EVALUATION OF TWO NEW HERBICIDE MIXTURES FOR WEED CONTROL IN MAIZE *(Zea mays L.)*

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ABSTRACT

Field trials were conducted at the University of Ilorin Teaching and Research Farm in the southern Guinea savanna zone of Nigeria during 2009 and 2010 growing seasons to evaluate the weed control efficiency of different herbicide treatments and the performance of maize. Two new preparatory herbicide mixtures: Lasset1 and Huricane2 each at 2.0, 3.0, 4.0 kg a.i./ha were evaluated alongside with a check herbicide Bullet®3 at 3.0 kg a.i/ha, a weedy check and two hand weedings at 3 and 6 weeks after planting. The trial was designed as a randomized complete block with three replications. Significant differences occurred in the level of weed control provided by the various treatments. Huricane and Lasset provided the same level of control as Bullet(R) at each of their application rates, except 2.0 kg ai/ha. There was no phytotoxic effect of the herbicides on maize. The plots that were hoe-weeded twice produced significantly higher grain yield that was similar to yields in the herbicide treated plots except for the plots treated with 2.0kg ai/ha of Lasset and Huricane. This study suggests, that the new formulated mixtures can be recommended to supplement the existing ones in this agroecology.

Keywords: *Lasset, Huricane, Weeds, Maize (Zea mays L.), herbicide, weed control*

INTRODUCTION

Maize is the third most important cereal crop in Nigeria (Ojo, 2000). The cultivation of maize was for previously subsistence purposes but it has gradually become an important commercial crop on which many agro-allied industries depend, as their raw-material (Iken and Amusa, 2004). The average yield of maize in developed countries can reach 8.6 tonnes per hectare, but in many sub-Saharan Africa countries yield is still as low as 1.3 tonnes per hectare (IITA, 2007). The unfolding performance of maize can be attributed to the fact that the bulk of the Nigeria's farm (over 90%), is dependent on small holder farmers with rudimentary farming system, low capitalization and low yield per hectare (Oyekale and Idjesa, 2009). Other factors like price fluctuation, diseases and pests, poor storage facilities have been associated with low maize production in Nigeria. Weeds have been a problem in agriculture since about 10,000 BC (Avery, 2006). They have always represented one of the main limiting factors in crop production, responsible for a loss of 13.2% of agriculture production or about $75.6 billion per year (Pacanoski, 2006). It is the most important pest complex and posed problems in crop production that are relatively constant. Apart from the quantitative damages caused by weeds due to competition for

water, light and nutrients (Jordan et al, 1987) and antagonism (parasitism and allelopathy), weeds are able to cause qualitative indirect damages to crop, yield reduction, contamination of seeds , slowing tillage and harvesting practices. In the past, farmers spent a lot of energy in manual weeding which consumed time, laborious and expensive but after the second world war, herbicides were introduced by the pesticide industries, that effectively control weeds to an economic threshold level, saving labour necessary for weed control practices and reducing the cost of farming. As new herbicides are introduced for agronomic crop use, investigations are being initiated for determining potential efficacy and safety in crops. This trial was designed to ascertain the efficacy of two new preparatory herbicide mixture as compared to the standard recommended Bullet® as weed control chemicals in maize field.

Bullet is a formulation of Monsanto company, USA, containing 250g/l Acetochlor (2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide), + 225g/l Atrazine (6-chloro-N-ethyl-N-(1-methylethyl)-1,3,5-triazine-2,4-diamine) + 225g/l Terbuthylazine (6-chloro-N-(1,1-dimethylethyl)-N-ethyl-1,3,5-triazine-2,4-diamine).

Lasset is a formulation of Monsanto Company, Belgium, containing 450g/l Acetochlor (2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide) + 214g/l Terbuthylazine (6-chloro-N-(1,1-dimethylethyl)-N-ethyl-1,3,5-triazine-2,4-diamine).

Huricane is a formulation of Volcano Agroscience PTY/Arysta Life Science-South Africa, containing 250g/l Acetochlor (2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide + 225g/l Atrazine (6-chloro-N-ethyl-N-(1-methylethyl)-1,3,5-triazine-2,4-diamine) + 225g/l Terbuthylazine (6-chloro-N-(1,1-dimethylethyl)-N-ethyl-1,3,5-triazine-2,4-diamine).

