

Influence of planting date and weed management practice on weed emergence, growth, and yield of maize (*Zea mays* L.) in southern Guinea savanna of Nigeria

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Field trials were conducted during the 2008 and 2009 growing seasons in Ilorin, southern Guinea savanna zone of Nigeria, to determine the effect of planting date and weed control method on weed infestation, growth, and the development of maize. The experiment was designed as a randomized complete block in a split-plot arrangement. Planting dates (2 July, 16 July, 30 July and 13 August) constituted the main plots, while weed management practices, which included a weedy check, two hoe weedings at 3 and 7 weeks after planting (WAP), one hoe weeding at either 4 or 5 WAP and a pre-emergence application of Primextra Gold(R) [a proprietary mixture containing 290 g/L of metolachlor (2-chloro-N-(2-ethyl-6-methyl-phenyl)-N-(2-methoxy-1-methyl ethyl) acetamide) and 370 g/L of atrazine (6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine)], at 2.5 kg ai/ha were the sub-plot treatments. Weed seedling emergence (infestation) was affected by date of planting in an inconsistent manner, a higher number of weed species were encountered in plots established on the first planting date (2 July) while plots established on the last date of planting (13 August) had the least number of weed species. Date of planting and weed control practice significantly affected maize grain yield and 100-seed weight, grain yield declined with delay in planting date. Maize growth likely contributes to the crop having a distinct competitive advantage over weeds when planted in early July, compared with late July and August plantings.

Keywords: Planting date, weed control, weed emergence, maize, grain yield, Nigeria.

INTRODUCTION

Managing weed populations through modification of the cropping pattern has been reported to be component of integrated weed management in maize [1]. A number of cultural practices including alteration in population density [2], row spacing [3], maize leaf orientation [4], or alteration of planting dates [5], etc. have been studied with the aim of improving the crop's ability to establish dominance over weeds, enduring competitive stress. In the last decade, crop modeling has been used to determine optimal planting dates for maize in the temperate regions [6]. Only very few of such studies have been conducted in tropical African countries, despite the fact that maize is one of the most important cereal crops

in the continent, it is currently the third most traded cereal, after wheat and rice. This crop is used as a staple food source in Africa however, because of its low prices and worldwide distribution; it has become the most important raw material for many agro-allied industries. The initial cultivation of maize in Nigeria was for subsistence purpose, it has gradually become an important commercial crop [7], but it has not been exploited full due to several constraints, among them weed infestation is major factor pulling down the yield of the crop in Nigeria [8].

Williams II [5] reported that the most limiting factor to maize production in the tropics is water. He attributed this to the poor distribution and/or variability of rainfall at the onset of the raining season from year to year and from

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Table 1. Partial summary of rainfall pattern during the 2008 and 2009 cropping season.

Date of planting	Total rainfall (mm) for different periods of the growing season											
	2008 cropping season						2009 cropping season					
	0-2WBP	0-3WAP	3-6WAP	6-9WAP	9-12WAP	Total	0-2WBP	0-3WAP	3-6WAP	6-9WAP	9-12WAP	Total
2 nd July	87.3	192.5	217.5	95.0	95.0	657.1	68.2	260.7	119.4	73.4	102.7	624.4
16 th July	93.2	257.1	122.4	57.6	320.7	851.0	149.0	189.3	102.2	72.8	56.5	569.8
30 th July	210.0	130.1	71.7	196.1	151.8	759.7	163.8	122.2	37.9	92.8	91.9	508.6
13 th August	105.4	82.0	79.2	282.6	4.8	554.0	66.7	73.4	102.7	30.3	91.1	364.2

Source: Nigerian Meteorological Agency, Ilorin, Nigeria.

