IDENTIFICATION OF WEEDS RESISTANT TO PARAEFORCE(R) AND AMINOFORCE(R) HERBICIDES

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ABSTRACT

Field experiment was conducted in the dry season between December 2012 to April 2013 at Bakori, Bakori local government, Katsina ($11^0$33'N, $7^0$36'E). The experiment consisted of 8 treatments which include 4 different formulations each; viz: ParaeForce(R)(Paraquat) at 150mL / 20L and 200ml / 20L and AminoForce(R) at 100ml / 15L and 125ml / 15L applied a day before sowing and 4 weeks after sowing and a weedy control. A randomized complete block design was used to lay out the treatments (RCBD). Ten families with total amount of seventeen species were documented including *Ipomoea vagans*, *Doctylocterium aegyptium*, *Cyperus rotundus*, *Cynodon dactylon*, and *Eleusine indica*. Exhibited significant (0.05) resistance to ParaeForce(R) + AminoForce(R) at 150mL / 20L, followed by 100mL / 15L, with 29, 31, 17.17, and 7.67 weed count at 4, 8 and 16 WAS, respectively, representing 91.70, 87.12, and 49.15 % weed control efficiencies. Sequential application of ParaeForce(R) + AminoForce(R) at 200mL/20L followed by 125mL/15L recorded significantly (≥0.05) low weed count with 13.33, 40 and 6.0 at 4, 8 and 16WAS which represent 86.28, 77.58 and 33.55% weed control efficiencies. This study recommended application of ParaeForce(R) and AminoForce(R) at 200mL/20L followed by 125mL/15L as alternative way of reducing weed resistance to ParaeForce(R) + AminoForce(R) formulation.

Keywords: Weeds, field, Katsina, treatments

INTRODUCTION

Weeds, which act at the same tropic level as the crop, are a key limitation in agricultural production systems [1]. Weeds capture a portion of the available resources that are essential for plant growth, and allowing weeds to grow unchecked will inevitably lead to a reduction in crop yield [2]. Weeds are highly adapted to where they grow, with large efficient root systems that grow rapidly and frequently produce thorns [3]. The majority of weeds can withstand drought and low fertility, and they produce lush foliage, huge seed, or fruit [4]. As a result, they can spread quickly through both vegetative structure and seed. There are many different couse of weed spread in reality, anything that moves spread have been identified in northern Nigeria [5]. These pathways are categorized broadly into deliberate, accidental and natural. Weed species resistance to herbicide is one of the most serious problem affecting the use of herbicides as one of the control agent weeds [6]. Weeds resistance changes the natural diversity and balance of ecological communities, these changes threaten the survival of many crop as they compete with natuve crops for space, nutrient and sunlight [7]. Many crops are threatened by these changes because they compete with native crops for space, nutrients, and sunlight. There are numerous factors that contribute to the development of herbicide resistance. However, weed traits, pesticide chemical qualities, and cultural practice are all important considerations [8]. Cultural approaches like as crop rotation and integrated weed management (IWM) systems may be used to combat herbicide resistance weeds [9]. With its unique mode of action, paraquat is one of the few chemical choices for preventing and mitigating issues with weeds that have developed resistance to the frequently used non-selective herbicides [10]. Weed control is a major problem to crop production[11]. Studies have been done on weed management strategies in crops production which include cultural, mechanical and chemical methods, this study aimed at identifying weed species that are resistant to ParaeForce$^{(R)}$ and AminoForce$^{(R)}$.

MATERIAL AND METHODS

Field trial were undertaken during the dry season, from December 2012 to April 2013, in Bakori, Bakori local government, Katsina state, where the land area was 10.2m by 5.9m and the yearly rainfall was 100mm (Figures 1). (62.54m2). The experiment was a randomized complete block design (RCBD) (herbicides) ParaeForce$^{(R)}$ and AminForce$^{(R)}$ were applied as pre-emergence and post-emergence herbicides (Figure 2).

