Growth and Yield of Maize as Influenced by Cropping Systems and Weed Control Measures

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Abstract

The need to identify an herbicide that is applied at a very low rate and achieving good weed control, as well as optimum yield is a necessity in Nigeria to further reduce environmental pollution caused by the application of herbicides at high rates. Therefore, field trials were conducted in the early and late wet season of 2019 at the Teaching and Research Farm of the Federal University of Agriculture Abeokuta, Ogun State, Nigeria to evaluate the effect of cropping system and weed control measures on growth and yield of maize. Treatments were laid out in a split-plot arrangement in a randomized complete block design with three replications. The main plot treatments consisted of a cropping system (sole maize and maize/sweet potato intercrop) while the sub-plot treatments were made up of six weed control measures. Data collected on growth, maize yield and weed biomass were subjected to analysis of variance and the means of the treatments separated using the least significant difference at $p \leq 0.05$. Results showed that sole maize produced taller plants than maize intercropped with sweet potato. There was a 21.3% to 31.4% reduction in weed biomass at 9 weeks after planting (WAP) and 12 WAP, respectively when maize was intercropped with sweet potato compared to planting maize in sole cropping. The application of Isoxaflutole plus Aclonifene as a pre-emergence herbicide at both rates enhanced the growth of maize. Isoxaflutole plus Aclonifene at 0.75 kg a.i/ha with or without hoe weeding resulted in higher maize yield and also cause significant reduction in weed biomass.

Keywords: Maize, herbicide, weed biomass, grain, hoe

Introduction

Maize (*Zea mays* L.) is a grainy strategic crop with significant global importance. It is one of the most important nutritional resources because it contains a significant amount of starch (80%), oil (4%), and protein (9%), as well as a high percentage of carbohydrates (around 70%). It also contains numerous mineral elements and vitamins (Laurie *et al.,* 2004; Khalaf and Diaa, 2009). Maize was previously grown on a subsistence basis in Africa. However, it has gradually become a significant commercial crop, providing raw materials for many agro-allied industries (Iken and Amusa, 2004). The demand for maize is high, creating an opportunity to increase production per unit area. According to FAOStat (2021), USA and China dominate global maize production, together producing over half of the total maize production. Africa's average maize production per hectare is extremely low (2.1t/ha), compared to Asia (5.4t/ha) and America (7.9t/ha) and unless something is done to change this situation, Africa will soon have the world's largest net cereal deficit (Mwangi, 1995). Weed infestation is the most significant factor contributing to low yield. Weed growth in maize fields reduces crop yields by 43% to 80% (Adigun, 2001; Falade *et al.,* 2023). Weeds compete with crop plants for space, light, moisture, nutrients, and carbon dioxide, reducing yield, and grain quality, thereby hindering harvest operations while also increasing production costs (Osunleti *et al.,* 2022). Previous research has shown that two-hoe weeding resulted in effective weed control and increased maize yields (Imoloame and Omolaiye, 2016; Imoloame 2017). Despite the benefits of this method, it is time-consuming, laborious, and costly per hectare. According to reports, weeding one hectare of maize-planted land can take up to 25-40 man days, accounting for 50-80% of the labour budget (Darkwa *et al.,* 2001; Chikoye *et al.,* 2002). This is supported by the findings of Ekeleme (2009) which show that labour and weeding operations account for 25-55% of total production costs.

Chemical weed control has been reported to be a superior alternative to manual weeding, despite criticism that it leaves toxic residues in the environment. This is because it is cheaper, and faster, reduces drudgery, improves weed control, and increases crop biological yield (Chikoye *et al.,* 2004; Ali *et al.,* 2003; Haider *et al.,* 2009).

Cropping systems have been shown to alter the abiotic and biotic features of an agroecosystem, as well as the life cycle of pests like weeds (Bani *et al.,* 2006). Intercropping has several advantages over monocropping, including soil conservation, lodging resistance, yield increase, and weed control (Anil *et al.,* 1998; Bani *et al.,* 2006).