place to place. In most African countries, the date of planting of crops is often determined by the onset of the rainy season. This in turn determines the duration of the vegetative and reproductive stages of the crops, with their effects on productivity of the crops [9]. Adjusting planting dates in row crops can alter the production season and be a viable means of reducing the impact of pests (weed) on crop growth, by shifting the competitive advantage to the crops [10]. Berzsenyi [11] reported that planting date is closely correlated with soil preparation which has a decisive effect on the periodicity of weed seed germination, while Williams II [20] reported that planting date influences crop losses due to weeds. Delayed planting has been reported to reduce yield losses due to weeds in soyabean [12] and dent maize [13]. There appears to be limited reports on the influence of planting date on weed infestation in maize fields in sub Saharan Africa, therefore, the objective of the present study was to quantify the influence of planting date and weed management method on emergence and growth of weeds as well as on the growth and yield

of maize in a southern Guinea savanna of Nigeria environment.

MATERIALS AND METHODS

Site description

This study was conducted at the University of Ilorin Teaching and Research Farm during the 2008 and 2009 growing seasons. The farm is located at Bolorunduro, Ilorin, in the southern Guinea savanna ecological zone (90 29' N, 40 35' E) of Nigeria, and is 307 m above sea level.

The area experienced a monomodal rainfall pattern that peaked in July and subsequently decreased with a daily temperature range of 20oc – 35oc, in both years (table 1). Two separate sites were used for this study. The site used in 2008 had been under continuous maize cropping for three years prior to the commencement of the study while an adjacent site which was used for the 2009 trial had a cropping history similar to the 2008 site, except that it was under natural fallow

in 2008.

Experimental layout

In each year the experiment was laid out in a randomized complete block design (RCBD) with a split-plot arrangement and three replications. The main plots consisted of four planting dates, which include: planting of maize seeds on 2 July, 16 July, 30 July and 13 August. The sub plots consisted of five weed management practices, made up of a weedy check, two hoe weeding at 3 and 7 weeks after planting (WAP), one hoe weeding at 4 WAP, one hoe weeding at 5 WAP and pre- emergence application of Primextra Gold® [a proprietary mixture of metolachlor (2-chloro-N-(2-ethyl-6-methyl-phenyl)-N-(2-methoxyl-1-methyl ethyl) acetamide) (290g/L) and atrazine (6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine) (370g/L)] at 2.5 kg ai/ha.

Field establishment

Prior to their cultivation, the vegetation cover of

the experimental sites was slashed to ground level, after which the land was disc ploughed and harrowed while ridging was done on the day of planting of each respective main plot. The experimental site for each year had an area of 1872 m², which was divided into three replications. Each replicate was further divided into main plots and sub plots that are 20 m x 5 m and 5 m x 4 m, respectively in size. Four seeds of maize (variety Suwan 1) were sown per hill. The resultant seedlings were thinned to two plants per stand after two weeks of planting (emergence) to give an approximate density of 80,000 plants/ha. A compound fertilizer, NPK (20: 10: 10) was applied in two splits at the rate of 200 kg ha⁻¹ at 3 WAP and 100 kg ha⁻¹ at 7 – 8 WAP respectively.

Data collection

Data on weed density and biomass were collected at 3, 6, 9, and 12 WAP. Weed seedling emergence was monitored in two fixed (0.25 m²) quadrats (continuously) per sub plot on each assessment date. Weed seedlings in each quadrat were counted, pulled out and separated into broadleaves, grasses and sedges accordingly. Thereafter, the number of weed seedlings within each category was enumerated. The weed types were further identified to species level using the weed identification manual of [14]. Dry matter production by the weeds was determined from the harvested weeds within each quadrat during each sampling periods. Samples from the same plots were bulked and oven dried at 80°C to a constant weight. Data on grain yield of maize were collected after harvesting and threshing. The dry grain weight per plot was extrapolated to tonnes per hectare. In addition, the weight of one hundred grains, selected from each plot, was determined.

Data analysis

Data on weed density, weed biomass and grain yield were subjected to analysis of variance (ANOVA) using Genstat statistical package for each of the individual years as well as for the combined data for the two years. Where F-ratios were significant ($p < 0.05$); means were separated using Fisher's protected least significant difference.