MATERIALS AND METHOD

This study was conducted at the University of Ilorin Teaching and Research Farm during the 2009 (July - November) and 2010 (June - October) growing seasons. The farm is located at Bolorunduro, Ilorin, in the southern Guinea savanna ecological zone (9^{o}29' N, 4^{o}35' E) of Nigeria, and is 307m above sea level. The area had a peak of rainfall in July that decreased gradually thereafter and a daily temperature range of 20^{oC} - 35^{oC}. The soil was a sandy clay loam, classified as a plinthustaffs with approximately 74.12% sand, 5.54% silt and 20.69% clay, organic matter 2% and pH 5.5. Three separate sites were used for this study. Sites I and II were used for the 2009 trial. Site I was adjacent to site II. Site III was located about 50 meters down slope from sites I and II. All the three sites had been under continuous cropping from 2004 till the commencement of this study.

The experiment was designed as a randomized complete blocks (RCBD) and replicated three times. Nine weed control treatments made up of pre-emergence application of three herbicides: Bullet® at the rate of 3.0 kg a.i./ha, Huricane and Lasset at (2.0, 3.0 and 4.0 kg a.i./ha, each), 2 hand weeding at 3 and 6 weeks after planting(WAP) and weedy control check. The vegetation cover of the experimental sites was slashed to ground level prior to carrying out the tillage operations. Thereafter, the appropriate plots were disc ploughed on 3rd July 2009, harrowed and ridged on 10th July, 2009. In 2010, the

plots were disc ploughed on 10th June while harrowing and ridging were done one week later. Maize (Zea mays L. variety, Suwan 1), was sown, three seeds per hole at a spacing of 1.3m x 0.3m, the seedlings were later thinned to two plants per stand to give an approximate plant density of 61,538 plants/ha. All the herbicide treatments were applied pre-emergence, using a CP3 knapsack sprayer, fitted with a polijet nozzle at a delivery rate of 250-300L/ha, immediately after sowing of maize seeds. Details of the weed control treatments are shown on table 1. Application of NPK (20:10:10) fertilizer was made in two splits, at the rate of 200kg/ha at 3 WAP and 100kg/ha at 7 - 8 WAP.

Data on weed seedling emergence (weed density) was monitored in two fixed quadrats ($0.5m^2$) at 4, 6, 8 and 10 WAP in each plot. Weed seedlings in each quadrat were counted and pulled out. Dry matter production by the weeds was determined in two randomly located quadrats ($0.5m^2$) at 4 and 9 WAP in each plot. The weed species harvested from each quadrat in each plot were identified to the species level using the weed identification manual of Akobundu and Agyakwa (1998) and then separated into broadleaves, grasses and sedges. Thereafter, the number of weeds within each category was enumerated. Samples from the same plot were bulked and oven-dried for 24 hours at 80^{oC} to a constant weigh.

Weed control efficiency was calculated as thus:

$$WCE = \frac{DWC - WDT}{DWC}$$

Where:

DWC= dry weed biomass of weedy check plots, and

WDT= dry weed biomass of treated plots.

Weed cover rating was assessed at 7 WAP using the beaded string method (Sarrantino,1991). A string, with knots at 10cm intervals was laid across both diagonals of each plot. The number of knots touching weed vegetation were counted and summed for the two diagonals and then divided by the total number of knots across the two diagonals in a plot. This ratio was thereafter multiplied by 100 to obtain percentage weed cover (Fadayomi and Takim, 2009). Crop parameters assessed included stand count at 4 WAP, plant height, and leaf area index at 7 WAP and grain yield at harvest. Data were subjected to analysis of variance (ANOVA) using the Gen stat statistical analysis package. Means were compared using the least significant difference (LSD) test.

