integrity Research Journals

Journal of Agricultural Science and Practice
Volume 2(3), pages 33-41, June 2017
https://doi.org/10.31248/JASP2017.041
ISSN 2536-7072. Copyright © 2017
Article Number: E2AF5DFD1
http://integrityresjournals.org/journal/JASP

Full Length Research

Susceptibility of maize varieties to periods of weed interference in Southern Guinea Savannah Zone of Nigeria

Tanimu, M. U.[1*], Adeosun, J. O.[2], Tsado, E. K.[3], Muhammad, A.[1] and Nura, K. M.[4]

[1]Crop Science Department, Faculty of Agriculture, Kebbi State University of Science and Technology, Aliero, Kebbi State, Nigeria.
[2]Crop Production Department, Faculty of Agriculture, Federal University Dutsin-ma Katsina State, Nigeria.
[3]Crop Production Department, School of Agriculture and Agricultural Technology, Federal University of Technology Minna, Nigeria.
[4]Crop Production Department, College of Agriculture, Zuru Kebbi State, Nigeria.

*Correspondent author. Email: musaumar99@gmail.com

Received 8th April, 2017; Accepted 19th May, 2017

ABSTRACT: The objective of the study was to investigate the susceptibility of maize varieties to periods of weed interference in southern guinea savannah zone of Nigeria. Two Field trials were conducted during the raining seasons of 2011 and 2012 at the Research Farm of the Federal University of Technology Gidan-kwano, Minna in the Southern Guinea Savannah zone of Nigeria. The trials were laid out in split plot design replicated three times. The main plots treatments comprised of four maize varieties namely Oba -98, Sammaz-13, EVDT Y-2000 and 2008-DTMA-Y-STR and sub-plot treatments were ten periods of the weed-interference. Plots were weeded for 3 weeks after sowing (WAS), 6 weeks after sowing (WAS), 9 weeks after sowing (WAS) and 12 weeks after sowing (WAS) and subsequently left weed infested till harvest. Plots were left weed infested for the corresponding periods and subsequently kept weed free until harvest. The combined analysis showed highest plant establishment at 2008-DTMA-Y-STR 75.65% and the least was Oba-98, 70.04%; while EVDTY 2000 and Sammaz-13 were observed to record 74.25% and 73.34% respectively. In 2011, (17) major species of weeds were identified on the experimental field. The species were broadly classified into three weed types as Grasses, Broad leaved and Sedges. Higher weed incidence was observed in 2011, while in 2012, the weed incidence was observed to be lower compared to 2011 wet season. The broadleaf species *Fleura aestuans, Commelina benghalensis* and sedge weeds species, *Cyperus esculentus* and *Cyperus rotundus* were observed to have higher incidence in 2012. Combined cumulative weed dry matter progressively increased as weeding was delayed or as plots were kept unweeded while weed dry matter decreased when plots were kept weed free. It is also concluded that the most susceptible of the tested maize varieties in this study were Oba 98 and 2008-DTMA-Y-STR (crop vigour value of 4.02 each), while the most tolerant is EVDTY-2000 (highest crop vigour value of 4.15). Sammaz-13 (crop vigour value of 4.10) is next to EVDTY-2000 in tolerance. Among the varieties tested, 2008-DTMA-Y-STR had the highest crop establishment percentage, and was observed to have the highest average grain yield of 4.00 T/ha followed by +EVDT Y-2000 with an average yield of 3.40 T/ha, Oba-98 3.32 T/ha and Sammaz-13 3.27 T/ha. 2008-DTMA-Y-STR and Sammaz-13 varieties are recommended for farmers' use in the study area.

Key words: Establishment, guinea savannah, interference, maize, period's susceptibility, unweeded, varieties, weed, weed free.

INTRODUCTION

Maize (Zea *mays* L.) production in Nigeria was initially restricted mainly to the forest zone but the production has

now expanded to the savannah region where it accounts for over 70% of the production in the country (Uyovbisere et al., (2001). Kassam et al. (2005) attributed the higher production of the crop in the savannah to more favourable production conditions which includes solar radiation intensities, lower night temperature and low incidence of diseases and pests. Maize is a cereal plant that produces grains that can be cooked, roasted, fried, ground, pounded or crushed to prepare various food items like pap, *tuwo*, *gwate*, *donkunu* and a host of others (Abdulrahaman and Kolawole, 2006). All these food types are readily available in various parts of Nigeria among different ethnic groups which are Hausas, Yorubas, Ibos, Ibiras, Ishas, Binis, Efiks and Yalas (Osagie and Eka, 1998).