RESULTS

Weed species composition

A total of 44 weed species, belonging to 32 genera, and 14 families, were identified during the two year study period (table 2). Fourteen (32 %) of the weed species belonged to the Poaceae family, seven species (16 %) belonged to the Cyperaceae and five (11 %) of the total weed species encountered were from the Asteraceae family. A higher number of weed species were encountered

in plots established on the first planting date (2 July) in both years, while plots established on the last date of planting (13 August) had the least number of weed species. More weed species were observed across the planting dates in 2009 than in 2008 cropping season (table 2).

Weed Seedling Emergence

Planting date of maize had no significant effect on weed seedling emergence at most of the sampling periods in both years (table 3). In 2008, maize plots established on the last date of planting (13 August) had a significantly higher weed densities at 3 WAP than the other plots, while at 9 WAP, plots established on the first (2 July) and second (16 July) dates of planting had similar weed densities that were higher than those in the other plots. In 2009, plots established on the second date of planting (16 July) had higher weed densities than those of plots planted on other dates at 9 WAP; and similar weed densities as in plots planted on the first date of planting (2 July) at 9 and 12 WAP. Average over the two years, date of planting did not significantly influence weed density, except at 12 WAP when weed emergence in plots established on the second date of planting (16 July) was higher than those of plots established on the first date (2 July) and fourth date (13 August) but similar to those of plots established on 30 July.

The weed management practices significantly influenced the density of emerged weed seedlings in both years except at 3 and 6 WAP in 2008 (table 3). In most cases, the plots treated with Primextra Gold(R) had relatively lower number of weed seedlings, that were similar to those in the hoe-weeded plots while the weedy plots recorded the highest weed density.

The interaction between planting date and weed management practice significantly affected weed seedling emergence in both years except at 9 WAP in 2008 (table 4). The unweeded plots had a higher weed seedling population across the planting dates, compared to herbicide treated plots while the hoe-weeded plots were similar across the planting dates.

The pattern of weed emergence in 2008 showed that weed density peaked at 6 WAP for most planting dates except plots established on 16 July that peaked of weed emergence were at 9 WAP. In 2009, weed emergence peaked at 9 WAP for all dates of plot establishment. Combined analysis of the two years data showed a similar pattern of weed seedling emergence as in 2008 cropping season (fig. 1).

Weed Dry Matter Production

The weed dry matter production was not significantly affected by the planting dates except at 3 WAP in 2008 whereas weed management practice significantly influence weed biomass except at 3 WAP in 2009 cropping season (table 5). The weedy plots had the highest weed biomass

Table 2. Weed species encountered across the planting dates during the trial periods.