RESULTS AND DISCUSSION

WEED SPECIES COMPOSITION: Fourty-eight weed species belonging to 37 genera within 17 families were observed in the unweeded control plots where 62% were broadleaf weeds while grass and sedge weed species accounted for 25% and 13%, respectively (Table 2). *Tridax procumbens, Eleusine indica, Fimbristylis littoralis, Euphorbia heterophylla, Brachiaria deflexa* and *Rottboellia cochinchinensis* had relative density of 5% and above in each growing season and across the sites and there were thereafter referred to as prevalent weed species. The relative composition of these weed species (Table 3), however, varied with the specific weed control treatment. The level of occurrence

of this species under the lower rate (2.0kg ai/ha) of herbicide treatments were similar to that in the weedy control plots. The overall occurrence of weed species was lower in plots that had 3.0 or 4.0kg ai/ha of herbicide and similar to what occurred in hand weeded plots.

WEED CONTROL: Weed control treatment significantly affected weed seedling population and dry matter production (Table 4) in all the trial sites and assessment periods except at 10 WAP in site I where similar weed seedlings emerged across the weed control treatments. The weed check plots had significantly higher emerged weed seedlings and weed biomass. The population of weed morphological types was significantly affected by the different weed control treatments except broadleaf weeds in site I at 4 WAP and grass population in site II at 9 WAP (Table 5). In all cases where significant differences were observed, the herbicide treated plots had similar population of various weed types and the population obtained from the above plots were similar in few cases with hand weeded plots but significantly lower to the density of weed types obtained from the weedy check plots.

Table 6 showed that weed control efficiency was similar acrossed the herbicide treated and hand weeded plots except site III where Huricane at 2.0kg ai/ha had the lowest weed control efficiency of 7.95% similar to the check herbicide while Lasset at 4.0kg ai/ha had the best weed control efficiency and similar to other plots.

YIELD AND YIELD COMPONENTS: Plots treated with pre-emergence herbicides had similar maize plant height and leaf area index which were significantly higher than what was obtained in unweeded control plots in both sites (Table 7). The grain yield obtained from the weed check plots was significantly lower than what was obtained from herbicide treated plots except site II and III where 2.0kg ai/ha was applied had similar grain yield with the unweeded control plots. All herbicide treated plots had similar grain yield, the grain yield relatively increased with an increase in the herbicide dosage.

CONCLUSION

In the past, farmers spent a lot of energy in manual weeding which consumed time, laborious and expensive but after the second world war, herbicides were introduced by the pesticide industries, that effectively control weeds to an economic threshold level, saving labour necessary for weed control practices and reducing the cost of farming. As new herbicides are introduced for agronomic crop use, investigations are being initiated for determining potential efficacy and safety in crops. This experimentation was designed to ascertain the efficacy of two new preparatory herbicide mixture as compared to the standard recommended Bullet® as weed control chemicals in maize field. Results showed that the various rates of the new formulated herbicide mixtures effectively controlled weeds associated in maize field for between 4 and 9 weeks after planting. Applying the mixtures at 3.0 or 4.0kg ai/ha was generally more effective on the weeds encountered. There was no phytotoxic effect of the herbicides on maize. As pre-emergence herbicides in maize field, the application of the new herbicide mixtures at 3.0 or 4.0kg ai/ha will supplement the check, Bullet.

Table 1: Chemical structure, rate, time and type of herbicides application

Treatment	Chemical name	Source	AR	TA	ToA
Bullet®	250g/l Acetochlor +225g/l Atrazine + 225g/l Terbuthylazine	Monsanto-Belgium/ South Africa	3.0 kg ai/ha	Pre-emergence	Sowing day
Lasset GD	450g/l Acetochlor + 214 g/l Terbuthylazine	Monsanto-Belgium	2.0kg ai/ha, 3.0kg ai/ha, 4.0kg ai/ha	Pre-emergence Pre-emergence	Sowingday Sowing day
Huricane	250g/l Acetochlor + 225g/l Atrazine + 225g/l + 225g/l Terbuthylazine	Volcano AgroScience PTY/Arysta Life Science -South Africa	2.0kg ai/ha 3.0 kg ai/ha 4.0kg ai/ha	Pre-emergence	Sowing day
Hand Weedings	-	-	-	Post emergence	3 and 6 weeks after sowing
Weedy Check	-	-	-	-	-