The major weed of maize in Nothern Nigeria is Striga. It has been reported that in the Nigerian Savannah, weed related yield losses ranging from 65 to 92% has been recorded (FAO, 2010). Striga causes estimated cereal grain losses of up to N1, 050.00 billion which affects the lives of about 300 million people (IITA 2009).

Hoeing is the cultural method adopted for weed control in cereals of which maize is inclusive in the southern guinea savannah zone. Hoeing is laborious, slow, expensive and only feasible on a small holding (Lagoke, 1988; Adeosun, 1990). Some weeds especially those that have close resemblance with the maize crop at the young stage (*Andropogon gayanus)* may however escape weeding. These weeds will compete with maize seriously and cause reduction in yield considerably. Hoe weeding is beneficial to the maize crop because it tends to improve aeration in the soil environment. For the hoe weeding to be successful, proper timing and frequency of weeding are necessary.

Weeds pose a problem to the growth, development and yield of maize crop. Like in other crops, weeds compete with maize for sunlight, water, nutrients and space. They cause significant yield losses worldwide with an average of 12.8% despite weed control applications and 29.2% in case of no weed control (Ali et al., 2011) The extent of the competition depends on rate of growth of the weeds, their growth habit, their density and time at which they start to grow relative to the crop (Harper, 1988). The density of weeds, relative to that of the crop will clearly have an influence on the degree of onset of competition (Harper, 1988). It is however interesting to note that most studies on the weed interference in maize in the guinea savannah zone of Nigeria have not taken into account the reaction of different varieties to weed competition. The new varieties used for his study are tall growing (especially the hybrid variety) and drought resistant which will enable them to form canopy to suppress the weeds. Hence the need to compare the four maize varieties and investigate their reaction to different weed competition at various periods in this ecological (southern guinea savannah) zone of Nigeria. The objective is to evaluate four maize varieties to periods of weed interference and estimate maize susceptibility.

MATERIALS AND METHODS

Field trials were conducted during the raining season of 2011 and 2012 at the Research Farm of Federal University of Technology Gidan-kwano, campus Minna (latitude 9° 41' N and longitude 6° 31' E; 258.5 m above sea level) in the southern Guinea savanna zone of Nigeria. Climate of Minna is sub humid with mean annual rainfall of about 1284 mm and a distinct dry season of about 5 months duration occurring from November to March. The mean maximum temperature remains high throughout the year, about 33.5^{o}C particularly in March and June (Ojanuga, 2006).

The trial was a Randomised complete block design in a split plot arrangement. The main plots include 4 maize varieties (early, extra early and a late maturing or hybrid) while ten periods of weed interference were sub plots. One set of the interference treatment, plots were kept initially weed free for 3 weeks after sowing (WAS), 6 weeks after sowing (WAS), 9 weeks after sowing (WAS) and 12 weeks after sowing (WAS) and subsequently left weed infested till harvest. In other set of treatments, plots were left weed infested for the corresponding periods and subsequently kept weed free until harvest. Two control treatments were maintained in which one plot weed free while the other plot was left weed infested until harvest. The treatment consisted of two (2) extra early maize varieties, one early variety and one hybrid. The maize varieties tested in this study are: (1) Oba 98. (2) SAMMAZ 13 (Extra early variety). (3) EVDT – Y2000 (Early variety). (4) 2008 DTMA – Y (STR) (Extra early variety).