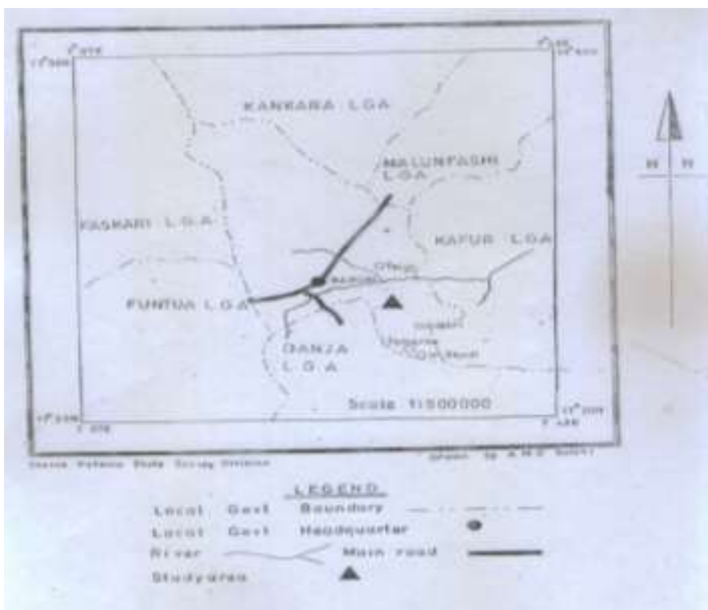

Figure 1: Map of Bakori Local Government Area showing the study area.

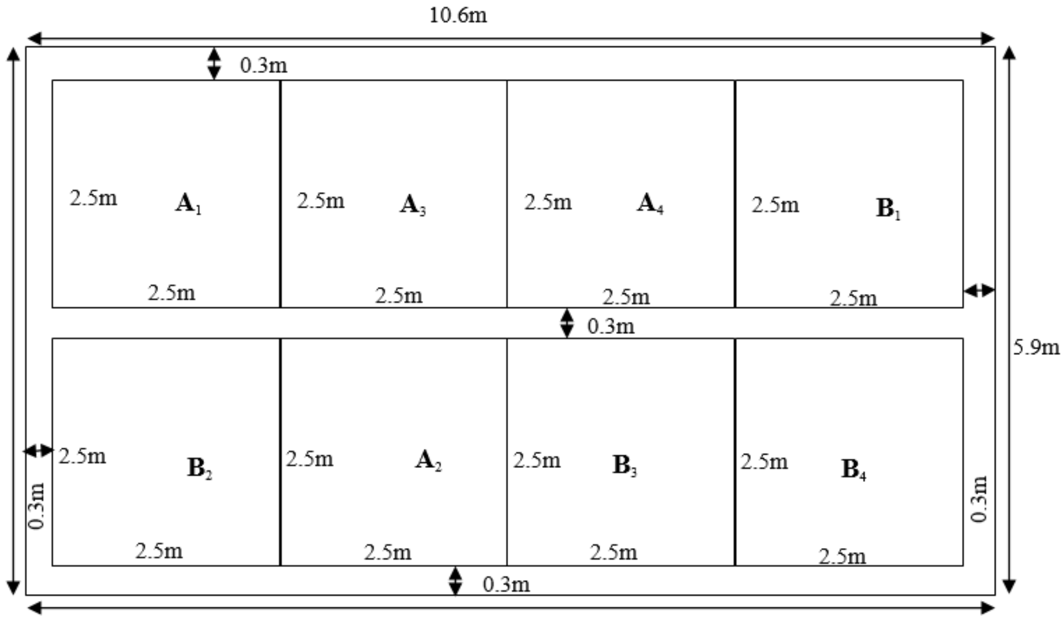

Figure 2: Complete randomized blocks design displaying the plot design

The trail occupied an area of 62.54m^2 (10.2m × 5.9m) which was ploughed, harrowed and the plot was divided into (A and B) experimental site with 0.3m irrigation channels. Each rows (A and B) consisted of 4 blocks of 6.25m^2 in size. Blocks A and B were arranged in a randomized complete block design (RCBD). Blocks (A_1 and B_2) were considered as control blocks in which no herbicides was applied, while blocks (A_3, A_4 and B_1) recieved ParaeForce$^{(R)}$ at 150ml / 20L and (A_2, B_3 and B_4) recieved ParaeForce$^{(R)}$ at 200mL / 20L as pre-emergence herbicide. While (A_3, A_4 and B_1) recieved AminoForce$^{(R)}$ at 100ml / 15L and (A_2, B_3 and B_4) recieved AminoForce$^{(R)}$ at 125ml / 15L as post-emergence herbicide at 4 weeks after sowing respectively. The following method adopted from [12]. Herbicides mixture were prepared by measuring ParaeForce$^{(R)}$ at two different concentrations 150mL and 200mL and mixed with 20liters of water each, (150ml/20L and 200mL/20L). Similarly, AminoForce$^{(R)}$ was prepared at two different concentrations of 100ml and 125mL with 15liters of water each making concentrations of 100mL/15L and 125ml/15L respectively. Premilary surveys, was carried out during the rainy season from May to October of 2012 and samples of weed species were collected and taken to Herbarium of Biological Science Department of Usmanu Danfodiyo University, Sokoto for identification. Total number of weeds present in each blocks was counted and recorded at 4, 8 and 16WAS were used to record fresh and dry weight of weeds at 4, 8 and 16WAS respectively. The fresh wieght of weed species was recorded using electronic weighing balance and the weed species used for fresh weight determination were also use to determine dry weight after oven drying at 120^{0}C until constant weight.