Higher dosages of herbicide have been used in the production of maize, particularly in Sub-Saharan Africa (SSA). Previously, herbicides such as Pendimethalin + Prometryn @ 1.4 kg a.i./ha (Tahir *et al.,* 2009), Atrazine 1.0 kg a.i./ha (Shrestha *et al.*, 2021), and Metolachlor + Atrazine at 2.5 kg a.i./ha (Imoloame, 2020) were applied to maize at a rate greater than 1.0 kg a.i./ha. Herbicide concentrations and usage rates should be further reduce to further minimize environmental pollution. Thus under various cropping systems, this study aims to evaluate effect of low-rate herbicides on weed biomass, growth and yield of maize.

Materials and Methods

Field experiments were conducted at the Federal University of Agriculture, Abeokuta, Ogun State, Nigeria (70, 20'N, 30, 23'E) during the early (June to September) and late (September to December) wet seasons of 2019 to evaluate the effect of cropping system and weed control measures on growth and yield of maize. Abeokuta, Ogun State is located in the forest savannah transition zone of South Western Nigeria and characterized by a bimodal pattern of rainfall. During the experiment, the site received a total rainfall of 535.3 mm during the early wet season and 518.6 mm during the late wet season (Table 1). The details of physico-chemical properties of the soil prior the commencement of the trials are contained in Table 2. The result of the analysis indicated that the soil was sandy loam in texture with 736.6 g/kg sand, 42.9 g/kg clay and 220.5 g/kg silt particles. The soil was slightly acidic with a pH of 6.6.

Table 1: Monthly distribution and annual total rainfall, mean temperature, and relative humidity during this experiment

Month	Mean. Temp (°C)	Total Rainfall (mm)	Relative Humidity (%)
May	27.7	150.4	80
June	27.1	264.5	83.1
July	26.2	108.7	87.4
August	34	65.8	83.4
September	26.6	96.3	85.7
October	26.4	310	84
November	28	112.3	86.9
December	29	0	81.2

Table 2: Soil physical and chemical properties at the experimental site

Soil Composition	2019
pH (H_2O)	6.6
Particle size analysis	
Sand (g/kg)	736.6
Silt (g/kg)	220.5
Clay (g/kg)	42.9
Textural class	Sandy-loam
Chemical composition	
Organic carbon (g/kg)	19.2
Available P (mg/kg)	4.05
Total N (%)	0.13
Exchangeable cations (cmol/kg)	
Ca	6.59
Na	0.16
Mg	0.18
K	0.45

Treatments and experimental design

The experiment was laid out in a split-plot arrangement in a Randomized Completely Block Design (RCBD) with three replicates. In both seasons, the main plot treatment consisted of cropping system (sole maize and maize/ sweet potato intercrop) while the sub-plot treatments was made up of six weed control measures viz: Hoe weeding at 3, 6, 9 WAP (WCM 1), pre-emergence herbicide application of Isoxaflutole + aclonifene @ 0.5 kg a.i/ha (WCM 2), Isoxaflutole + aclonifene @ 0.5 kg a.i/ha followed by (fb) hoe weeding (WMC 3), Isoxaflutole + aclonifene @ 0.75 kg a.i/ha (WCM 4), Isoxaflutole + aclonifene @ 0.75 kg a.i/ha (fb) hoe weeding (WMC 5) and Untreated (WCM 6 (where no herbicide was sprayed and no hoe weeding was done). The follow-up hoe weeding on the herbicide-treated plots was done at the 6 WAP.

Cultural practices

The experimental site in each season was ploughed and harrowed after two weeks to destroy established vegetation, destroy weed seedlings, and produce level-smooth and weed-free fields. After the land preparation, the field was ridged at 1m x 1m, the land was then marked out into various replicates, plots and subplots. Planting of sole maize and maize/ sweet potato into appropriate plots, according to the treatments was done. Maize seeds (SUWAN 1) were planted (two seeds per hole and latter thinned to one) on the crest of the ridges at 1m x 0.5m, while the sweet potato was planted on the ridges at 1m x 0.4m. Immediately after planting, pre-emergence application of Isoxaflutole + aclonifene was done according to the treatment structure.

Data Collection and Analysis

Data collected on maize height, leaf area, maize cob length, 100 grain weight, grain yield and weed biomass were analyzed using the GENSTAT procedures. The least significant difference (LSD) was used to separate the means of significant treatment at a 5% level of probability.