The field was marked out (1800.00 m^2) into split plots and replications. Each split plot (4 m x 3.75 m) had six ridges. The ridges were spaced at 75 cm. Seeds were sown manually at the rate of 3 seeds per hole along the ridges at intra-row spacing of 50 cm. The plants were thinned to 2 plants per stand at ten days after planting. Weeding using hoe was carried out at 3, 6, 9 and 12 WAS in both years. Basal application of fertilizer in band using NPK 15-15-15 was done at recommended rate of 120 kgN, 60 kgP and 60 kgK per hectare (Onasanya et al., 2009). This was applied at a distance of about 5 to 8cm from the maize plant and below the soil surface at the first application and the urea was applied during the second application. In both cases after the application, the holes were covered with soil to avoid the fertilizer from volatilizing. Fresh weed weight were obtained by taking weed samples at random from 1 m^2 quadrat in each plot at 3, 6, 9 and 12 WAS. The weed samples were cleaned free of soil and oven dried at 70^{0}C to constant weight and the dry weight was recorded. Cumulative weed dry matter was obtained by adding weights of dried weeds obtained at the respective weeding periods. Major

Table 1. Physico-chemical properties of soil at the experimental site at a depth of (0-15cm) and (15-30cm).

Soil Properties	0-15cm	15-30cm
Physical properties(g Kg^{-1})		
Sand	760	750
Silt	110	130
Clay	130	120
Textural class	Sandy loam	Sandy Loam
Chemical Properties		
pH in water(H_2O)	6.7	6.5
pH in $CaCl_2$	5.5	5.3
Organic carbon (%)	2.9	3.9
Total Nitrogen	0.03	0.03
Available phosphorus (mg kg^{-1})	31.0	35.0
Exchangeable bases (cmol kg^{-1})		
Ca^{2+}	1.61	1.10
Mg^{2+}	0.73	0.62
K^{+}	0.31	0.30
Na^{+}	0.07	0.08
Exch. Acid	0.02	0.01
ECEC	2.57	2.10

common weeds found on the experimental field for both seasons were recorded. Net plot (2.25 m x 4 m) from each plot was harvested, threshed, winnowed, weighed and grain yield of maize was calculated on per hectare basis. Data on plant height, crop vigor score was also recorded at 3, 6, 9 and 12WAS. Crop vigour score was assessed visually using a scale of 1-5, where scale 1 was assigned to plots with completely dead plants, while scale 5 was assigned to the most vigorous plants. Assessment features of the plants used for scoring were height, greenness of the leaves and crop establishment.

Data analysis

Data collected was subjected to analysis of variance (ANOVA). Means were separated by Duncan Multiple Range Test (DMRT).

RESULTS

Table 1 shows the physico-chemical properties of soil of the experimental site at depth of 0 to 15 cm and 15 to 30 cm. The Table showed the different fractions of sand silt and clay with sand having highest value. The textural class of the soil is sandy loam for both depths. The chemical properties showed that it had a fairly alkaline pH, low content of organic carbon, total nitrogen and ECEC at both depths. On the basis of this fertilizer was applied.

There was high weed infestation during 2011 season than 2012 and conversely the crops performed better in 2012 than 2011. The most prevalent grass weeds include *Brachiaria deflexa* (Schuman), *Digitaria sanguinalli, Rottboellia cochinchinensis* and *Andropogon gayanus.* The prevalent broad leaf weeds were *Fleura aestuans* (Linn.), *Commelina benghalensis*(L.), *Sida acuta* Polak, *Tridax procumbens* and *Calapogonium muconoides*. *Cyperus esculentus* (L.) and *C. rotundus* (L.) were the only sedges prevalent in the fields. The effect of variety on weed dry matter was only significant in 2012 but not in 2011 (Table 2). During 2011 wet season, the weed biomass was higher than 2012. Weed suppression was shown by weed dry matter of which the varieties were not consistent across the two years of the study. While 2008-DTMAYSTR gave the best weed suppression in 2011, EDTY-2000 gave the best weed suppression in 2012. The effect of period of weed interference on cumulative weed dry matter was significant in both years (Table 2). Although weed biomass increased in plots that were initial weed infested from 3 to 12 weeks after sowing and till harvest, this however did not show any statistical significance. Keeping the plot initial weed infested for 9 WAS did not differ significantly from those kept initially weed infested for 12 WAS and till harvest in 2011.

Variety X period of weed interference was significant on

Table 2. Effect of variety and period of weed- interference on cumulative weed dry matter production at Gidan-Kwano for 2011 and 2012 Wet seasons.