Family	Weed species	Planting Date							
		2008				2009			
		D1	D2	D3	D4	D1	D2	D3	D4
Amaranthaceae	<i>Gomphrena celosiodes</i> Mart	+	-	+	-	+	+	-	-
Asteraceae	<i>Aspilia Africana</i> L	+	-	-	+	+	-	-	-
	<i>Ageratum conyzoides</i> L	-	+	-	+	+	+	-	+
	<i>Chromolaena odorata</i> (L.) R.M.Kings	+	+	-	-	+	-	+	-
	<i>Tridax procumbens</i> L	-	+	+	+	+	+	-	-
	<i>Vernonia galamensis</i> (Cass) Less	+	+	-	-	+	-	-	-
Caryophyllaceae	<i>Polycarpaea corymbosa</i> L(Lam)	-	-	-	-	-	-	+	-
Cleomaceae	<i>Cleome viscosa</i> L	+	-	+	-	+	+	+	-
Commelinaceae	<i>Commelina benghalensis</i> L	+	-	-	-	+	-	-	-
	<i>C. diffusa</i> Burm	+	-	+	-	+	-	-	-
	<i>C. erecta</i> L.	+	+	+	-	+	-	-	-
Cyperaceae	<i>Cyperus difformis</i> L	-	-	-	+	-	+	-	-
	<i>C. esculentus</i> L	+	+	-	+	+	+	-	-
	<i>C. iria</i> L	-	-	-	-	+	+	+	-
	<i>C. rotundus</i> L	+	+	-	+	+	+	-	+
	<i>Kyllinga bulbosa</i> Beav	+	+	+	-	+	+	-	+
	<i>K. squamulata</i> Thorn	+	+	+	-	+	+	-	+
	<i>Scleria verrucosa</i> Willd	-	-	-	-	-	-	+	+
Euphorbiaceae	<i>Euphorbia heterophylla</i> L	+	+	+	+	+	-	+	+
	<i>Euphorbia hirta</i> L	+	+	-	-	+	-	+	+
Fabaceae	<i>Neptunia oleracea</i> Lour	-	-	-	-	-	-	+	+
Malvaceae	<i>Sida acuta</i> Burm	-	-	-	-	+	-	+	+
Nyctaginaceae	<i>Boerhavia diffusa</i> L	+	-	+	+	+	-	-	-
	<i>B. erecta</i> L	+	-	+	+	-	-	-	-
Onagraceae	<i>Ludwigia hyssopifolia</i> Exell	-	-	-	-	+	+	-	-
Poaceae	<i>Andropogon gayanus</i> Kunth	-	-	-	-	+	+	-	-
	<i>Brachiria deflexa</i> (Schum.) C.E. Hubbard ex Robyns	+	-	+	+	+	-	+	-
	<i>B. lata</i> (Schum.) C.E. Hubbard	+	-	-	+	+	-	+	-
	<i>Chloris pilosa</i>	-	-	-	-	-	-	+	-
	<i>Cynodon dactylon</i> (L.) Pers	+	+	-	-	+	+		+
	<i>Dactyloctenium aegyptium</i> (L.) P.Beauv	+	-	+	-	+	-	-	+
	<i>Echinochloa obtusiflora</i> Stapf	-	-	-	-	-	-	+	+
	<i>Eleusine indica</i> Gaertn	+	+	-	+	-	-	-	-
	<i>Imperata cylindrica</i> Anders	+	-	-	-	+	+	+	-
	<i>Panicum maximum</i> Jacq	+	+	-	+	+	-	+	
	<i>Paspalum conjugatum</i> Berg	+	+	-	-	+	-	+	-
	<i>P. vaginatum</i> SW	-	-	+	-	+	-	+	-
	<i>P. scrobiculatum</i> L.	-	-	-	-	+	+	-	-
	<i>Rottboellia cochinchinensis</i> (Lour) Clayton	+	-	+	+	+	+	-	+
Portulacaceae	<i>Portulaca oleracea</i> L	+	+	-	+	+	-	-	-
	<i>Talinum triangulare</i> (Jacq) Willd	-	+	-	-	+	+	-	-
Rubiaceae	<i>Mitracapus villosus</i> (SW) DC	+	-	+	+	+	-	+	-
	<i>Oldelandia corymbosa</i> L	+	+	+	-	+	-	+	-
	<i>Oldelandia herbacea</i> L	-	-	-	-	+	+	+	-

D1= 2nd July, D2= 16th July, D3= 30th July, D4= 13th August, - = absent , + = present.

Table 3. Effect of date of planting and weed management practice on weed seedling population (seedling/m²).