***AR** = Application rate; **TA** = Type of application; **ToA** = Time of application*

Table 2: Relative density (%) of different weed species in the untreated control plots at two different growing seasons in the three trial sites at 7 WAP

Family	Weed species	Types	Relative Density		
			Site I	Site II	Site III
Asteraceae	Aspilia africana (Pers.) C.D. Adams	PB	-	-	0.29
	Chromolaena odorata (L.) R.M.Kings	PB	-	0.63	-
	Tridax procumbens L.	AB	12.52	14.39	8.85
	Vernonia galamensis (Cass) Less.	AB	0.66	-	
Cleomaceae	Cleome viscosa L.	AB	0.77	0.88	0.66
Commelinaceae	Commelina benghalensis L.	PB	-	-	0.59
	C. diffusa Burm	PB	1.14	0.69	-
	C. erecta L.	APB	-	-	0.26
Convolvulaceae	Ipomoea involucrata P. Beauv	APB	-	0.66	-
Cyperaceae	Cyperus esculentus L.	PS	2.31	2.98	1.24
	C. rotundus L.	PS	-	-	0.48
	C. tuberosus Rottb	PS	0.51	-	-
	Fimbristylis littoralis Gaudet	AS	9.99	9.71	6.33
	Mariscus alternifolius Vahl	PS	1.06	2.61	1.76
	Pycerus lanceolatus (Poir). C.B. Cl	PS	4.06	3.61	2.45
Euphorbiaceae	Euphorbia heterophylla L.	AB	11.39	8.24	4.72
	E. hirta L.	AB	0.8	3.02	1.13
	E. hyssopifolia L.	AB	0.59	0.66	1.12
	Phyllantus amarus Sch. Thonn	AB	0.66	2.24	1.35
	Croton lobatus L.	AB	2.67	1.77	-
Fabaceae	Tephrosia bracleolata Guill & Per	AB			
	Asteraceae	-	0.59	1.13	
Laminaceae	Hyptis suaveolens Poir	AB	0.51	-	1.57
Loganiaceae	Spigelia anthelmia L.	AB	-	-	0.59
Malvaceae	Sida rhombifolia L.	PB	-	0.77	-
Nyctaginaceae	Boerhavia coccinea Mill	PB	0.62	0.29	-
	B. diffusa L.	PB	-	0.66	-
	B. erecta L.	AB	-	-	0.69
Poaceae	Brachiaria deflexa (Schum.)				
	C.E. Hubbard ex Robyns	AG	7.73	7.03	8.19
	B. lata (Schum.) C.E. Hubbard.	AG	2.34	3.97	1.94
	Cynodon dactylon (L.) Pers	PG	4.79	3.72	5.19
	C. nlemfuensis (L.) Pers	PG	0.66	-	-
	Dactylotenium aegyptium (L.) P.Beauv	APG	0.77	1.14	-
	Eleusine indica Gaertn	AG	8.82	7.06	11.37
	Imperata cylindrica Anders	PG	0.51	-	0.99
	Paspalum conjugatum Berg	PG	-	0.59	-
	P. orbiculare Forst	PG	-	-	0.62
	Rottboellia cochinchinensis (Lour) Clayton	AG	9.96	5.92	3.44
	Setaria barbata (Lam) Kunth	AG	0.62	0.77	2.99
	Digitaria horizontalis Willd	AG	6.37	3.97	2.34
Rubiaceae	Diodia scandens SW	PB	2.34	2.83	4.06
	Mitracapus villosus (SW) DC	AB	0.84	4.12	2.99
	Oldelandia corymbosa L.	AB	0.59	1.03	1.49
	Richardia brasilliensis Gomez	AB	0.51	1.88	0.59
Portulacaceae	Portulaca oleracea L.	AB	-	0.66	-
	Talinum triangulare (Jacq) Willd	PB	0.59	-	-
Solanaceae	Physalis angulata L.	AB	1.50	0.88	0.80
Sterculiaceae	Melochia corchorifolia L.	PB	0.33	-	-
Urticaceae	Fleurya aestuans (L.) ex Miq	AB	0.37	-	0.44

Table 3: Relative composition (%) of prevalent weed species encountered in the experimental sites at 7 WAP.