Treatments	Cumulative weed dry (WAS) (T/ha)		
	2011	2012	combined
Variety			
Oba-98	1.72	0.37b	0.88
Sammaz-13	1.61	0.33b	0.82
EVDTY-2000	1.47	1.58a	081
2008DTMA-YSTR	1.35	0.35b	0.69
SE ±	0.35	0.34	0.15
Significance level	NS	**	NS
Period of weed-interference			
Weed Infested for 3WAS[1]	0.55cd	0.28b	0.57b
Weed Infested for 6WAS	0.62cd	0.44b	0.78b
Weed Infested for 9WAS	3.21a	0.45b	1.62a
Weed Infested for 12WAS	3.39a	0.48b	1.72a
Weed Infested till harvest	3.52a	3.36a	1.78a
Weed free for 3WAS	1.53b	0.44b	0.44b
Weed free for 6WAS	1.10bc	0.39b	0.33b
Weed free for 9WAS	0.63cd	0.34b	0.32b
Weed free for 12WAS	0.42d	0.25b	0.22b
Weed free till harvest	0.40d	0.18b	0.22b
SE±	0.14	0.22	0.24
Significance level	**	**	**
Interaction (VxW)	*	NS	NS

WAS, week after sowing. Means followed by the same letter (s) along the column are not significantly different at 5% level of probability (DMRT). **NS,** Not significant. *Significance at 5% level of probability. **Significance at 1% level of probability.

cumulative weed dry matter (Table 3) in all initially weed infested and those of weed free plots during the 2011 wet season. The effect of variety and period of weed interference on maize establishment percentage at harvest during 2011 and 2012 wet seasons ws presented in Table 4. Crop establishment was not affected by variety in 2012 but in 2011. Variety 2008-DTMAYSTR had higher establishment percent than Oba 98 in both years. The effect of variety and period of weed interference on maize crop establishment percentage at harvest during 2011 and 2012 wet seasons was presented in Table 4. Variety did not significantly ($p > 0.05$) affect crop establishment in 2012 except in 2011 and the combined. Variety 2008-DTMAYSTR exhibited higher establishment percent than Oba-98 in both years (Table 4). Period of weed interference significantly affected crop establishment percentage in both years (Table 4). The percentage establishment was observed to decrease as plots were kept unweeded after 6WAS, till harvest during 2011 and after 3WAS till harvest in 2012 wet seasons.

The percentage crop establishment was observed to increase to a maximum value when plots were kept weed-free initially from 3WAS till harvest. The crop establishment percentage was higher during 2012 wet season than 2011. However, keeping the crop initially weed infested for 3WAS did not differ significantly in crop establishment percentage from those kept weed free for 12WAS. There was no significant interaction between the variety and period of weed interference in crop establishment throughout the study (Table 5). In 2011, Crop vigour was not significantly different among the varieties. But in 2012, crop vigour was significantly different between the varieties at 9WAS and at harvest. There was no significant difference ($p > 0.05$) between Sammaz-13 and EVDTY-2000. Period of weed interference significantly affected crop vigour score throughout the period of the study at 9WAS and at harvest (Tables 5). During the 2011, keeping the weed infested up to 6 WAS only was comparable to keeping the crop weed free initially from 6WAS up till harvest (Tables 5). Irrespective of variety used, there was a significant ($p < 0.05$) interaction between the maize varieties and the treatment (periods of weed interference). It was observed at 9 weeks after sowing (9WAS) in 2012 (Table 6). All the varieties showed

Table 3. Variety X period of weed interference Interaction on cumulative weed dry matter at Gidan-Kwano during 2011 wet season.

Period of weed-interference	Variety (weed dry matter kg/ha)			
	Oba98	Sammaz-13	EVDT-Y2000	2008-DTMA-YSTR
Weed Infested for 3WAS[1]	0.16e	0.27d	0.12e	0.24d
Weed Infested for 6WAS	0.21d	0.29d	0.24d	0.37c
Weed Infested for 9WAS	0.45b	0.46b	0.48b	0.43c
Weed Infested for 12WAS	0.54b	0.35c	0.48b	0.40c
Weed Infested till harvest	0.55b	0.43c	0.60a	0.36c
Weed free for 3WAS[1]	0.50b	0.42c	0.30d	0.32c
Weed free for 6WAS	0.37c	0.42c	0.30d	0.34c
Weed free for 9WAS	0.50b	0.39c	0.18e	0.45b
Weed free for 12WAS	0.27d	0.18e	0.23d	0.33c
Weed free till harvest	0.13e	0.09e	0.24d	0.26d
SE±			0.22	

WAS, week after sowing. Means followed by the same letter (s) along the column are not significantly different at 5% level of probability (DMRT).