Treatment	Weed density during 2008 trial					Weed density during 2009 trial					Combined analysis				
	3WAP	6WAP	9WAP	12WAP	TOTAL	3WAP	6WAP	9WAP	12WAP	TOTAL	3WAP	6WAP	9WAP	12WAP	TOTAL
Date of Planting (DP)															
2 nd July	37	60	45	17	159	18	28	43	26	115	27	44	44	21	136
16 th July	32	40	44	23	139	18	27	49	27	121	25	33	46	25	129
30 th July	37	65	35	21	158	15	20	37	22	94	26	42	37	22	127
13 th August	49	52	32	20	153	15	25	39	19	98	32	38	36	20	125
Sed	4.66	9.32	3.20	1.24	14.98	3.11	5.13	3.56	2.13	16.84	3.07	6.11	3.22	1.46	13.26
LSD (0.05)	11.40	NS	7.35	3.56	NS	NS	NS	8.01	5.32	NS	NS	NS	NS	3.57	NS
Weed Management (WM)															
Weedy	47	38	24	17	172	17	37	43	24	121	32	35	58	21	146
HW@3&7WAP	34	81	22	17	154	10	17	28	19	74	22	49	25	18	114
HW @ 4 WAP	44	68	23	18	152	14	22	45	19	99	29	45	34	18	126
HW@ 5 WAP	37	37	44	18	136	16	24	44	20	105	27	31	44	19	120
Herbicide	31	51	32	32	146	24	25	51	35	135	27	38	42	34	140
Sed	8.78	11.08	9.25	5.80	23.16	3.44	4.86	6.07	4.47	13.67	4.74	5.93	5.61	3.33	14.13
LSD (0.05)	NS	NS	18.84	11.82	NS	7.01	9.91	12.36	9.11	27.84	NS	12.07	11.44	6.79	NS
Interaction															
DP x WM	*	*	NS	*	*	*	*	*	*	*	*	*	*	*	*

Sed = standard error of difference of means, WAP = weeks after planting, HW = hand weeding.

that were similar, in a few cases, with the hoe weeded plots. The interaction between planting dates and weed control practice on weed dry matter production was significant in all sampling periods except at 9 WAP in both years (table 6) while the herbicide treated plots had a significantly lower weed biomass across the planting dates, there was no difference between the weedy plots and hoe-weeded plots at 3 WAP.

The combined analysis of the two year data showed that the date of planting had no effect on weed biomass whereas weed control practice significantly affected weed dry matter production. The un-weeded control plots had significantly higher weed biomass while the herbicide treated plots had the least dry weed biomass. The hand-

weeded plots had similar dry weed weight except at 12 WAP where plots that were weeded twice produced less weed biomass compared to other weed control plots.

Maize grain yield

Date of planting and weed control practice significantly affected maize grain yield and 100-seed weight in both years, except that the 100-seed weight was not affected by weed management practice in 2009 (table 7). In both years grain yield declined with delay in planting date. In 2008, maize plots established on 2 July produced the highest grain yield that was similar to those of plots planted on 16 July. These yields

were significantly higher than those obtained from plots established on the last two planting dates. In 2009, plots established on 2 July produced significantly higher grain yield than the other plots, while plots established on the second and third planting dates had similar grain yields that were significantly higher than the yield obtained from plots established on the last date of planting. The effect of planting date on grain yield for the combined data showed that, grain yield declined with delay in planting date. The effect of planting date on 100-seed weight followed the same trend as for grain yields, plots planted on 2 July had significantly heavier seeds while the 100-seed weight of grains obtained from the other plots were similar. The hand-weeded plots recorded

Table 4. Interaction effects of date of planting and weed management practice on weed seedling population (seedling/m²).

Treatment	Weed management practice				
	2008				
	Weedy	HW @ 3&7 WAP	HW@ 4WAP	HW@ 5WAP	Herbicide
Date of Planting					
2 nd July	216	98	187	146	147
16 th July	182	146	58	137	162
30 th July	229	204	126	100	137
13 th August	237	144	15	160	70
Sed			46.33		
LSD (0.05)			94.37		
			2009		
2 nd July	162	137	110	119	135
16 th July	202	119	37	130	117
30 th July	124	68	138	13	134
13 th August	108	71	111	157	42
Sed			27.34		
LSD (0.05)			55.68		
			Combined analysis		
2 nd July	175	68	148	133	155
16 th July	182	133	48	134	149
30 th July	169	149	132	57	131
13 th August	130	108	174	158	56
Sed			28.26		
LSD (0.05)			57.56		

Sed = standard error of difference of means, WAP = weeks after planting, HW = hand weeding.