	Site	EH	TP	FL	RC	EI	BD
Treatment	**I**						
Lasset @ 2.0 kg ai/ha		17.51	9.23	16.53	12.37	16.35	15.79
Lasset @ 3.0 kg ai/ha		7.52	12.31	14.92	7.34	6.73	3.51
Lasset @ 4.0 kg ai/ha		9.17	5.38	10.89	9.63	0.00	7.02
Huricane @ 2.0 kg ai/ha		15.03	16.15	11.29	15.59	22.11	19.29
Huricane @ 3.0 kg ai/ha		5.83	7.69	6.85	10.09	9.62	7.02
Huricane @ 4.0 kg ai/ha		6.67	3.08	7.77	7.34	1.93	1.75
Bullet @ 3.0 kg ai/ha		9.17	10.02	6.45	8.72	15.38	10.53
2HW @ 3 & 6 WAP		5.83	12.31	3.63	9.63	7.69	3.51
Weedy check		23.33	23.85	21.77	19.27	20.19	31.59
	II						
Lasset @ 2.0 kg ai/ha		13.64	8.14	6.98	6.78	10.39	15.38
Lasset @ 3.0 kg ai/ha		4.55	4.65	5.81	13.95	2.59	15.38
Lasset @ 4.0 kg ai/ha		12.12	6.98	2.33	9.30	1.29	15.38
Huricane @ 2.0 kg ai/ha		12.12	12.79	9.30	11.63	14.29	7.69
Huricane @ 3.0 kg ai/ha		4.55	8.14	8.14	6.78	7.79	15.38
Huricane @ 4.0 kg ai/ha		3.03	3.49	2.33	9.30	3.89	15.38
Bullet @ 3.0 kg ai/ha		7.58	10.46	5.81	4.65	5.19	0.00
2HW @ 3 & 6 WAP		21.21	18.60	29.07	13.95	22.08	7.69
Weedy check		21.21	26.74	30.23	23.26	31.17	15.38
	III						
Lasset @ 2.0 kg ai/ha		11.83	9.74	3.45	7.68	6.19	8.56
Lasset @ 3.0 kg ai/ha		3.27	5.46	8.19	8.67	7.34	4.56
Lasset @ 4.0 kg ai/ha		0.99	5.97	10.24	1.56	8.43	3.73
Huricane @ 2.0 kg ai/ha		12.17	14.73	12.76	15.23	11.09	20.43
Huricane @ 3.0 kg ai/ha		12.76	8.23	6.90	2.71	3.85	12.45
Huricane @ 4.0 kg ai/ha		5.97	6.23	15.06	8.45	14.39	0.78
Bullet @ 3.0 kg ai/ha		11.87	7.94	5.76	22.23	12.89	11.08
2HW @ 3 & 6 WAP		20.43	13.12	8.67	12.68	16.43	12.89
Weedy check		20.18	28.94	28.35	20.96	19.35	25.64

HW = hand weeding, WAP = weeks after planting, EH= Euphorbia heterophylla, TP = Tridax procumbens, FL= Fimbristylis littoralis, RC= Rottboellia cochinchinensis, EI = Eleusine indica, BD = Brachiaria deflexa

Table 4: Effects of different weed control treatments on weed seedling population (seedling/m^2) and biomass (g/m^2)