Results

Maize Height

Table 3 shows the effect of planting season, cropping system and weed control measures on maize height. The cropping system had a significant effect on maize height only at 9 WAP with sole maize (168.1 cm) producing taller plants than maize intercropped with sweet potato (161.6 cm). Weed control measures had a significant effect on maize height at 6, 9 and 12 WAP. Throughout the period, application of Isoxaflutole plus Aclonifene at both rates and hoe weeding at 3, 6, and 9 WAP produced taller maize plants than the untreated (Table 3). At 9 WAP, sole maize in the early wet season produced taller maize than maize intercropped with sweet potato in the same season (Fig. 1a). Also at 9 WAP, plots hoe weeded at 3, 6 and 9 WAP in the early wet season produced taller plants than the untreated irrespective of the planting season (Fig. 1b). At 12 WAP, the shortest maize plants were observed on the untreated plots, irrespective of the season of planting. Also at 12 WAP application of Isoxaflutole plus Aclonifene at both rates in the late wet season, produced taller maize crops than their corresponding in the early wet season (Fig. 1c).

Table 3: Effects of planting season, Cropping system and weed control measures on maize height

	Maize Plant Height (cm)			
Treatments	**3 WAP**	**6 WAP**	**9 WAP**	**12 WAP**
Planting Season (S)				
Early Wet Season	36.2	77.1	163.9	212.7
Late Wet Season	39.2	85.9	165.8	217.0
LSD	7.699	12.130	12.190	14.920
p-value	0.236	0.090	0.586	0.339
Cropping System (C)				
Maize with Potato	38.2	81.2	161.6	212.5
Sole Maize	37.1	81.8	168.1	217.2
LSD	4.074	7.830	5.120	11.850
p-value	0.496	0.824	0.024	0.335
Weed Control Measures (W)				
WCM 1	38.4	83.4	182.3	222.5
WCM 2	37.7	85.2	168.4	223.5
WCM 3	37.8	78.7	168.2	225.8
WCM 4	36.5	82.9	168.3	217.7
WCM 5	37.6	84.9	179.3	230.6
WCM6	38.0	73.8	122.7	169.0
LSD	2.664	7.930	14.800	16.070
p-value	0.765	0.043	<.001	<.001
Interactions (p-value)				
S * C	0.463	0.864	0.016	0.473
S * W	0.082	0.109	0.002	<.001
C * W	0.342	0.879	0.300	0.971
S * C * W	0.641	0.642	0.234	0.913

Note: Hoe weeding at 3, 6, 9 WAP (WCM 1), Isoxaflutole + aclonifene @ 0.5 kg a.i/ha (WCM 2), Isoxaflutole + aclonifene @ 0.5 kg a.i/ha followed by (fb) hoe weeding (WMC 3), Isoxaflutole + aclonifene @ 0.75 kg a.i/ha (WCM 4), Isoxaflutole + aclonifene @ 0.75 kg a.i/ha (fb) hoe weeding (WMC 5) and Untreated (WCM 6)

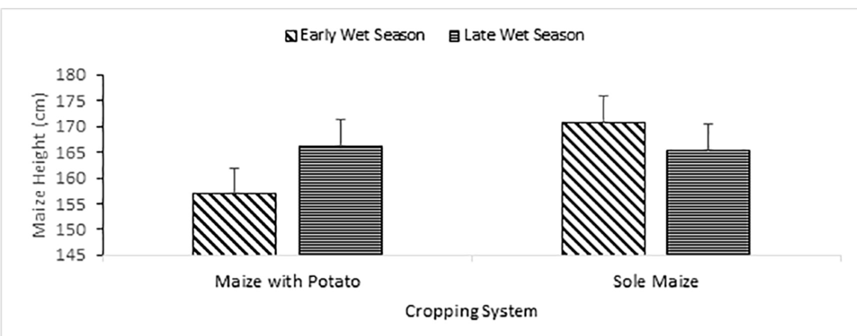

Figure 1a: Interaction of planting season and cropping system on maize height at 9 WAP

