Indian Journal of Weed Science 43 (3&4) : 145-148, 2011

Bio-efficacy of herbicides applied at the 2 to 4 leaf stage of weeds in sugarcane after second interculture

Rohitashav Singh, Radhey Shyam, Amit Bhatnagar, V. K. Singh and Jitendra Kumar
Department of Agronomy, G.B. Pant University of Agriculture & Technology, Pantnagar (Uttarakhand)
E-mail: rohitash_1961@rediffmail.com

ABSTRACT

A field experiment was conducted during 2006-2008 to find out suitable dose of velper K4 60 WP for the control of weeds in spring planted sugarcane. Weed population and weed dry weight were reduced significantly due to different weed control measures. Cane yield increased significantly with all the measures over weedy check and was highest under weed free conditions (94.3 t/ha) though it was at par with hoeing at 30, 60 and 90 day after transplanting (DAT). Atrazine was the most effective herbicide reducing weed population and weed dry weight followed by Velpar. Weed growth in weedy plot caused 73.5% reduction in cane yield compared to weed free condition. Among herbicidal treatments, maximum cane yield of 82.4 t/ha was obtained in atrazine and no herbicide treatment was at par with this. Due to phytotoxicity reason Velpar K_4 60 WP resulted in lower cane yield, though it effectively controlled the weeds.

Key words : Crop injury, Cane yield, Weed control efficiency.

Sugarcane, being a long duration crop with slow initial growth habit, is severely affected by weed infestation. Various studies have shown that weed competition has resulted in an estimated sugarcane yield loss of 12 to 83% (Sathyavelu *et al.* 2002, Kanwar *et al.* 1992). However, the losses depend on the weed intensity and stage of infestation besides the stage of crop. A weed free environment during the germination and tillering phase is important for getting higher yield. This can be achieved by the use of herbicides. Only a few chemicals have proved effective for the control of diverse weed flora in sugarcane. Selection of appropriate herbicide along with accurate dose and time of application is the key to success for controlling weeds. Velper is a ready mix combination of hexazinone (13.2%) and diuron (46.8% WP) which controls *Echinochloa colonum, Dactylotenium aegyptium, Trianthema monogyna, Amaranthus virdis, Ipomea* spp., *Cyperus rotundus, Cyperus esculentus, Setaria* spp., *Parthenium hysterophorus* and *Euphorbia hirta* in sugarcane. The objective of the study was to evaluate the bio-efficacy and dose of herbicides with special reference to Velpar K_4 60WP to control weeds in sugarcane.

MATERIALS AND METHODS

A field trial was conducted during 2006-07 and 2007-08 at the Norman E. Borlaug Crop Research Centre of G.B.P.U.A.&T., Pantnagar to evaluate the bio-efficacy of herbicides along with Velpar K_4 60 WP in sugarcane crop (herbicide marketed by E.I. Dupont India Limited). Experiment consisted of nine treatments *viz.,* three doses of Velpar K_4 60 WP at 1000, 1200 and 1400 g/ha, hexazinone 75 DF at 300 g/ha, diuron 80 WP at 1600 g/ha, atrazine at 2000 g/ha, three hoeings at 30, 60 and 90 days after planting (DAP) of sugarcane crop, weed-free and weedy check was laid out in randomized block design with three replications The plot size was 6x8 metre. Velpar, hexazinone and diuron were applied at the 2 to 4 leaf stage of weeds after second interculture while atrazine was applied just after first irrigation followed by hoeing. Herbicides were applied by using a Maruti foot sprayer fitted with flat fan nozzle as spray using 600 litres of water per hectare. Recommended package of practices were followed to raise the crop. Observations on weed population and dry weight of weeds were taken at 60 days after execution of treatments. Yield attributes *viz.,* cane length, cane girth and millable cane and cane yield were recorded at harvest. Data pertaining to density of total weeds and dry weight of sedges, grasses and broad leaved weeds were subjected to log transformation by adding 1.0 to original values prior to statistical analysis.

Phytotoxicity study, *viz*., yellowing, necrosis, epinasty, hyponasty and scorching was also recorded for Velpar at 5, 10, 15, 20 and 30 days after application of this herbicide for other herbicides, phytotoxicity observations were taken but all showed no symptoms as these were applied at the recommended dose..