	Site	Weed seedling population				Weed biomass	
Treatment	**I**	**4WAP**	**6WAP**	**8WAP**	**10WAP**	**4WAP**	**9WAP**
Lasset @ 2.0 kg ai/ha		63	17	163	119	6.24	19.80
Lasset @ 3.0 kg ai/ha		33	27	114	80	5.11	18.37
Lasset @ 4.0 kg ai/ha		35	9	73	52	3.13	16.43
Huricane @ 2.0 kg ai/ha		106	24	155	126	14.53	34.92
Huricane @ 3.0 kg ai/ha		62	49	134	97	9.41	21.65
Huricane @ 4.0 kg ai/ha		12	3	52	56	6.17	22.59
Bullet @ 3.0 kg ai/ha		50	51	202	102	11.16	21.27
2HW @ 3 & 6 WAP		297	14	47	7	7.43	3.25
Weedy check		383	151	192	104	17.38	73.36
Sed		41.31	35.65	31.24	35.47	4.74	9.16
LSD (0.05)		87.57	75.51	66.22	NS	10.23	19.43
	II						
Lasset @ 2.0 kg ai/ha		29	31	36	56	5.71	14.07
Lasset @ 3.0 kg ai/ha		18	22	37	47	1.64	11.32
Lasset @ 4.0 kg ai/ha		20	16	25	38	1.32	31.34
Huricane @ 2.0 kg ai/ha		30	41	44	61	2.87	18.74
Huricane @ 3.0 kg ai/ha		31	27	50	83	4.07	55.91
Huricane @ 4.0 kg ai/ha		25	19	53	57	5.33	11.42
Bullet @ 3.0 kg ai/ha		22	29	39	26	2.90	54.18
2HW @ 3 & 6 WAP		127	87	32	63	18.74	6.12
Weedy check		206	224	105	94	20.70	176.54
Sed		18.87	14.34	13.11	21.73	3.13	29.57
LSD (0.05)		40.00	32.81	27.79	45.38	6.63	62.70
	III						
Lasset @ 2.0 kg ai/ha		20	31	55	61	8.31	16.24
Lasset @ 3.0 kg ai/ha		31	29	63	76	10.24	26.89
Lasset @ 4.0 kg ai/ha		4	25	46	49	3.04	17.75
Huricane @ 2.0 kg ai/ha		35	87	102	112	18.17	81.73
Huricane @ 3.0 kg ai/ha		27	36	86	82	4.74	11.14
Huricane @ 4.0 kg ai/ha		18	36	71	92	14.36	23.13
Bullet @ 3.0 kg ai/ha		64	90	93	103	17.09	48.24
2HW @ 3 & 6 WAP		35	89	137	143	10.11	38.28
Weedy check		108	118	145	182	18.23	96.74
Sed		31.04	37.84	26.30	27.84	4.26	17.04
LSD (0.05)		65.80	80.22	55.75	59.03	9.03	36.13

HW= hand weeding, WAP = weeks after planting.

Table 5: Effects of different weed control treatments on weed morphological types.

	Site	Broadleaves		Grasses		Sedges	
Treatment	**I**	**4WAP**	**9WAP**	**4WAP**	**9WAP**	**4WAP**	**9WAP**
Lasset @ 2.0 kg ai/ha		8	34	55	102	0	34
Lasset @ 3.0 kg ai/ha		10	33	23	61	0	21
Lasset @ 4.0 kg ai/ha		25	22	10	43	0	9
Huricane @ 2.0 kg ai/ha		21	44	86	69	2	42
Huricane @ 3.0 kg ai/ha		13	31	50	85	0	19
Huricane @ 4.0 kg ai/ha		3	11	9	39	0	2
Bullet @ 3.0 kg ai/ha		2	40	43	68	0	32
2HW @ 3 & 6 WAP		57	17	131	25	109	5
Weedy check		64	57	160	130	155	64
Sed		23.29	8.98	39.12	22.67	6.31	12.58
LSD (0.05)		NS	19.04	82.93	48.05	13.37	26.62
	II						
Lasset @ 2.0 kg ai/ha		15	12	13	15	2	10
Lasset @ 3.0 kg ai/ha		7	9	9	23	2	8
Lasset @ 4.0 kg ai/ha		8	9	10	10	2	5
Huricane @ 2.0 kg ai/ha		14	5	12	19	5	16
Huricane @ 3.0 kg ai/ha		6	13	23	22	2	9
Huricane @ 4.0 kg ai/ha		11	15	14	29	0	9
Bullet @ 3.0 kg ai/ha		9	14	12	16	1	9
2HW @ 3 & 6 WAP		36	9	47	15	43	7
Weedy check		47	34	95	31	64	28
Sed		7.45	5.22	13.66	8.27	8.55	7.99
LSD (0.05)		15.80	11.06	28.95	NS	18.13	16.50
	III						
Lasset @ 2.0 kg ai/ha		8	20	9	21	3	19
Lasset @ 3.0 kg ai/ha		11	14	19	11	1	14
Lasset @ 4.0 kg ai/ha		0	9	4	6	0	3
Huricane @ 2.0 kg ai/ha		15	21	17	25	3	18
Huricane @ 3.0 kg ai/ha		12	29	15	19	0	11
Huricane @ 4.0 kg ai/ha		8	12	9	16	1	4
Bullet @ 3.0 kg ai/ha		24	31	41	24	0	18
2HW @ 3 & 6 WAP		18	33	14	61	4	9
Weedy check		68	49	30	71	12	33
Sed		8.47	10.34	7.38	13.14	4.11	11.96
LSD (0.05)		18.21	21.47	15.92	28.53	9.63	24.18

