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Full length Research paper

Effect of Weed Management Strategies on Maize Yield

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Weed management strategies differed in weed control rate and this influenced crop performance. An experiment was conducted at the Institute of Agricultural Research and Training, Moor-Plantation, Ibadan in 2006 and 2007, to compare four weed management strategies in maize farms. Maize + mucuna, Maize + sweet potato, Maize + primextra 5L/ha (1.45 kg/ha S-metolachlor + 1.85 kg/ha atrazine), Maize + handweeding at 3 and 6 weeks after planting. A control experiment was set up where there was no weeding in the maize plot.Results showed that, weed control rating (WCR) was higher in maize + handweeding and maize + mucuna treatments in 2006. All the treatments applied had similar WCR in 2007. Treatments applied significantly reduced the density and biomass of *Mimosa invisa* and *Euphorbia heterophylla* in 2006. The disappearance of M. invisa from maize + Mucuna, Maize + herbicide and Maize + hand-weeding treatment in 2007 led to upsurge of *E. heterophylla*. Maize plant height was significantly different with tallest plants in Maize + hand-weeded plots and shortest in weedy control at 8 WAP in 2006. Grain yield was doubled in Maize + hand-weeded compared to other treatments in 2006. Weed infestation accounted for 66% reduction in maize yield in weedy control compared to the average grain yield. Lower grain yield in maize + mucuna and maize + sweet potato may be due to inter-specific competition between maize and the cover crops. Density and biomass of *M. invisa* and *E. heterophilla* were reduced by over 60% at 12 WAP in maize + handweeded and maize + herbicide giving optimum grain yield.

Keywords: *Mimosa invisa, Euphorbia heterophylla* and weed control rating (WCR).

INTRODUCTION

Weed infestation remains a major barrier to economic crop yield. Hence, weed management is an important aspect of sustainable crop production. The devastating effects of weeds are evident in crop yield and quality reduction. It's of importance that weeds are properly managed. Maize production is seriously challenged in several places around the world by weed problems. Yield reduction in maize due to weed infestation range from 20 % to 100 % (Carson, 1987; Choudhary and Lagoke 1981; Mugabe et al., 1980; Starkey 1981; Saini and Angiras 1998; Chikoye et al., 2004; chikoye et al., 2008). Specific weed competitions with maize such as giant foxtail, common lambquarters, velvetleaf and common cocklebur at a density of 2 weeds per foot of row resulted in 10%, 11%, 18% and 22 % yield reduction respectively (Beckett et al., 1988, Lindquist et al., 1996).

Mimosa invisa was ranked as one of the world worst weeds. The infestation of *M. invisa* is well established in Nigeria, Thailand, Malaysia and tropical parts of the World. (Alabi et al., 2001; EPPO, 2009; Holm et al., 1977; Waterhouse and Norris 1987; Moody, 1989; Napompeth, 1990; Noda et al., 1985; Waterhouse, 1993). The spread of *M. invisa* can be alarming in tropical areas when proper control measures are not in place. It was declared a class two weed in the ranking of weeds in the USA. It forms impenetrable spiny thickets that invade highly disturbed sites, especially in cultivated land. It is extremely difficult to control effectively using mechanical or chemical means. Interference of *M. invisa* for more than 5weeks after planting has been reported to reduce storage root yield in cassava in Ibadan (Alabi et al., 2004).
M. invisa is poisonous to grazing animals (Jayasere et al., 2007; Alex et. al., 1991; Rajan et al., 1986).
Euphorbia heterophylla is a rapidly growing weed with

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high competitiveness with crop. The short gestation period of *E heterophylla* enables the weed to form canopy and produce large quantity of seeds severally during the growing season. Ayeni et al., (1984), identified *Euphorbia heterophylla* amongst other weeds in maize. It's a serious weed in warm climate. This illustrates its ability to infest crop fields in many environments. Yields of semi-prostrate and an erect variety of cowpea in Nigeria were reduced by 25 and 53 % respectively when ten *E. heterophylla* plants / m^2 compete with the crop all season (FAO 2014).