Table 4. Effects of Variety and period of Weed- interference on percentage crop establishment at harvest at Gidan-Kwano for 2011 and 2012 wet seasons.

Treatments	Crop establishment at harvest		
	2011	2012	combined
Variety			
Oba-98	66.92b	73.16	70.04b
Sammaz-13	73.26ab	73.41	73.34ab
EVDTY-2000	73.47ab	75.02	74.25ab
2008DTMA YSTR	77.54a	73.75	75.65a
SE±	0.70	NS	0.43
Period of weed interference			
Initially weed infested for 3WAS[1]	85.31a	86.04b	85.68a
Initially weed infested for 6WAS	82.90a[2]	74.48d	78.69bc
Initially weed infested for 9WAS	75.70ab	67.54f	71.62de
Initially weed infested for 12WAS	64.24bc	60.32g	62.28f
Initially weed infested till harvest	29.69d	36.95h	33.32g
Initially weed free for 3WAS	59.29c	71.19e	65.24ef
Initially weed free for 6WAS	73.94ab	79.09c	76.52cd
Initially weed free for 9WAS	84.03a	85.05b	84.54ab
Initially weed free for 12WAS	85.62a	86.34b	85.98a
Initially weed free till harvest	87.24a	91.37a	89.31a
SE±	4.40	1.08	2.29
Interaction (V x W)	NS[3]	NS	NS

WAS, week after sowing. Means followed by the same letter (s) / are not significantly different at 5% level of probability (DMRT). **NS**, Non significant. - Treatment not applied.

significant difference with the treatment. Considering the responses of the varieties, Oba-98 and EVDT Y-2000 (early variety and drought tolerant) had fairly higher value of crop vigour across the years of 2011 and 2012 while varieties 2008 DTMA-YSTR and Sammaz-13 had the lowest crop vigour among them all. This showed their relative tolerance of weed interference during the growing period. Period of weed interference significantly affected crop vigour at harvest (Table 5). In both years, crop vigour decreases as the plots were kept unweeded and

Table 5. Effect of Variety and Period of weed- interference on crop vigour score at harvest for 2011 and 2012 Wet seasons Gidan-Kwano.

Treatments	Crop vigour score at harvest		
	2011	2012	Combine
Variety			
Oba-98	4.27	3.73b	4.02
Sammaz-13	4.20	4.00a	4.10
EVDTY-2000	4.20	3.97a	4.15
2008DTMA-YSTR	4.23	3.93b	4.02
SE ±	NS	9.07	1.00
Period of weed-interference			
Weed Infested for 3WAS[1]	4.75a	4.2ab[2]	4.38abc
Weed Infested for 6WAS	4.92a	4.0bc	4.38abc
Weed Infested for 9WAS	4.25c	3.9bc	4.13bc
Weed Infested for 12WAS	3.25d	3.3de	3.38e
Weed Infested till harvest	2.33e	3.1e	2.75f
Weed free for 3WAS	4.00e	3.7bc	3.9bc
Weed free for 6WAS	4.50ab	3.8bc	4.17abc
Weed free for 9WAS	4.83a	3.9bc	4.25abc
Weed free for 12WAS	4.75a	4.1b	4.46ab
Weed free till harvest	4.83a	4.5a	4.71a
SE±	0.14	0.12	0.16
Interaction (VxW)	NS	NS	NS

WAS, week after sowing. Means followed by the same letter (s) / are not significantly different at 5% level of probability (DMRT),**NS,** non significant. **-** Treatment not applied.

conversely the crop vigour increases as the plots were kept weed free from weed free at 3WAS to weed free till harvest in 2011 and 2012 wet season at the same period.