Weed management efficiency was determined using Mani's formula on a dry weight basis [12].

$$WCE\ (\%) = \frac{DW_c(g) - DW_t\ (g)}{DW_c\ (g)} \times 100$$ Where:

DWc = Dry weight of weed in control plot
DW_t = Dry weight of weed in treated plot

Data collected were subjected to analysis of variance (ANOVA) using SPSS Statistical Software version 17 and mean were separated by using Least Significant Difference (LSD).

RESULT AND DISCUSSION

A weed is a plant that is out of place, or it can be described generally as any undesired plant. The majority of weeds are plants that are usually disliked by farmers and gardeners [13]. They may also affect crop quality and make harvesting more difficult; crops produced in weedy conditions will generate lower yields or may not produce at all [14]. A total of 17 weeds species belongs to 10 families were documented during the field survey (Table 1). The farmers have reported disturbance of the following species every season in the field. Weeds like *Murdannia nudiflora*, *Cyperus rotundus*, *Eleusine indica*, *Doctylocterium aegyptium*, *Amaranthus spinosus*, *Cynodon dactylon*, *Senna occidentalis* and *Gisekia pharnociode* were resistant to ParaeForce(R) at 150ml / 20L and 200ml / 20L in the first four weeks (4WAS), *Cyperus rotundus* had high resistance to herbicides followed by *Doctylocterium aegyptium*, *Cynodon dactylon*, *Eleusine indica* that also resist the herbicides but not as *Cyperus rotundus*. Similarly, *Murdannia nudiflora*, *Cyperus rotundus* and *Cynodon dactylon* were resistant to AminoForce(R) at 100ml / 15L and 125ml / 15L with high number of weeds count in each blocks followed by *Eleusine indica*, *Amaranthus spinosus* and *Gisekia pharnociode* with the lowest number of weed count at 8 and 16WAS. *Cyperus rotundus, Cynodon dactylon, Murdannia nudiflora* and *Doctylocterium aegyptium* had survive up to 16WAS.

Table 1: Description of weed species encountered in the study area.

S/N	Family	Species name
1	Cyperaceae	*Cyperus rotundus* L.
2	Euphorbia	*Euphorbia hirta* L.
3	Leguminosae	*Senna occidentalis* (L.) Link
4	Poaceae	*Cynodon dactylon (L.) Pers.*
5	Amaranthaceae	*Amaranthus spinosus L.*
6	Commelinaceae	*Murdannia nudiflora (L.)*
7	Poaceae	*Dactyloctenium aegyptium (L.) Willd.*
8	Poaceae	*Ophiuros exaltatus (L.) Kuntze*
9	Poaceae	*Eleusine indica (L.) Gaertn.*
10	Poaceae	*Pennisetum pedicellatum Trin.*
11	Gisekiaceae	*Gisekia pharnaceoides L.*
12	Malvaceae	*Sida acuta Burm.f.*
13	Solanaceae	*Solanum americanum Mill.*
14	Leguminosae	*Crotalaria retusa L.*
15	Malvaceae	*Sida ovata Forssk.*
16	Poaceae	*Digitaria gayana (Kunth) A.Chev.*
17	Convolvulaceae	*Ipomoea vagans Baker*

Weeds population at 4, 8 and 16WAS is presented in Table 2. The result revealed that weeds population were significantly ($P \geq 0.05$) influenced by sequential application of the herbicides on weed control treatments. At eight weeks after sowing (8WAS) the weedy check had the highest number with 112.5 then 40 after application of ParaeForce(R) and AminoForce(R) at 200ml / 20L followed by 125ml / 15L and 31.67 at 150ml / 20L followed by 100ml / 15L; At four weeks after sowing (4WAS) weedy check had the highest number of weeds 73.50 then 29 after applying ParaeForce(R) and AminoForce(R) at 150ml / 20L and 100ml / 15L and 13.33 at 200ml / 20L followed by 125ml / 15L. At 16WAS the weed count was very low as compared with the other weeks with weedy check of 34 number of weeds, while 7.67 after applying herbicides (ParaeForce(R) fallowed by AminoForce(R)) at 150ml / 20L followed by 100mL / 15L and 6 which was treated with herbicides (ParaeForce(R) followed by AminoForce(R)) at 200mL / 20L followed by 125mL / 15L.