Weed management practices vary with degree of successes and shortcomings. The study was carried out to determine the effectiveness of weed management strategies in maize cultivation for the suppression of the growth of *M. invisa* and *E. heterophylla*.

MATERIALS AND METHODS

The experiment was conducted at the Institute of Agricultural Research and Training, Moor Plantation Ibadan ($7^0$38' N$3^0$84'E) in the rainy seasons of 2006 and 2007. The land was tilled and later harrowed. Maize + Mucuna, Maize + Sweetpotato, Maize + Primextra 5L/ha (1.45 kg/ha S-Metolachlor + 1.85 kg/ha Atrazine), Maize + handweeding at 3 and 6 Weeks after planting (WAP) and Weedy check were the treatments applied. The plot size was 5 x 3 m. The treatments were arranged in randomized complete Block design with three replicates.

Data collection

Data were collected on plant height using a meter rule. Weed density was determined by identifying and counting the weeds within the 1m x 1m quadrant. The weeds within 1 m^2 quadrant were uprooted and oven dried at 80^0C for 48 hours. Weed control rate was visually determined using a scale of 1 to 10, where 1 is the minimum and 10 the maximum.Grain yield was determined from the three middle rows. The grains were weighed at 13 % moisture content.

RESULTS AND DISCUSSION

The result showed highest weed density and biomass in the weedy check. Weed density and weed biomass were low in Maize + herbicides treatment and Maize + handweeding treatment at 6 WAP (Table 1). This might have resulted from poor initial crop establishment and canopy coverage. *Mimosa invisa* was absent in Maize + Mucuna cover, Maize + herbicide treatment and maize + handweeding treatment. However, higher *M. invisa* was recorded in Maize + sweetpotato cover (Table 1).

This might have resulted from slow canopy formation of sweet potato cover which gave rise to early establishment of *M. invisa*.

Euphorbia heteropylla density was highest in Maize + handweeding treatment. This was similar to Maize + Mucuna cover and Maize + herbicide treatments at 6 WAP. This may be due to build up of seed bank of *E. heterophylla* compared to *M. invisa* (Table 1). The short gestation period and high seed production rate of E. *heterophylla* compared to *M. invisa* made it possible for *E. heterophylla* to have higher seed deposited in the soil seed bank. *M. invisa* has fairly slow initial growth rate compared to *E. heterophylla*. However, weedy check had higher weed biomass and density compared to all the treated plots that were similar. High *E. heterophylla* biomass and density may be as a result of poor initial weed suppression from maize and cover crops (Table 1). The no tillage method of land preparation might also result into an upsurge of *E. heterophylla*. This is in line with the findings of Mloza and Materechera (1999); Wruckle and Arnold (1985) and Cardinal et al., (1991), that weed seeds have great potential to survive at the soil surface under minimum tillage and give greater weed flora than disturbed, ridged and heap tillage system.

Maize plants were tallest in plot treated with Maize + hand-weeding (Table 3). This was comparable to other treatments applied except the control in 2006. There was similarity in plant height across the plots at 8 WAP in 2007. This may be due to the accumulation of nutrients from fertilization and organic matter obtained from plant residue.

.Highest Weed control rate (WCR) was recorded in Maize + hand-weeding and Maize + Mucuna cover in 2006. WCR was similar across treatments applied except the weedy check in 2007 at 8WAP. Maize yield from Maize + hand-weeding treatment was two times higher than yields from other treatments applied in 2006. In 2007, yields produced by Maize + hand-weeding and Maize + herbicide treatments were significantly higher than the grain yield from other treatments. This can be directly related to the higher WCR and plant height obtained from these plots. The absence of competition from cover crop may also be implicated for higher grain yields in these two plots. Establishment of maize and cover crops may be demanding on soil nutrients. The devastating effects of *E. heteropylla* and *M. invisa* on maize and cover crop competitions for limited soil nutrients cannot be underestimated. This established the fact that weed infestation within the first few weeks of crop establishment is critical to crop performance. Highest weed densities and biomass were recorded in weedy check plots in both years was evident (Table 2)

Table 1: Effects of weed management on weed density and biomass at 6 WAP in 2006/2007.