The effect of variety and period of weed interference on plant height is presented on Table 7. Plant height differed significantly ($p < 0.05$) among the varieties at harvest in 2011 and 2012 (Table 7). Oba-98 and Sammaz-13 consistently had the taller plant than either of EVDTY-2000 or 2008-DTMAYSTR in 2012. Period of weed interference significantly affected plant height in both years. The least plant height was recorded in plots which were not weeded throughout the growing periods for both years. The interaction between the maize varieties and the treatment was not statistically significant ($p > 0.05$) (Table 7).

The effect of variety on grain yield was significant only in 2011 (Table 8). Variety 2008-DTMA-YSTR was observed to have the highest grain yield in 2011 with a value of 3.77 t/ha (Table 8) followed by Sammaz-13 (2.71t/ha), next was EVDT Y-2000 (2.57 t/ha) and Oba-98 (2.25 t/ha) had the least grain yield value during the 2011 wet season. Although not significant, the yield in 2012 was more than that of 2011.

Period of weed interference significantly affected grain yield in both years and the combine. The grain yield was observed to decrease as plots were kept initially weed infested beyond 3WAS till harvest during 2011 and 2012 wet seasons and the combined. As the plots were initially kept weed free the grain yield was observed to increase from a minimum value of 1.69 to 2.73 to 2.36 t/ha respectively for 2011, 2012 and combined to a maximum value of 3.87 to 6.47 to 5.17 t/ha respectively from 2011, 2012 and combined hence showing that weeds interfere or deplete nutrients from the soil rendering it unavailable to crop plants.

DISCUSSION

The prevalent weed species at the experimental site were *Cynodon dactylon* (L) Pers, *Cyperus esculentum (*L*), Rottboellia cochinchinensis (*L*), Ageratum conyzoides (*Linn*).* These weeds if not properly controlled could cause serious yield reduction in maize crop (IITA, 2009) hence the low yield obtained in the plots that were weed infested for many weeks (Ali and Sohrab, 2009). Although the varieties were on the field for the same period, obvious differences in their growth and subsequent yields were observed. While hybrid variety

Table 6. Interaction of Variety and period of Weed interference on crop Vigor at Gidan-Kwano during 2012 wet season.

Period of weed-interference	Variety			
	Oba-98	Sammaz-13	EVDTY-2000	2008-DTMA-YSTR
Weed Infested for 3WAS[1]	4.33a	3.33abc	4.67a	3.67ab
Weed Infested for 6WAS	4.00ab	4.00ab	4.00ab	3.33ab
Weed Infested for 9WAS	4.00ab	4.33a	4.00ab	3.67ab
Weed Infested for 12WAS	3.33abc	4.33a	3.00abc	3.67ab
Weed Infested for till harvest	3.33abc	4.67a	3.00abc	3.33ab
Weed free for 3WAS[1]	3.33abc	4.67a	4.00ab	3.67ab
Weed free for 6WAS	4.00ab	4.00ab	4.00ab	3.33abc
Weed free for 9WAS	4.33a	4.00ab	4.00ab	4.00ab
Weed free for 12WAS	4.00ab	3.00abc	4.00ab	4.00ab
Weed free till harvest	4.00ab	3.67ab	5.00a	4.67a
SE±			0.256	

WAS, week after sowing. Means followed by the same letter (s) / are not significantly different at 5% level of probability (DMRT).

Table 7. Effects of Variety and period of Weed interference on plant height (cm) at harvest during 2011 and 2012 wet seasons at Gidan-Kwano.

Treatments	Plant height (cm)	
	2011	2012
Variety		
Oba98	171.85a	189.71a
Sammaz-13	168.46a	185.52a
EVDTY-2000	127.4c	191.46b
2008DTMA-YSTR	156.35b	187.95a
SE ±	3.86	4.05
Period of weed-interference(W)		
Weed Infested for 3WAS[1]	156.54bc[2]	195.10abc
Weed Infested for 6WAS	154.84c	193.18abc
Weed Infested for 9WAS	150.06c	181.68cd
Weed Infested for 12WAS	149.33c	175.65d
Weed Infested for till harvest	115.26d	135.40e
Weed free for 3WAS[1]	163.07abc	188.87abc
Weed free for 6WAS	164.65abc	200.00ab
Weed free for 9WAS	164.67a	203.77ab
Weed free 12WAS	171.38ab	204.15ab
Weed free till harvest	179.34a	207.95ab
SE ±	6.1	5.20
Interaction (VxW)	NS	NS

WAS, week after sowing. Means followed by the same letter (s) / are not significantly different at 5% level of probability (DMRT). **NS,** non significant.