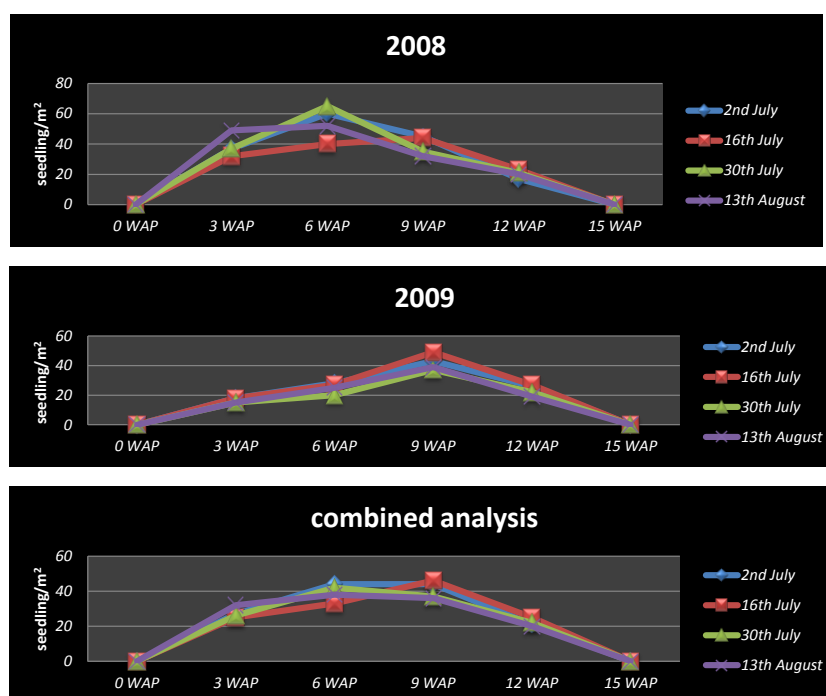
**Figure 1.** Pattern of weed seedling emergence across dates of planting and weed management practices in Ilorin.

Table 5. Effect of date of planting and weed management practice on weed biomass (g/m²).

Treatment	Weed biomass during 2008 trial					Weed biomass during 2009 trial					Combined analysis				
	3WAP	6WAP	9WAP	12WAP	TOTAL	3WAP	6WAP	9WAP	12WAP	TOTAL	3WAP	6WAP	9WAP	12WAP	TOTAL
Date of Planting (DP)															
2 nd July	3.15	14.91	6.30	0.62	25.60	6.55	34.01	29.61	18.21	88.38	5.15	24.51	17.91	9.41	57.01
16 th July	3.10	9.50	5.96	0.72	19.30	4.87	25.90	27.30	19.22	77.39	3.99	17.70	16.60	10.01	48.30
30 th July	3.02	17.51	4.61	0.82	26.01	7.17	37.42	24.81	17.04	86.36	5.09	27.43	14.70	8.90	56.10
13 th August	4.95	19.20	5.70	0.53	30.40	6.19	39.71	31.74	18.62	96.29	5.57	29.43	18.70	9.61	63.39
Sed	0.34	2.74	2.63	0.25	3.36	0.96	7.42	9.88	4.47	5.51	0.88	3.21	5.61	2.18	3.20
LSD (0.05)	0.82	6.97	NS	NS	8.21	2.54	NS	NS	NS	12.65	NS	7.03	NS	NS	7.53
Weed Management (WM)															
Weedy	6.54	5.70	16.02	0.56	28.90	10.33	77.74	45.01	18.51	151.58	8.43	41.71	30.51	9.51	90.26
HW@3&7WAP	1.67	38.32	0.95	1.06	42.00	4.31	13.91	29.32	7.42	54.96	2.99	26.12	15.11	4.21	48.49
HW @ 4 WAP	3.75	20.61	4.75	1.01	30.11	5.05	30.90	35.54	13.01	84.49	4.40	25.81	20.10	7.02	57.33
HW@ 5 WAP	3.92	4.90	9.51	0.42	13.80	6.27	24.32	23.04	26.83	80.49	5.09	14.60	13.80	13.61	47.19
Herbicide	2.65	6.80	1.99	0.32	11.70	4.99	24.62	8.91	25.54	64.08	3.82	15.71	5.52	12.90	37.85
Sed	1.01	4.74	2.73	0.26	6.14	2.16	9.75	10.97	3.43	14.63	1.11	5.39	6.05	1.72	8.77
LSD (0.05)	2.04	9.66	5.56	0.54	12.50	NS	19.87	22.35	6.98	29.80	2.26	10.99	12.30	3.50	17.86
Interaction															
DP x WM	*	*	*	NS	*	*	*	*	NS	*	*	*	NS	*	*