RESULTS AND DISCUSSION

Effect on weed

The major weeds found in the weedy check during 2006-07 were *Cyperus rotundus*, *Echinochloa colona,*

Table 1. Effect of herbicides on weed density (no./m^2) at 60 days after execution of treatment during 2006-07 and 2007-08

Treatments	Stage of application	Dose (g/ha)		*Cyperus rotundus*		*Echinochloa colona*		*Brachiaria mutica*		Ds		Tm		Ph		Ca		*Ipomoea spp.*		Others		Total	
				2006-2007	2007-2008	2006-2007	2007-2008	2006-2007	2007-2008	2006-2007	2007-2008	2006-2007	2007-2008	2006-2007	2007-2008	2006-2007	2007-2008	2006-2007	2007-2008	2006-2007	2007-2008	2006-2007	2007-2008
Velpar K$_4$ 60 WP	2-4 leaf	1000	1000	88	197	9	11	5	7	8	3	4	5	5	4	9	9	4.9(128)	5.5 (236)				
Velpar K$_4$ 60 WP	stage of	1200	1200	85	180	5	8	3	4	5	0	3	3	3	3	5	7	4.7 (109)	5.3 (205)				
Velpar K$_4$ 60 WP	weeds	1400	1400	79	176	3	3	0	0	3	0	0	1	1	1	3	5	4.5 (89)	5.2 (186)				
Hexazinone 75 DF		300	300	96	200	9	12	7	8	9	7	11	8	7	7	11	11	5.0 (150)	5.5 (253)				
Diuron 80 WP		1600	1600	91	197	12	15	9	9	13	4	5	5	5	5	8	9	5.0 (143)	5.5 (244)				
Atrazine	PI	2000	2000	45	96	11	5	7	7	9	5	0	3	5	3	7	7	4.4 (84)	4.8 (126)				
Hoeings	30, 60 and 90 DAP	-	-	24	48	3	3	1	3	4	0	0	1	1	0	3	3	3.6 (36)	4.1 (58)				
Weed free	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0 (0)	0.0 (0)				
Weedy	-	-	-	91	193	32	41	23	23	33	33	48	19	13	13	17	21	5.6 (257)	5.8 (343)				
LSD (P=0.05)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.2				

PI = applied after first irrigation followed by hoeing, DAP=days after planting, Figures in paranthesis denotes original values
Ds = *Digitaria sanuinalis,* Tm= *Trianthema monogyna ,* Ph= *Parthanium hysterophorus ,*Ca=*Caesulia axillaris.*

Table 2. Effect of herbicides on dry weight of weeds (g/m^2) at 60 days after execution of treatment

Treatments	Stage of application	Dose (g/ha)	Sedges			Grasses			Broad leaved weeds		
			2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
Velpar K$_4$ 60 WP		1000	3.7(39.8)	4.5(89.3)	4.1(64.6)	3.7(40.5)	3.6(36.7)	3.7(38.6)	3.0(20.1)	2.8(15.3)	2.9(17.7)
Velpar K$_4$ 60 WP		1200	3.7(38.5)	4.4(81.0)	4.0(59.8)	2.9(17.1)	3.0(18.3)	2.9(17.7)	2.3(9.3)	2.0(6.7)	2.2(8.0)
Velpar K$_4$ 60 WP	2-4 leaf stage of weeds	1400	3.6(35.6)	4.4(77.4)	4.0(56.5)	1.8(4.9)	1.5(3.8)	1.6(4.4)	1.4(3.0)	1.5(3.3)	1.4(3.15)
Hexazinone 75 DF		300	3.8(43.5)	4.5(91.5)	4.2(67.5)	3.8(44.6)	3.7(39.5)	3.8(42.1)	3.5(30.8)	3.3(26.5)	3.4(28.7)
Diuron 80 WP		1600	3.7(40.5)	4.5(88.6)	4.1(64.6)	3.9(48.9)	3.6(43.4)	3.8(46.2)	3.1(21.7)	3.0(17.7)	3.1(19.7)
Atrazine	PI	2000	2.7(14.3)	3.4(29.7)	3.1(22.0)	3.8(45.8)	2.6(13.2)	3.2(29.5)	2.2(8.2)	2.4(10.5)	2.3(9.35)
Hoeings	30, 60 and 90 DAP	-	1.6(4.1)	2.1(7.4)	1.8(5.8)	1.9(5.7)	1.1(2.1)	1.5(3.9)	1.3(2.7)	1.0(1.7)	1.1(2.2)
Weed free	-	-	0.0(0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)	0.00(0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)
Weedy	-	-	3.8(42.3)	4.5(90.2)	4.1(66.3)	5.2(182.3)	5.0(153.7)	5.1(168.0)	4.3(73.0)	4.3(74.6)	4.3(73.8)
LSD (P=0.05)	-	-	0.3	0.4	0.3	0.2	0.7	0.5	0.3	0.3	0.4