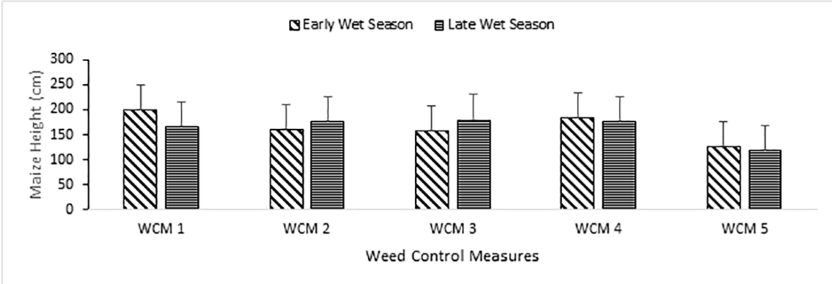

Figure 1b: Interaction of planting season and weed control measures on maize height at 9 WAP

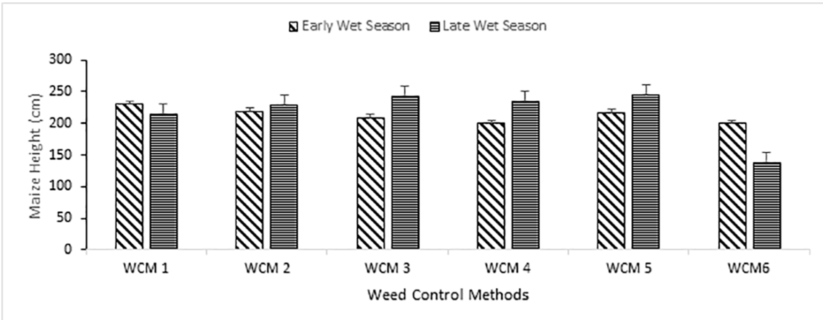

Figure 1c: Interaction of planting season and weed control measures on maize height at 12 WAP

Leaf Area

At 9 WAP, maize planted in the late wet season produced maize plants with larger leaves than those planted in the early wet season (Table 4). Cropping system had significant effect on maize leaf area only at 3 WAP, with maize intercropped with sweet potato having higher value. Weed control measures had significant effect on leaf area throughout the period of observation except at 3 WAP. The lowest values of leaf area (247.9 cm^2 to 306.5 cm^2) were recorded on the untreated plots. At 6 WAP, application of Isoxaflutole plus Aclonifene at 0.75 kg a.i /ha fb hoe weeding (455.6 cm^2) and hoe weeding at 3, 6, 9 WAP (476.0 cm^2) resulted in similar leaf area and significantly higher than application of Isoxaflutole plus Aclonifene at 0.5 kg a.i /ha fb hoe weeding (399.9 cm^2). At 9 WAP, the widest leaf was recorded on plots hoe weeded at 3, 6, 9 WAP (673.3 cm^2), followed by application of Isoxaflutole plus Aclonifene at 0.75 kg a.i /ha fb hoe weeding (598.5 cm^2). Maize planted in the late wet season irrespective of the cropping system produced wider leaves (563.9 cm^2 to 568.7 cm^2) than maize intercropped with potato in the early wet season (491.3 cm^2) (Fig. 2).

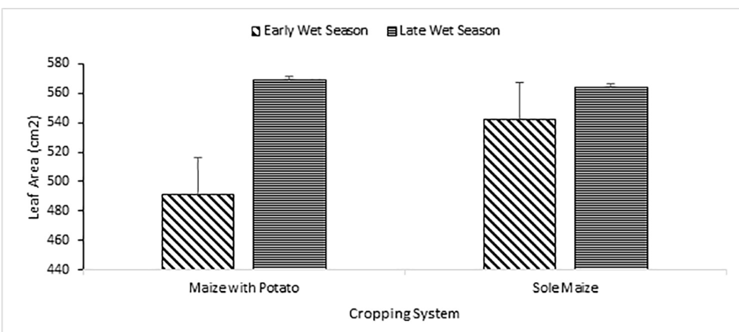

Figure 2: Interaction of planting season and cropping system on leaf area at 9 WAP