Treatments			*Mimosa invisa*		*Euphorbia heterophylla*	
	WD (no/m^2)	WB (g/m^2)	Density (no/m^2)	Biomass (g/m^2)	Density (no/m^2)	Biomass (g/m^2)
Maize + Mucuna	119ab	61.40ab	-	-	76a	28.50b
Maize + sweetpotato	124ab	55.10ab	8.00a	2.60	50b	19.20b
Maize + herbicide	80c	61.80ab	-	-	71a	16.90b
Maize+ handweeding	107bc	39.90b	-	-	90a	28.50b
Weedy check	168a	80.80a	3.00b	3.20	47b	56.30a

*Figures carrying different subscript within a column are significantly different ($P \leq 0.05$)
Legends: WD – Weed density, WB – Weed biomass

Table 2: Effects of weed management on weed density and biomass at 12 WAP in 2006/2007

Treatments			*Mimosa invisa*		*Euphorbia heterophylla*		
	WD (no/m^2)	WB (g/m^2)	Density (no/m^2)	Biomass (g/m^2)	Density (no/m^2)	Biomass	(g/m^2)
Maize + Mucuna	22b	19.13bc	2b	1.05bc	11b	11.44b	
Maize + sweetpotato	36b	49.56b	3b	13.89b	7b	5.55b	
Maize + herbicide	60a	44.55b	2b	3.24b	12b	9.06b	
Maize+ handweeding	29b	11.22c	1b	0.01c	3b	0.98b	
Weedy check	60a	119.61a	7a	53.12a	49a	25.22a	

*Figures carrying different subscript within a column are significantly different ($P \leq 0.05$)
Legends : WD - Weed density, WB - Weeds biomass

Table 3: Effects of weed management on the control rate, plant height and grain yield

	Weed control rate		Plant height (cm)		Grain yield (T/ha)	
Treatments	2006	2007	2006	2007	2006	2007
Maize+ Mucuna	8.00a	7.50a	156.30ab	115.80	0.85c	1.09b
Maize + Sweet potato	4.50b	7.20a	153.60abc	141.20	1.20b	1.12b
Maize + herbicide	5.50b	9.00a	167.40ab	145.80	1.34b	1.76a
Maize + Handweeding	10.00a	10.00a	175.40a	116.00	2.47a	1.89a
Weedy Check	0.00c	0.00b	133.30b	119.20	0.50c	0.68c

*Figures carrying different subscript within a column are significantly different ($P \leq 0.05$)

Maize grain yield was highest in maize + hand- weeding In both years of the study (Table 3). This was similar to maize + herbicide in 2007 (Table 3). Weed competition in early crop establishment is critical to crop performance (Akobundu, 1987), under inter cropping system, early crop establishment in both main crop and companion crop is critical. Rapid establishment of companion crop might be to the detriment of the main crop when plant nutrients are limited. Additional fertilizer application may be needed in such situation. Lowest grain yield was recorded in the weedy check plot in both years of the study. The weed competition with maize for soil nutrients and space might have influenced the drastic yield reduction recorded in the weedy check. This further informed the need for at least a weed control measure after crop establishment by Busari (1996). This was similar to grain yield in the plot sown to Maize + Mucuna and Maize + Sweet-potato. This might have resulted from the keen competition between mucuna and maize crop. The reduction in maize yield in 2006 might have been compensated for in 2007 in the same plot when considerable quantity of nitrogen was fixed and high organic matter was added to the soil.

CONCLUSION

The weed management strategies significantly reduced weed biomass across the treatments applied.

Highest weed density and weed biomass were recorded in the weedy check. Lowest weed density and biomass were recorded in Maize + herbicide treatment. This was comparable to results in Maize+ hand weeding treatment. This might have resulted from early weed control at 3 WAP and 6 WAP. However, this method is limited to resource poor farmers operating at subsistence level. The use of cover crops for weed suppression should be investigated in relation to soil nutrient status for early crop establishment and optimum crop yield, especially in nutrient deficient soils.

REFERENCES

Akobundu IO (1987). Weed Science in the Tropics: Principle and Practices, ohn Wiley and Sons, London, 1987.