PI = applied after first irrigation followed by hoeing, DAP=days after planting, Figures in paranthesis denotes original values

Table 3. Effect of herbicides on cane length, cane girth, millable cane and cane yield

Treatments	Stage of application	Dose (g/ha)	Cane length (cm)			Cane girth (cm)			Millable cane (000/ha)			Cane yield (t/ha)		
			2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
Velpar K_4 60 WP		1000	201	198	199.5	7.1	6.9	7.00	73.8	70.9	72.4	57.6	54.0	55.8
Velpar K_4 60 WP	2-4 leaf	1200	206	203	204.5	7.1	7.0	7.05	75.7	71.8	73.8	62.2	57.1	59.7
Velpar K_4 60 WP	stage of	1400	191	186	188.5	6.9	6.8	6.85	69.4	66.8	68.1	52.4	48.3	50.4
Hexazinone 75 DF	weeds	300	197	192	194.5	7.0	6.9	6.95	71.1	68.3	69.7	54.7	50.0	52.4
Diuron 80 WP		1600	200	195	197.5	7.0	6.9	6.95	72.3	70.0	71.2	55.8	53.3	54.6
Atrazine	PI	2000	215	217	216.0	7.1	7.0	7.05	104.3	105.1	104.7	81.4	83.4	82.4
Hoeings	30, 60 and 90 DAP	-	230	238	234.0	7.2	7.2	7.20	111.7	113.4	112.6	92.0	93.0	92.5
Weed free	-	-	235	241	238.0	7.2	7.1	7.15	114.2	115.9	115.1	93.8	94.8	94.3
Weedy	-	-	174	167	170.5	6.6	6.5	6.55	44.0	41.5	42.8	26.5	23.5	25.0
LSD (P=0.05)	-	-	7.9	9.4	8.7	NS	NS	NS	9.6	20.3	14.9	3.3	7.2	5.3

PI = applied after first irrigation followed by hoeing, DAP=days after planting

Brachiaria mutica, Digitaria sanguinalis, Parthenium hysterophorus and *Ipomoea* spp.,While *C. rotundus, E. colona, B. mutica, Trianthema monogyna, Ipomoea* spp. and *Caesulia axillaris* were the dominant during 2007-08. The other weeds with very low density were *T. monogyna, Portulaca oleracea, Eleusine indica* and *Commelina benghalensis* during 2006-07 and *Cleome viscosa, Digera arvensis, D. sanguinalis, C. benghalensis* and *P. hysterophorus* during 2007-08.

All the weed control measures caused significant reduction in the density of all the weeds over weedy check during both the years (Table 1). The lowest density of total weeds was reoccurred with hoeing treatment during both the years (36 and 58 weeds/m^2, respectively). Among the herbicidal treatments, atrazine proved the most effective for the control of weeds in sugarcane crop followed by Velpar at 1200 or 1400 g/ha. Three hoeing at 30, 60 and 90 DAP were found very effective for the control of grasses, broad leaf weeds and sedge during both the years. Application of Velpar at 1200 or 1400 g/ha at the 2 to 4 leaf stage of weeds also effectively controlled *E. colona, B. mutica* and *D. sanguinalis* during 2006-07 and *E. colona,* and *B. mutica* during 2007-08 as compared to other herbicides. This herbicide at these doses was also found better against broad leaved weeds *viz., Ipomea* spp*., T. monogyna* and *C. axillaries* than other herbicides. Application of Velpar at 1400 g/ha, atrazine and three hoeings resulted in complete control of *P. hysterophorus* during the year 2006-07. Moreover, execution of three hoeings was found the most effective for the control of *C. rotundus* during both the years. None of the herbicidal treatments was found suitable for the control of *C. rotundus* except atrazine.