Yield and Yield Component

Planting season had a significant effect on 100 grain weight and grain yield with late wet season planting having higher values (14.7g, 892.0 kg/ha) than the early wet season planting (14.2g, 786.0 kg/ha) (Table 5). Weed control measures had a significant effect on maize yield and yield components with the untreated having the lowest values. Application of Isoxaflutole plus Aclonifene at 0.5 kg a.i/ha alone resulted in shorter maize cob (19.5 cm) than hoe weeding at 3, 6, 9 WAP (20.9 cm) and Isoxaflutole plus Aclonifene at 0.75 kg a.i/ha fb hoe weeding (21.4 cm). A similar 100-grain weight was recorded on the different weed control measures (13.8 g to 16.5 g) except the untreated (10.3 g) where a significantly lower value was recorded. Maximum maize grain yield was recorded with application of Isoxaflutole plus Aclonifene at 0.75 kg a.i/ha fb hoe weeding (1071.8 kg/ha), which was similar to hoe weeding at 3, 6, 9 WAP (946.6 kg/ha) and Isoxaflutole plus Aclonifene at 0.75 kg a.i/ha (975.1 kg/ha). Application Isoxaflutole plus Aclonifene at 0.5 kg a.i/ha (763.7 kg/ha) resulted in significantly lower grain yield than higher rates of Isoxaflutole plus Aclonifene (975.1 kg/ha to 1071.8 kg/ha) (Table 5). The lowest maize grain yield was recorded on the untreated plots irrespective of the planting season. Application of Isoxaflutole plus Aclonifene at 0.75 kg a.i/ha on intercropped plots and Isoxaflutole plus Aclonifene at 0.75 kg a.i/ha fb hoe weeding on the sole maize plots produced similar maize grain yield significantly higher than all other weed control measures irrespective of cropping system (Fig. 3).

Weed Biomass

Planting season had a significant effect on weed biomass only at 12 WAP with early planting season higher value (Table 6). The cropping system also had a significant effect on weed biomass where planting maize alone had higher (1054 kg/ha to 1798 kg/ha) values than when intercropped with sweet potato (829 kg/ha to 1233kg/ha). Weed control measures had a significant effect on weed biomass throughout the period of observation. At 3 WAP, the application of pre-emergence herbicide at both rates (75 kg/ha to 267 kg/ha) resulted in significantly lower weed biomass than the untreated (669 kg/ha). At 6 WAP, the highest (2166 kg/ha) and lowest (128 kg/ha) weed biomass were recorded on the untreated and hoe weeding at 3, 6, and 9 WAP, respectively. At 9 WAP, application of Isoxaflutole plus Aclonifene at both rates fb hoe weeding (392 kg/ha and 399 kg/ha) and hoe weeding at 3, 6, 9 WAP (213 kg/ha) resulted in similar weed biomass which was significantly lower than application of Isoxaflutole plus Aclonifene alone at both rates (900 kg/ha and 798 kg/ha) and the untreated (2946 kg/ha). At 12 WAP, the highest (3887 kg/ha) and lowest (233 kg/ha) weed biomass were recorded on the untreated and hoe weeding at 3, 6, and 9 WAP, respectively. Also at 12 WAP, application of Isoxaflutole plus Aclonifene at both rates fb hoe weeding (732 kg/ha and 986 kg/ha) resulted in similar weed biomass which was significantly lower than the application of Isoxaflutole plus Aclonifene alone at both rates (1865 kg/ha and 1390 kg/ha) (Table 6). Planting maize alone in the early wet season resulted in

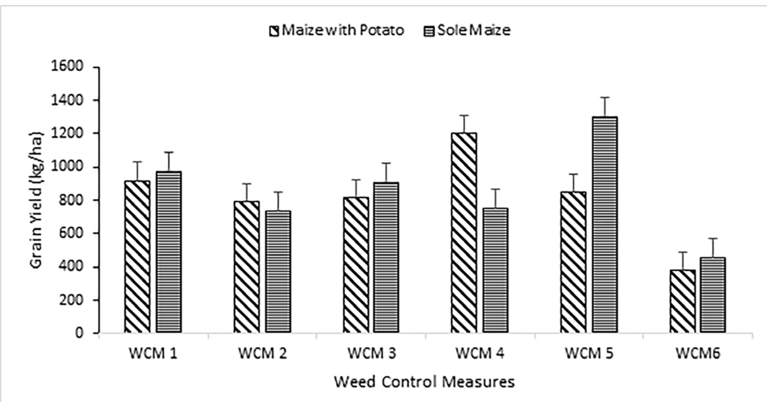

Figure 3: Interaction of cropping system and weed control measures on grain yield

significantly higher weed biomass than late wet season planting irrespective of cropping system as well as maize – sweet potato intercrop in early wet season (Fig. 4a). Application of both rates of Isoxaflutole plus Aclonifene irrespective of the follow up treatment and cropping system, and hoe weeding at 3, 6, 9 WAP produced significantly lower weed biomass than the untreated irrespective of cropping system (Fig. 4b).

