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Short Communication

Effect of tillage on the efficacy of CGA362622 on weed control in maize

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A field trial was conducted to assess the performance of CGA362622 (trifloxysulfuron sodium), a sulfonylurea based herbicide formulated with ametryn (N-ethyl-N-(1- methy (ethyl)-6-(methylthio)-1,3,5-triazine-2, 4-diamine) on weed control in maize at the Faculty of Agriculture, University of Benin, Benin City, Nigeria. The herbicide was applied pre-emergence at 200 g ai/ha and post emergence at 300 g a.i. ha^{-1} under three tillage methods. The trial was laid out in a split plot arrangement in a randomized complete block design. The main plots were tillage and subplots treatments were the weed control methods. The tillage treatments were no-till with existing stubble packed (NT), ploughed (P), and ploughed and harrowed to obtain a fine seed bed (P+H). The subplots were herbicide (H) and no herbicide (NH). Weed regeneration was significantly higher under NT compared with other methods of land preparation. The herbicide treatment depressed maize yield. Grain yields were 1619.58 and 277.46 kg/ha for H and NH, respectively. Tillage treatment significantly affected grain yield with values of 3446.4, 2296.67 and 841.99 kg/ha for P+H, P and NT, respectively (P<0.05).

Key words: Plough, no-till, herbicides.

INTRODUCTION

Farmers in Nigeria adopt different modes of tillage during land preparation for crops such as maize and cassava. Usually seed bed preparation is done to provide optimal conditions for crop growth. Other than the initial seed bed preparation and planting, farmers expend most of their time and resources managing weeds. Tillage alone or in combination with good cropping methods is often the best and most economic methods of weed control (Lal, 1979; Robinson et al., 1984). Tillage directly affects the seed bank by physically mixing the soil (Ball and Miller, 1990). The common tillage systems include convectional, involving plough, disc and harrow, reduced tillage where use of various conventional tillage equipment is reduced and no till which eliminates all pre-planting seedbed operations and weed control is achieved through use of herbicides (Lal, 1979). Herbicide usage in no-till systems has been found to be responsible for shifts in weed species. Various authors (Ikuenobe et al., 1994; Robinson et al., 1984) have shown that tillage systems influence the efficacy of weed control by use of herbicides. Tillage may help in managing herbicide resistance weeds and may also increase weed density as well as reduce crop yield (Anderson, 2004). Higher dose of pre-emergence herbicide may be required to control weeds in no-till systems than in conventional tillage systems because crop residue present at time of application of pre-emergence herbicide usually intercepts herbicides (Banks and Robinson, 1982). Hendrix et al. (2004) reported lower control of Giant foxtail (*Setaria faberi Herrm*) and common waterhemp (Amaranthus rudis Saur) following Acetochlor plus atrazine application as pre-emergence treatment in no till compared with conventional tillage.

CGA 362622 is a relatively new herbicide being evaluated for weed control in some crops in Nigeria. The objective of this study was to evaluate the performance of CGA362622 in weed control under different tillage systems using maize as test crop.

MATERIALS AND METHODS

The field experiment was conducted at the Faculty of Agriculture farm, University of Benin. Soil samples collected randomly from the

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Table 1. Physio-chemical properties of soil of the experimental site.

pH	Org C	Av. P	Total N	Ca	Mg	Na	K	Exch acidity	ECEC	Sand	Silt	Clay
	mg kg^{-1}		%	C mol kg^{-1}						%		
5.2	1.42	8.25	0.11	0.096	0.15	0.016	0.44	0.49	2.39	75	12	13

Table 2. Effect of tillage and herbicide on weed composition during cropping.

Tillage	Herbicide	No herbicide
P+H	*Panicum maximum, Spermacea ruelliae, Digitaria horizontalis*	*Commelina benghalensis, Ageratum conzyoides,Talinum fruticosum* (L) (Syn) T *triangulare, Mimoa Invisa, Vernonia cinerea*
P	*Panicum maximum, Spermacea ruelliae, Digitaria horizontalis*	*Commelina benghalensis, Ageratum conzyoides,Talinum fruticosum* (L) (Syn) T *triangulare, Mimoa Invisa, Vernonia cinerea*
NT	*Panicum maximum, Spermacea ruelliae, Digitaria horizontalis Vernonia cinerea*	*Commelina benghalensis, Ageratum conzyoides,Talinum fruticosum* (L) (Syn) T *triangulare, Mimoa Invisa, Vernonia cinerea, spigella anthelimia.*

experimental site using soil auger were bulked, air dried and composite sample analysed for physio-chemical properties. The experimental site had been under fallow for about a year, having been previously cultivated to maize. The pre-planting vegetation was dominated by Guinea grass (*Panicum maximum* Jacq*).* Siam weed (*Chromolaena odorata* L.R.M King Robinson), and *Calopogonium mucunoides* Desv. The experimental site was manually slashed and the tillage treatments were ploughed and harrow (P + H), ploughed (P) and no till (NT). The methods of weed control were the subplots. The weed control methods were herbicide (H) and no herbicide (NH). The tillage treatments were replicated four times in a randomised complete block design. The main plot size was 6 x 9 m, while the subplots were 6 x 4 m, totally 24 subplots. CGA 362622 was applied at the rate of 100 g ai ha^{-1} in a spay volume of 200 L ha^{-1} using knapsack, pre-emergence a day before planting and later at 300g ai/ha as post emergence four weeks after planting. The no herbicide plots were hand weeded on the same day of post emergence herbicide application. Army worm (*Spodoptera exempta inperfecta)* invasion was controlled 5 days after planting using Decis. Fertilizer, 80 kg/ha 20:10:10 NPK was applied at three weeks after planting.