Alabi BS, Ayeni AO, Agboola AA, Majek BA (2004). Manual Control of thorny Momisa (Mimosa invisa) in Cassava (Manihot esculenta). Weed Tech. Jan – Mar. 2004, Vol 18(1):p.77

Alabi BS, Ayeni AO, Agboola AA, Majek BA (2001). Giant sensitive Plant Interfrence in cassava, Weed Sci., 49 (2):pp.17 –176

Alex PC, Rajankutty K, Valsala KV, Nair KN (1991). Mimosa Poisoning in a heifer. J. Vet. Anim. Sci., 22:pp.134 – 136.

Ayeni AO, Duke WB, Akobundu IO (1984). Weed interference in maize, cowpea and maize-cowpea intercrop in a sub-humid tropical environment: Influence of cropping season. Weed Research 24:pp.265-271

Beckett TH, Stoller EW, Wax LM 1988. Interference of four annual weeds in corn (Zea mays). Weed Sci. 36 :pp.764 – 769.

Carson AG (1987). Improving weed management in the draft animalbased production of early pearl millet in the Gambia. Tropical Pest Management, 33(4): In FAO Corporate Document Repository: Weed Control systems in Maize based on animal drawn cultivator. (Shetto RM, Kwilligwa EM) Uyole Agricultural Centre, Mbeya, Tanzania.

Chikoye D, Lum AF, Robert A, Menkir A, Kamara A, Ekeleme F, sanginga N (2008). Response of corn genotypes to weed interference and nitrogen in Nigeria. Weed Science Vol. 56(3)2008:pp.424–433.

Chikoye D, Schulza S, Ekeleme F, Evaluation of integrated weed management practices for maize in the northern Guinea savanna of Nigeria. Crop Protec. 2004, 23:pp.895–900.

Choudhary AH, Lagoke STO (1981). Weed control in Pearls Millet the savanna zone of Nigeria. Tropical Pest Management 27 (4):pp.465 – 471.

FAO (2014). weeds

Holm LG, Plucknett DL, Pancho JV, Herberger JP (1977). The World's Worst Weeds. Distribution and Biology. University Press, Hawaii, 1977.

Jayasere PK, Nair ND, Abraham CT, Jagadeeshkumar TN (2007). Effect of ensiling Mimosa invisa Mart.on the expression of Mimosine Toxicity symptoms in Animals. Abstract: Indian J. Anim. Sci. vol. 77 (7).

Lindquist JL, Mortensen DA, Clay SA, Schmenk R, Kells J.J, Howatt K, Westra P (1996). Stability of corn (Zeamays)-Velvetleaf (Abutilontheophrasti) interference relationships. Weed Sci. 44:pp.309–313.

Mloza-Banda HR, Materechera SA (1999). Influence of Tillage, residue management and weeding practices on maize, weed composition and biomass under low-input cropping system in Central Malawi. Pp.45–55. In:Mloza-Banda HR, Nanthambwe SJ, (2010). Conservation Agriculture programmes and projects in Malawi: Impacts and Lessons

Mugabe NR, Sinje ME, Sibuga KP (1980). a study of crop/weed competition in intercropping. Proc. Of the 2nd symposium on intercropping in semiarid areas. (Eds. Keswani CL,Ndunguru BJ) Morogoro, Tanzania, August 4–7, 1980.

Rajan A, Manomohan CB, Valsala KV, Sreekumaran T, Lalitha CR, Ramachandra KM, Nair ND (1986). Experimental studies on the toicity of the plant Mimosa invisa in Calves. Karala J. Vet. Sci. 17:pp91-98

Saini JP, Angiras NN (1998). efficacy of herbicides alone and in mixtures to control weeds in maize under midhill conditions of Himachal Pradesh. Indian J. Weed Sci., 30 (1/2):pp.65–68.

Starkey PH (1981). Farming with work oxen in sierra Leone. Ministry of Agriculture and Forestry. Sierra Leone

Waterhouse DF, Norris KR (1987) Biological Control-Pacific Prospects, Inkata Press, Melbourne 1987.