recorded on the sole maize, especially at 9 WAP could be attributed to optimum utilization of environmental resources as a result of less plant population on the sole maize plots compared to maize – sweet potato intercrop. Bilalis et al. (2005) found that sole maize had better growth compared to maize intercropped with cowpea. They attributed it to the limiting effect of cereal-legume competition.

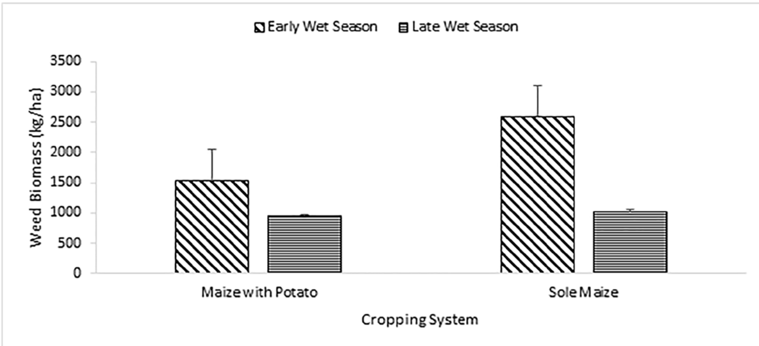

Figure 4a: Interaction of planting season and cropping system on weed biomass

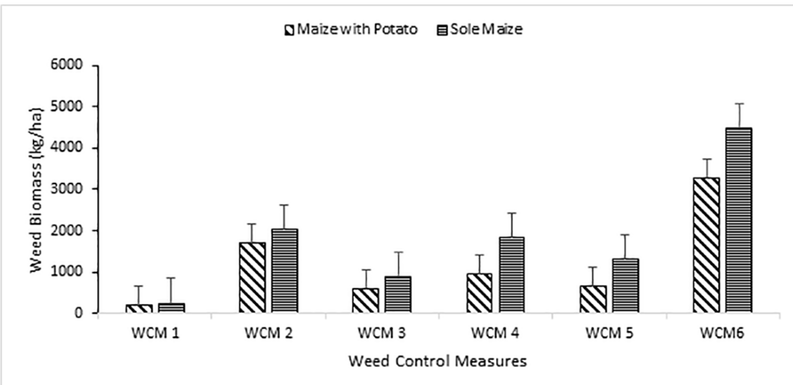

Figure 4b: Interaction of cropping system and weed control measures on weed biomass

Discussion

Maize Parameters

Larger leaf, 100 grain weight and grain yield recorded in the late wet season could be attributed to lower weed infestation during the growing season. There was a 37.6% and 52.3% reduction in weed biomass in the late wet season compared to the early wet season at 9 and 12 WAP, respectively. This result is consistent with the earlier observation of (Osunleti *et al.,* 2021) on the fact that weed infestation was more in the early stage of growth during the early season than in the late season. Taller plants recorded on the sole maize, especially at 9 WAP could be attributed to optimum utilization of environmental resources...

Taller plants and larger leaves on the herbicide-applied plots and hoe-weeded plots compared to the untreated ones could be attributed to less crop-weed competition on the plots as a result of the weed control measures. Constant weed removal by hoe on the hoe-weeded plots causes mechanical damage to the weeds. The weeds were uprooted during the weeding operations and did not allow continuous and uninterrupted weed growth on the plots as seen on the untreated plots. Also, the application of pre-emergence herbicide at planting was efficient in inhibiting the growth and establishment of both weed seeds and their

Table 4: Effects of planting season, Cropping system and weed control measures on leaf area Leaf Area (cm²)