Oba-98 was initially fast growing than other three, the variety 2008-DTMAYSTR was most vigorous until harvest of the other three varieties. This is in conformity with the report of Shinggu et al. (2009) that showed similar effects on some tested maize varieties.

Variety 2008-DTMAYSTR gave the best weed suppression in 2011, EDTY-2000 gave the best weed suppression in 2012, while Oba- 98 produced highest cumulative weed dry matter in 2011 among the other varieties .This might be as a result of the long slender

Table 8. Effect of Variety and Period of weed- interference on grain yield at Gidan-Kwano, for 2011 and 2012 wet seasons.

Treatments	Grain yield (T/ha)		
	2011	**2012**	**Combined**
Variety			
Oba-98	2.25b	4.38	3.31
Sammaz-13	2.71b	3.83	3.27
EVDT-Y2000	2.57b	4.23	3.40
2008DTMA-YSTR	3.77a	4.23	4.00
SE ±	0.21	0.25	0.20
Period of weed-interference			
Weed Infested for 3WAS[1]	3.57a	5.95a[2]	4.76a
Weed Infested for 6WAS	2.51bc	4.63bc	3.57cd
Weed Infested for 9WAS	2.40bc	3.93dc	3.17ed
Weed Infested for 12WAS	1.69c	2.97e	2.27ef
Weed Infested till harvest	1.57c	1.79e	1.74f
Weed free for 3WAS	1.69c	2.73de	2.36ef
Weed free for 6WAS	2.00c	3.53dc	3.45d
Weed free for 9WAS	3.59a	4.25bc	3.96bcd
Weed free for 12WAS	3.67a	5.41ab	4.50abc
Weed free till harvest	3.87a	6.47a	5.17a
SE±	0.33	0.41	0.32
Interaction (VxW)	NS	NS	NS[3]

WAS, week after sowing. Means followed by the same letter (s) / are not significantly different at 5% level of probability (DMRT). **NS,** non significant.

leaves of the variety which cannot form canopy to smoother weeds in order to prevent them growing. It is apparent that once the crop was kept weed free for 12WAS subsequent weed infestation until harvest did not cause any significant reduction in maize grain yield in the four varieties. Contrary to earlier reports (Lagoke et al., 1986), weeds infestation for first 3WAS caused significant reduction in maize grain yield for both seasons and in the combined, even though it did not have adverse effect on crop growth as reflected in crop vigour score, crop height and weed dry matter. The yield depression by weed infestation for 3WAS may be attributed to rapid weed growth and its high infestation within 3WAS during the growing season. This was apparent in the weed cover at 9WAS and beyond. Weed infestation with crop until 12WAS resulted in significantly lower crop vigour and grain yield compared to infestation for 3WAS. This result agrees with those obtained by Carson (2010) and Kunjo (2011) who have similarly reported significant maize yield reduction when weeds were associated with the crop for 6 and 8WAS respectively. Subsequent weed removal until 12WAS did not prevent reduction in grain yield compared with weed infestation until harvest. Weed dry matter was higher during 2011 than 2012. From the results of this study, among the varieties tested 2008-DTMAYSTR had the highest crop establishment, while Sammaz-13, was the most tolerant followed by 2008-DTMAYSTR and Oba-98. The most susceptible variety is EVDTY-2000. Weed biomass increased with the initially weed infested from 3 to 12 weeks after sowing and till harvest.

Conclusions and recommendation

It is therefore recommended to keep the field free of weed from 3WAS when competition between crop and weed commences. In conclusion, 2008-DTMA-Y-STR and EVDTY-2000 maize varieties are also recommended for farmers' use in the study area.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

REFERENCES

Abdulrahaman, A. A., & Kolawole, O. M. (2006). Traditional preparations and uses of maize in Nigeria. *Ethnobotanical Leaflets*, 2006(1), 23.