Sed = standard error of difference of means, WAP = weeks after planting, HW = hand weeding.

Table 6. Interaction effects of date of planting and weed management practice on weed biomass(g/m²).

Treatment	Weed management practice				
	2008				
	Weedy	HW @ 3&7 WAP	HW@ 4WAP	HW@ 5WAP	Herbicide
Date of Planting					
2 nd July	35.61	7.21	54.03	21.01	10.30
16 th July	36.42	32.74	10.11	9.30	8.22
30 th July	17.41	61.70	16.32	8.90	25.51
13 th August	26.03	66.51	40.20	16.22	2.90

Table 6. Cont.

Sed			12.28		
LSD (0.05)			25.01		
2009					
2 nd July	200.42	17.23	65.91	66.30	91.91
16 th July	135.81	100.61	15.70	77.61	56.81
30 th July	113.40	36.41	169.21	15.30	97.41
13 th August	156.62	65.43	87.01	162.40	9.62
Sed			29.26		
LSD (0.05)			59.60		
Combined analysis					
2 nd July	118.01	12.22	59.91	43.71	51.11
16 th July	86.10	66.60	12.90	43.41	32.50
30 th July	65.40	49.01	92.71	12.40	61.51
13 th August	91.31	65.91	63.60	89.31	6.30
Sed			17.53		
LSD (0.05)			35.72		

Sed = standard error of difference of means, WAP = weeks after planting, HW = hand weeding.

Table 7. Effect of date of planting and weed management practice on grain yield.

Treatment	Grain yield (ton/ha)			100-seed weight (g)		
	Date of Planting (DP) 2008	2009	Combined	2008	2009	Combined
2 nd July	1.213	2.201	3.414	17.73	17.89	35.62
16 th July	1.033	1.431	2.464	15.49	16.44	31.93
30 th July	0.241	1.369	1.610	14.06	15.67	29.73
13 th August	0.427	0.295	0.722	14.49	16.52	31.01
Sed	0.175	0.142	0.245	0.485	0.558	0.683
LSD (0.05)	0.428	0.347	0.600	1.188	1.366	1.671
Weed Management (WM)						
Weedy	0.233	1.107	1.341	15.27	15.29	30.55
HW@3&7WAP	0.875	1.472	2.347	15.65	17.31	32.96
HW @ 4 WAP	0.927	1.421	2.348	14.72	17.17	31.89
HW@ 5 WAP	1.050	1.468	2.518	16.23	16.00	32.22
Herbicide	0.558	1.152	1.710	15.36	17.39	32.75
Sed	0.100	0.159	0.335	0.527	0.750	0.868
LSD (0.05)	0.204	0.310	0.641	NS	1.527	NS
Interaction						
DP x WM	*	NS	NS	*	NS	*

Sed = standard error of difference of means, WAP = weeks after planting, HW = hand weeding.

similar grain yields that were significantly higher than yields obtained from the herbicide treated and the weedy control plots, in both years in the combined analysis of data from the two years. The yield from the herbicide-treated plots was similar to those obtained from the

weedy control plots except in 2008. The 100-seed weight was only marginally affected by weed management practice in each of the two years and in the combined data analysis. The interaction between planting date and weed control practice on grain yield was significant

Table 8. Interaction effects of date of planting and weed management practice on grain yield.