Pooled data on the dry weight of weeds *viz*., sedges, grasses and broad leaved (Table 2) varied significantly among weed control measures. The lowest dry weight of all the categories of weeds was recorded under hoeing treatments. Application of Velpar at 1400 g/ha also exhibited similar dry weight of grasses and broad leaved weeds with that of three hoeings. Among the herbicidal treatments, atrazine was the most effective for reducing the dry weight of sedge followed by Velpar at 1400 or 1200 g/ha. Velpar at 1400 g/ha was found superior for the reduction of dry weight of grasses and broad leaved weeds followed by Velpar at 1200 g/ha and atrazine.

Effect on yield attributes and cane yield

Pooled data analysis revealed that weed free condition resulted in significantly more cane length (238.0 cm) than other treatments but remained at par with hoeing (234.0 cm) (Table-3). Differences among treatments in relation to cane girth were non-significant, however hoeing treatment recorded numerically maximum value (7.2 cm). Significantly more millable canes were obtained in weed free treatment (115.1 thousand/ha) that remained statistically same with hoeing (112.6 thousand/ha) and atrazine (104.7 thousand/ha). Comparison among different doses of Velpar for cane length and millable canes exhibited that application at 1200/ha was superior to 1000 and 1400 g/ha. These results corroborate with the findings of Srivastava (2001).

It was observed that uncontrolled weeds growth in weedy plot caused 73.5% reduction in cane yield compared to weed free condition (Table 3). Significantly higher cane yield (94.3 t/ha) was recorded under weed free treatment which was statistically at par with hoeing and was significantly superior to all the herbicide treatments. This is in conformity with the results of Rana and Singh (2004). Application of Velpar at 1200 g/ha at the 2 to 4 leaf stage of weeds recorded 59.7 t/ha cane yield, which was statistically at par at with (50.4 t/ha) Velpar at 1000 g/ha (55.8 t/ha) and diuron (54.6 t/ha) significantly higher than Velpar at 1400 g/ha (50.4 t/ha) and hexazinone (52.4 t/ha).

Phytotoxicity

Velpar at 1200 g/ha showed light yellowing of sugarcane plants and tip burning of (contact) leaves at 5th day after herbicide application, which was recovered within 20-25 days. Curling of new leaf, yellowing of plants, burning of contact leaves and reduction in growth of sugarcane were noted with the application of Velpar at 1400 g/ha, which caused reduction in number of millable canes and ultimately cane yield.

On the basis of two years bio-efficacy study, it can be concluded that among the herbicides, atrazine at 2000 g/ha applied after first irrigation followed by hoeing was found most effective for the control of weeds. Among different rates of Velpar, 1200 g/ha could be the standard dose for post emergence application at the 2 to 4 leaf stage of weeds in sugarcane crop to achieve effective control of both grassy as well as broad leaved weeds with higher cane yield.

REFERENCES

Kanwar RS, Singh Sarjit, Sodhi RS and Garcha AIS. 1992. Comparative performance of different herbicide combination for weed control in sugarcane. *Indian Sug.* **42** (8): 621-625.

Rana NS and Singh D. 2004. Studies on integrated weed management in spring planted sugarcane under tarai conditions of Uttaranchal. *Indian J. Weed Sci.* **36** (1&2): 89-92

Sathyavelu A, Somasundaram E, Poonguzhalan R and Rangaraj T. 2002. Integrated weed management in sugarcane. *Indian Sug.* **51** (12): 871-873.

Srivastava TK. 2001. Efficacy of certain new herbicides in spring planted sugarcane. *Indian J. Weed Sci.* **33** (1&2): 56-58.