HW= hand weeding, WAP = weeks after planting.

Table 6: Percentage weed cover and mean weed control efficiency as affected by different weed control treatments

	Site I		Site II		Site III	
Treatment	**WEC(%)**	**WC(%)**	**WEC(%)**	**WC(%)**	**WEC(%)**	**WC(%)**
Lasset @ 2.0 kg ai/ha	68.51	36	82.25	41	68.84	39
Lasset @ 3.0 kg ai/ha	72.84	25	92.86	30	58.09	24
Lasset @ 4.0 kg ai/ha	79.85	13	87.92	15	82.56	11
Huricane @ 2.0 kg ai/ha	34.47	42	74.36	35	7.95	44
Huricane @ 3.0 kg ai/ha	58.25	23	87.82	24	81.35	28
Huricane @ 4.0 kg ai/ha	66.97	19	83.95	15	48.73	12
Bullet @ 3.0 kg ai/ha	53.48	24	77.63	23	28.26	27
2HW @ 3 & 6 WAP	76.45	13	77.24	17	52.5	15
Weedy check	-	69	-	71	-	83
Sed	12.02	6.34	13.62	8.70	12.75	9.53
LSD (0.05)	NS	12.72	NS	16.51	30.14	18.06

WEC= weed control efficiency, WC = weed cover, HW = hand weeding, WAP = weeks after planting.

Table 7: Effects of weed control treatment on the plant height, leaf area index and grain yield maize.

	Plant Height(m)			Leaf Area Index			Grain Yield(tons/ha)		
Treatment	**Site I**	**Site II**	**Site III**	**Site I**	**Site II**	**Site III**	**Site I**	**Site II**	**Site III**
Lasset @ 2.0 kg ai/ha	0.82	1.11	1.15	3.47	3.96	4.68	2.42	1.24	1.3
Lasset @ 3.0 kg ai/ha	1.06	0.93	0.87	3.61	3.47	3.51	2.72	3.20	3.03
Lasset @ 4.0 kg ai/ha	1.08	0.97	1.01	3.62	3.76	3.88	2.92	3.20	3.32
Huricane @ 2.0 kg ai/ha	0.79	0.98	0.64	2.64	3.22	2.76	2.56	1.50	1.72
Huricane @ 3.0 kg ai/ha	1.12	1.02	1.28	3.82	4.43	5.24	3.26	2.21	2.43
Huricane @ 4.0 kg ai/ha	1.05	0.96	0.96	3.48	3.82	3.98	3.36	3.04	3.73
Bullet @ 3.0 kg ai/ha	1.18	1.23	0.96	3.89	4.01	3.27	3.09	3.35	3.11
2HW @ 3 & 6 WAP	1.27	1.31	0.89	3.29	3.84	3.75	3.59	4.35	4.02
Weedy check	0.49	0.42	0.45	1.93	2.02	1.54	0.77	1.04	0.83
Sed	0.240	0.232	0.198	0.624	0.783	0.962	0.387	0.670	0.821
LSD (0.05)	0.51	0.49	0.42	1.34	1.76	2.63	0.82	1.39	1.42

HW =hand weeding, WAP = weeks after planting

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