Three permanent quadrants of 0.5 x 0.5 m were placed in each sub-plot. Weed identification was done and weed re-growth in the quadrants were clipped to the ground level, dried and weighed fortnightly. The quadrants were excluded from weeding throughout the experimental period. Leaf area was taken 6 weeks on 5 stands from the middle row in each plot.

Maize was harvested at maturity by sampling from the middle row. Fresh weight of the cobs was recorded. 2 kg sample was air dried for 21 days and weight of the cobs and grain recorded. Particle size analyses were done using the hydrometer method (Bouyoucous, 1951). Soil pH was determined in 1:1 soil: water suspension using pH meter. Soil organic matter was determined using Walkley–Black method as modified by Black (1965). Exchangeable cation was extracted with neutral 1 N ammonium acetate determined with the EDTA titration, Na and K were measured with digital flame Analyzer. Exchangeable acidity was extracted with 1 N potassium chloride and titrated with sodium hydroxide. Effective cation exchange capacity (ECEC) was determined by the summation of exchangeable cations plus exchangeable acidity. All data were subjected to analyses of variance and treatment means separated by Duncan multiple range test using the Statistical Analysis System (SAS, 1995).

RESULTS AND DISCUSSION

The physio-chemical properties of the soil are shown in Table 1. The soil was a sandy loam, acidic with low base saturation. The effect of tillage and herbicide treatments on weed regeneration is shown in Table 2. In all tillage treatments with herbicide treatments, the dominant weed population were *Panicum maximum, Spermacoce ruelliae, Digitaria horizontalis.* In addition *Vernonia cinerea.*was present in the NT plots only. The No herbicide treatment had different weed population with *Commelina benghalensis, Ageratum conzyoides, Talinum fruticosum* (L) (Syn) T *triangulare, Mimosa Invisa, Vernonia cinerea* as the dominant species.

Weed biomass and population significantly (p=0.05) differed between the tillage treatments (Table 3). There were significant differences in weed biomass between the NT and P+H and P, throughout the period of the study, (Table 3). However there were no differences between the P, and P+H treatments for the period of the study. Herbicide application significantly influenced weed population throughout the duration of the experiment (p<0.05). The weed re-growth was lower in herbicide plots except on the 12th week when the weed population was higher under the herbicide treatment. The effect of herbicide treatment on weed re-growth became significant after 4 weeks after planting.

Both tillage and herbicide treatments influenced maize yield. The P+H, and P plots had mean grain yields than NT (Table 4). The no herbicide treatment had higher yield compared with the herbicide treatment plots. The yield

Table 3. Effect of tillage and herbicide treatments on weekly biomass of weed re-growth.

Weeks after planting	Treatment	P+H	p	NT	Mean
WAP2	H	24.07	24.43	37.04	28.51[a]
	NH	22.91	23.04	47.27	31.07[a]
	Mean	23.48[b]	23.73[b]	42.15[a]	
WAP4	H	158.13	124.93	470.12	215.06[b]
	NH	217.46	206.26	601.72	341.86[a]
	Mean	187.73[b]	165.60[b]	535.85[a]	
WAP6	H	166.66	200	454.66	273.33[a]
	NH	181.33	194.46	184	266.66[a]
	Mean	174.66[b]	197.33b	439.99[a]	
WAP8	H	158.13	124.93	470.12	215.06[b]
	NH	217.46	206.26	601.72	341.86[a]
	Mean	187.73[b]	165.60[b]	535.85[a]	
WAP10	H	90.4	151.46	521.45	254.53[a]
	NH	99.2	146.93	548.65	264.93[a]
	Mean	94.8[b]	149.20[b]	535.85[a]	
WAP12	H	930.64	1011.97	1522.63	1154.64[a]
	NH	449.32	677.32	995.98	707.98[b]
	Mean	690.65[a]	845.31[b]	991.98[a]	

Weekly means with similar letters in same column are not significantly different. Weekly means with similar letters in same row are not significantly different.

Table 4. Effect of tillage and herbicide treatment on maize grain yield kg/ha.

Treatment	Tillage			
	P+H	P	NT	Mean
H	2833.6	1705.85	1319.3	2619.58[a]
NH	3059.2	2887.5	1364.67	2770.46[a]
Mean	2946.4	2296.67[b]	1340.98[c]	

reduction resulted from the effect of CGA herbicide injury to maize when applied post emergence.

Weed control method and tillage treatment influenced weed regeneration. *Panicum maximum*, *Digitaria horizontalis* and *Spermacea ruelliae* more in the herbicide treated plots than others indicating that they were less susceptible to CGA362622. This change in weed composition agrees with Richley et al. (1977) indicating shift from broad leaf species which were more susceptible to certain herbicides to more resistant weeds.

CGA362622 performed better in weed control when land is ploughed and ploughed and harrowed. This result seems to suggest that although CGA362622 may be more effective in weed control when the land is ploughed or harrowed; it may perform less under No-till.

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