Treatments	3 WAP	6 WAP	9 WAP
Planting Season (S)			
Early Wet Season	31.1	392.9	516.6
Late Wet Season	31.1	423.2	566.3
LSD	9.608	36.570	23.600
p value	0.981	0.071	0.012
Cropping System (C)			
Maize with Potato	32.3	410.0	530.0
Sole Maize	29.9	406.2	552.9
LSD	0.788	32.96	25.52
p-value	0.001	0.768	0.067
Weed Control Measures (W)			
WCM 1	32.5	476.0	673.3
WCM 2	29.9	439.1	540.7
WCM 3	30.7	399.9	543.6
WCM 4	29.8	429.9	586.2
WCM 5	30.8	455.6	598.5
WCM6	32.5	247.9	306.5
LSD	4.097	47.44	52.5
p-value	0.607	<.001	<.001
Interactions (p-value)			
S * C	0.002	0.343	0.039
S * W	0.629	0.291	0.099
C * W	0.036	0.189	0.971
S * C * W	0.039	0.274	0.724

Note: Hoe weeding at 3, 6, 9 WAP (WCM 1), Isoxaflutole + aclonifene @ 0.5 kg a.i/ha (WCM 2), Isoxaflutole + aclonifene @ 0.5 kg a.i/ha followed by (fb) hoe weeding (WMC 3), Isoxaflutole + aclonifene @ 0.75 kg a.i/ha (WCM 4), Isoxaflutole + aclonifene @ 0.75 kg a.i/ha (fb) hoe weeding (WMC 5) and Untreated (WCM 6

seedlings. This results corroborates earlier report of Imoloame (2020) who reported larger leaf area on herbicide treated plots and hoe weeding than the untreated.

Longer cob and higher maize grain yield on the plot treated with Isoxaflutole plus Aclonifene at 0.75 kg a.i/ha followed by hoe weeding compared to Isoxaflutole plus Aclonifene at 0.5 kg a.i/ha with or without hoe weeding could be attributed to higher weed control efficacy as a result of additional 0.25 kg a.i/ha. Also, subsequent weed removal by the hoe on the plots with the application of Isoxaflutole plus Aclonifene at 0.75 kg a.i/ha followed by hoe weeding provided longer weed-free for the crop. Similarly, the application Isoxaflutole plus Aclonifene at 0.75 kg a.i/ha followed by hoe weeding produced higher grain yield than plots of hoe weeding at 3, 6, and 9 WAP. Application of pre-emergence herbicide followed by hand weeding or hoe weeding had been observed to have a superior yield to either the application of only pre-emergence herbicide or only hoe weeding (Osunleti *et al.,* 2021a; Peer *et al.,* 2013)

Table 5: Effects of planting season, Cropping system and weed control measures on maize yield and yield components

Treatments	Cob Length (cm)	100-grain weight (g)	Grain Yield (kg/ha)
Planting Season (S)			
Early Wet Season	19.2	14.2	786.0
Late Wet Season	20.4	14.7	892.0
LSD	0.031	0.070	6.300
p-value	0.94	0.001	<.001
Cropping System (C)			
Maize with Potato	19.7	15.1	826.0
Sole Maize	19.8	13.8	853.0
LSD	0.842	3.440	99.600
p-value	0.717	0.346	0.495
Weed Control Measures (W)			
WCM 1	20.9	15.3	946.6
WCM 2	19.5	13.8	763.7
WCM 3	20.5	15.3	861.7
WCM 4	20.1	15.3	975.1
WCM 5	21.4	16.5	1071.8
WCM6	16.3	10.3	417.4
LSD	1.187	2.657	143.4
p-value	<.001	<.001	<.001
Interactions (p-value)			
S * C	0.445	0.987	0.996
S * W	0.281	1.000	0.277
C * W	0.207	0.001	<.001
S * C * W	0.483	1.000	0.997

Note: Hoe weeding at 3, 6, 9 WAP (WCM 1), Isoxaflutole + aclonifene @ 0.5 kg a.i/ha (WCM 2), Isoxaflutole + aclonifene @ 0.5 kg a.i/ha followed by (fb) hoe weeding (WMC 3), Isoxaflutole + aclonifene @ 0.75 kg a.i/ha (WCM 4), Isoxaflutole + aclonifene @ 0.75 kg a.i/ha (fb) hoe weeding (WMC 5) and Untreated (WCM 6)