Treatment	Weed management practice				
	Grain yield (ton/ha) during 2008 trial				
	Weedy	HW @ 3&7 WAP	HW@ 4WAP	HW@ 5WAP	Herbicide
Date of Planting					
2 nd July	0.33	1.40	1.70	1.90	0.83
16 th July	0.23	1.37	1.43	1.27	0.30
30 th July	0.13	0.33	0.50	0.33	0.33
13 th August	0.23	0.40	0.07	0.70	0.77
Sed			0.200		
LSD (0.05)			0.408		
		100-seed weight (g) during 2009 trial			
2 nd July	15.91	18.17	19.20	18.37	17.02
16 th July	16.12	15.64	14.21	15.51	15.97
30 th July	15.27	14.00	9.86	16.83	14.35
13 th August	13.76	14.80	15.62	14.20	14.09
Sed			1.054		
LSD (0.05)			2.146		
		Combined analysis of two year data on 100-seed weight (g)			
2 nd July	32.33	36.42	39.64	36.05	33.49
16 th July	31.87	33.24	31.29	30.53	32.72
30 th July	30.02	29.23	24.54	31.83	33.06
13 th August	27.80	32.96	23.09	30.48	31.75
Sed			1.736		
LSD (0.05)			3.536		

Sed = standard error of difference of means, WAP = weeks after planting, HW = hand weeding

($p \leq 0.05$) in 2008 while on the 100-seed weight; significant differences were observed in 2008 and in the combined analysis of the two years data (table 8). The first and second planting dates had significantly higher grain yield under the hand-weeded plots compared to what was obtained from the third and fourth dates of planting across the weed control practices. Similarly, better seeds weights were obtained from plots established on 2 and 16 July under the hand-weeded plots.

DISCUSSION

In this study, weed seedling emergence (infestation) was affected by date of planting in an inconsistent manner. In 2008, plots established during the first planting date had higher number of weed seedlings while in 2009; plots established on the last planting date had the highest weed density. This is in contrast to the results of [15] who reported that weed infestation was significantly affected by sowing date of wheat in Hungary. Unfortunately, most of the available earlier local studies on this subject [16-18] did not report on this aspect of their studies. The inconsistent effect of planting date on weed infestation

might be related to the amount and distribution of rainfall at the experimental location. It was recently observed that weed emergence in this same location is highly correlated with both total rainfall and cumulative rainfall before assessment [19]. As expected, weed management practice affected weed density in both years, with the herbicide-treated plots recorded the lowest weed density while the weedy control plots recorded the highest density. The poor grain yield recorded from late cropping could be due to the sensitivity of the maize crop to climatic factors, especially rainfall and temperature. Similar results have been reported by [16-18]. It is essential that planting should be done on time so that the crop will have enough time for vegetative growth and reduce chances of disease and insect problems. Late planting reduces chance of survival, generally delays maturity, increases disease chances and reduces yield potential [9]. The weed management practice that gave the best weed control (herbicide-treated) did not result in the best grain yield in this study. This could be due to re-infestation of the affected plots after the breakdown of the herbicide treatment. On the other hand, a single hand weeding at 5 WAP was comparable to the two hand weedings and the herbicide treated plots. Williams II [5]

observed that planting date influence crop losses due to weeds although, the exact outcome of crop-weed competition is dependent on site-specific factors, including climatic variation, weed species composition and crop-specific products issue [4].

Under southern Guinea savanna of Nigeria conditions and weeds commons to this zone, maize growth likely contributes to the crop having a distinct competitive advantage when planted in early July as against late July and August plantings. There is however, the need for further studies to determine the influence of climate change on planting date and weeds interference on maize growth and development in this agro ecological region.

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