Adeosun, J. O. (1990). Valuation of Sowing Date, nitrogen,

variety and herbicide for the control of *Striga hermonthica* (Del) Benth in Sorghum (*Sorghum bicolour* L. Moench). A Thesis submitted to the department of Agronomy, Ahmadu Bello University Zaria.

Ali, K., Munsif, F., Husain, Z., Khan, I., Ahmad, N., Khan, N., & Shahid, M. (2011). Effect of different weed control methods on weeds and maize grain yield. *Pakistan Journal of Weed Science Research*, 17(4), 314-315.

Carson, A. G. (2010). Weed competition and control in maize (*Zea mays L*). *Ghana journal of Agricultural Sciences,* 9, 161-167

FAO (2010). Faosat.

Harper, F. (1988). *Principles of Arable Crop Production*; Blackwell Science Ltd. Osney Mead, Oxford OX2 OEL. Pp. 202-213

IITA-Maize (2009). Report.

Kassam, A. H., Kowal, J., Dagg, M., & Harrison, M. N. (2005). Maize in West Africa and its potential in Savanna areas. *World Crops,* 27(2), 73-78.

Kunjo, I. (2011). An evaluation of the critical period and effect of weed competition on maize (*Zea Mays*). Phd Thesis, College of Agriculture, Ahmadu Bello University, Zaria, Niggeria, 65p.

Lagoke, S. T. O. (1988). Effect of intra-row spacing, Nitrogen levels and periods of weed interference of transplanted tomato (*Lycopersicum esculentum* Mill.) in Nigerian Savanna*. Samaru Journal of Agricultural Research,* 11, 31-42*.*

Lagoke, S. T. O., Adejonwo, K. O., & Sinha, T. D. (1986). Herbicide evaluation for Season long weed control in Onion (Allium cepa) on the Nigerian Savanna. In *Proceedings 22nd Annual Conference of the Agricultural Society of Nigeria, Ahmadu Bello University Zaria 1st - 3rd September, 1986,* Pp. 6-10*.*

Ojanuga, A. G. (2006). Agroecological Zones of Nigeria Manual. FAO/NSPFS, Federal Ministry of Agriculture and Rural Development, Abuja, Nigeria, 124 pp. In Afolabi, S. G., Adeboye, M. K. A., Lawal, B. A., Adekanmbi, A. A., Yusuf, A. A., & Tsado, P. A (2014). Evaluation of Some Soils of Minna Southern Guinea Savanna of Nigeria for Arable Crop Production. *Nigerian Journal of Agriculture, Food and Environment*. 10(4), 6-9.

Onasanya, R. O., Aiyelari, O. P., Onasanya, A., Oikeh, S., Nwilene, F. E., & Oyelakin, O. O. (2009). Growth and Yield Response of Maize (*Zea mays* L.) to different rates of Nitrogen and Phosphorus fertilizers in Southern Nigeria. *World Journal of Agricultural Sciences*, 5(4), 400-407.

Osagie, A. U., & Eka, O. U. (Eds) (1998). Nutritional Quality of Plant Foods. Post-harvest Research unit, University of Benin, Benin Pp. 34-41.

Shinggu, C. P., Dadari, S. A., Shebayan, S. A. Y., Adekpe, D. I., & Ishaya, D. B. (2009). Effects of Variety crop arrangement and period of weed interference on the performance of maize grown in mixture in Northern Guinea Savannah of Nigeria. Department of Agronomy, Faculty of Agriculture, Ahmadu Bello University, Zaria, Nigeria, p.48.

Uyovbisere, E. O., Elemo, K. A., & Tarfa, B. D. (2001). Effect of locust bean (*Parkia biglobosa*) and neem (*Azadiracta indica*) on soil fertility and productivity of early maize in savannah alfisol, Pp.185-194. In Badu- Aparaku, B., Fakorede, M.A.B., Quedraogo, M. and R. J. Carsky, R.J (eds). *Impact Challenges and prospects of Maize Research and development in West and central Africa*. Proceedings of a Regional Maize Workshop, IITA-Cotonou Benin Republic, 4-7 May 1999.WECAMAN/IITA.