Weed biomass

The higher weed biomass observed in the early wet season in this trial could be attributed to higher rainfall in the early wet season than in the late wet season. Also, the land preparation towards the late wet season planting which would have taken care of the first flush of weeds thereby reducing the weed infestation in the late wet season could have been partly responsible for lower weed biomass in the late wet season. These results corroborate the report of Osunleti *et al.,* 2024 who reported higher weed dry matter in the early wet season compared to the late wet season. Within a weed community, Adigun *et al.* (2017) reported that rainfall affects weed species distribution and their competitiveness. Osunleti *et al.* (2021) have attributed a more serious effect of weeds in crop production to rapid weed growth occasioned by conducive climatic conditions such as rainfall and relative humidity. Subsequent lower weed biomass on plots with maize–sweet potato intercrop compared to those with sole maize could be attributed to canopy closure as a result of higher plant population from the combination of maize and sweet potato on the plots. Canopy closure

Table 6: Effects of planting season, Cropping system and weed control measures on weed biomass

	Weed Biomass (kg/ha)			
Treatments	**3 WAP**	**6 WAP**	**9 WAP**	**12 WAP**
Planting Season (S)				
Early Wet Season	331	1020	1159	2053
Late Wet Season	280	909	723	979
LSD	232	528.1	500.2	331
p value	0.446	0.463	0.064	0.005
Cropping System (C)				
Maize with Potato	331	922	829	1233
Sole Maize	280	1007	1054	1798
LSD	60.3	299.8	142.1	489.6
p value	0.078	0.471	0.012	0.033
Weed Control Measures (W)				
WCM 1	487	128	213	233
WCM 2	148	1413	900	1865
WCM 3	267	656	392	732
WCM 4	75	739	798	1390
WCM 5	186	685	399	986
WCM6	669	2166	2946	3887
LSD	347.4	451.4	336.6	381.4
p value	0.01	<.001	<.001	<.001
Interactions (p value)				
S * C	0.757	0.427	0.019	0.049
S * W	1.000	0.934	<.001	<.001
C * W	0.049	0.638	<.001	0.037
S * C * W	0.999	0.895	<.001	0.145

Note: Hoe weeding at 3, 6, 9 WAP (WCM 1), Isoxaflutole + aclonifene @ 0.5 kg a.i/ha (WCM 2), Isoxaflutole + aclonifene @ 0.5 kg a.i/ha followed by (fb) hoe weeding (WMC 3), Isoxaflutole + aclonifene @ 0.75 kg a.i/ha (WCM 4), Isoxaflutole + aclonifene @ 0.75 kg a.i/ha (fb) hoe weeding (WMC 5) and Untreated (WCM 6).

by the crop increases the light interception by the crops and reduce photosynthesis activities of the weeds, thereby reducing the vigorous growth of the weeds. The general reduction in weed biomass in intercropped plots compared with the sole crop plots was in line with the results obtained by other scientists (Ngouajio and Mennan, 2005; Saucke and Ackermann, 2006; Takim, and Fadayomi, 2010). The higher weed biomass on plots with the application of both rates of Isoxaflutole plus Aclonifene alone, compared to Isoxaflutole plus Aclonifene at both rates followed by hoe weeding further confirms the superiority of integrated weed management over the application of only pre-emergence herbicide. The lowest weed biomass recorded on the plots hoe weeded at 3, 6, and 9 WAP could be attributed to constant weed removal using hoe. Hoe weeding however has been reported to be labour-intensive and time-consuming, while pre-emergence herbicides have been reported to save time and resources (Osunleti *et al.,* 2022a).

Conclusion

The results of this study showed the advantage of intercropping maize with sweet potato over sole maize, as it ensures early canopy closure, smothers weeds and consequently results in comparable maize yield with those of sole maize. Our study also showed that the application of Isoxaflutole + aclonifene @0.75 kg a.i/ha followed by hoe weeding at 6 WAP, gave acceptable weed control and resulted in the highest maize yield. Therefore, maize farmers can intercrop maize with sweet potato with the application of Isoxaflutole + aclonifene @0.75 kg a.i/ha followed by hoe weeding for good weed control and optimum maize yield.

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