigenous vegetables: an overview of the cultivated species. Natural Resources Institute (Great Britain): pp. 103-118.

Shinggu, C. P., Dadari, S. A., Shebayan, J.A.Y., Adepke, D. I., Mahadi, M. A., Mukhtar, A. and Asala, S.W. (2009). Influence of spacing and seed rate on weed suppression in finger millet (*Eleusine corocana* Gaertn). *Middle East Journal of Science Research.* **4**:267-270.

Smith, M. A. K. and Ojo, I. K. (2007). Influence of intra-row spacing and weed management system on gap colonization of weeds, pod yield and quality in okra (*Abelmoschus esculentus* (L.) Moench. Africa Crop Science Society Conference Proceedings, Vol.8. p.313-317.

Smith,M. A. K., Oloyede, K. O. and Adedeji, A. B. (2009). Preliminary evaluation of weed management method x crop variety interaction on weed control and okra yield. *Journal of Applied Biosciences.* **22**:1283-1288.

Wibawa, W., Mohammed, R., Juraimi, A. S., Omar, D., Mohayidin, M. G. And Begun,M. (2009). Weed control efficacy and short term weed dynamic impact of three non-selective herbicides in immature oil palm plantation. *International Journal of Agriculture and Biology.* **11**:145-150.