Table 2: Total weed count after sequential application of herbicide doses

	Mean weed count (weeks)		
Treatment	**Four**	**Eight**	**Sixteen**
150ml/20L fallowed by 100ml/15L	$29.00^{ab}\pm0.58$	$31.67^{a}\pm0.88$	$7.67^{a}\pm1.20$
200ml/20L fallowed by 125ml/15L	$13.33^{a}\pm1.86$	$40.00^{a}\pm3.00$	$6.00^{a}\pm1.16$
Weedy check	$73.50^{b}\pm32.50$	$112^{b}\pm7.50$	$34.00^{b}\pm7.00$

***mean in the same column followed by similar alphabets are significantly the same using Turkey HSD (P≥0.05), SE= Standard error, ml= milliliters and L=Liters.

Weed control efficiency was obtained at 4, 8 and 16WAS on the basis of total dry weight of weeds in weedy check. Treated weed recorded maximum weed control efficiency at all time interval with weedy check recording very low weed control efficiency of 0.00, 0.10 and 0.10% respectively (Table 3). Weed control treatments, at 4WAS (Four weeks after sowing) application of ParaeForce(R) at 150ml / 20L recorded significantly (P≥0.05) higher weed control efficiency of 91.70% over ParaeForce(R) at 200ml / 20L Which had 86.28% with weedy check of 0.00%. At 8WAS (Eight weeks after sowing), application of ParaeForce(R) and AminoForce(R) at 150ml / 20L followed by 100mL / 15L had the highest weed control efficiency of 87.12% over the 200mL / 20L followed by 125mL / 15L which had 77.58% and weedy check of 0.10% respectively. At 16WAS the weed control efficiency was high at 150ml / 20L followed by 100ml / 15L of 49.15% over the 200ml / 20L fallowed by 125ml / 15L with 33.55% and weedy check of 0.10%.

Table 3: Weed control efficiency after Sequential application of herbicides doses

	Mean weed control efficiency ± SE per weeks		
Treatment	**Four**	**Eight**	**Sixteen**
150mL/20L fallowed by 100ml/15L	91.70^{b}±0.00	87.12^{b}±5.06	49.15±4.27
200mL/20L fallowed by 125ml/15L	86.28^{b}±4.11	77.58^{b}±6.21	33.55±3.64
Weedy check	0.00^{a}±0.00	0.10^{a}±38.66	0.10±47.76

*** mean in the same column followed by similar alphabets are significantly the same using Turkey HSD (P≥0.05), SE=Standard error, ml=milliliters and L=liters.

This study further reaffirm the dominance of grasses, sedges and a few broadleaves weeds in the guinea savanna region of Nigeria as reported earlier [15, 16]. The dominance of grasses may be influenced by the large number of seeds they produced that are easily dispersed by wind. The sedges are noted to have persistent root system that is not easily destroyed by herbicides [17]. Among the dominant broadleaves Amaranthus and Gesikia produce large number of lightly weight seeds that are easily dispersed. Seeds of Senna have protective coat that can resist herbicides. Sida has numerous seeds that are small in size, hard in nature and easily dispersed. *Crotalaria retusa* and *Euphorbia hirta* produces many hard seeds that when dispersed can go deep into the soil because of its light nature and *Murdannia nudiflora* reproduces by seeds and vegetative which make it's hard to control. Among grasses, *Doctylocterium aegyptium*, *Digitaria gayana*, *Eleusine indica* and *Pennisetum pedicellatum* produces numerous seeds that are easily dispersed by wind and they have long root system that can resist herbicides, while Cynodon dactylon propagate both from seeds, vegetatively and has very strong root systems that cannot be easily killed by single application of herbicides. Sedges such as *Cyperus rotundus* has persistent root system that goes deep in the ground and can produce seeds that are hard and numerous in numbers. Herbicide treatment changed the weed species composition, prompting shifts toward weeds that were more difficult to control. More research is needed to establish the economic feasibility of herbicide combinations, crop population density, weeding time and number, and cover crops for weed management.

CONCLUSION

For small holders and/or resource limited farmers in North-Western Nigeria. Identifying the types of weeds is one of the most important factors influencing the effectiveness of chemical weed control (herbicides) activities, therefore sequential application of herbicides (ParaeForce$^{(R)}$ and AminoForce$^{(R)}$) at time intervals, recommends herbicides formulation of 200mL / 20L followed by 125ml / 15L which shows positive response to theses weed control.

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