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Integrated weed management studies in spring planted sugarcane

Rohitashav Singh, Radhey Shyam, S.S. Tripathi and Sanjay Kumar
Department of Agronomy, G. B. Pant University of Agriculture & Technology, Pantnagar (Uttarakhand)
Email : rohitashsingh_agro@india.com

ABSTRACT

A field experiment was conducted to study the effect of integrated weed management practices in spring planted sugarcane. *Echinochloa* spp, *Cyperus rotundus, Celosia argentia, Ipomoea* spp, were the dominant weeds associated with the crop and constituted 22.22, 48.38, 13.62 and 5.73% of total weed population, respectively. Three hoeings at 30, 60 and 90 days after planting pre-emergence application of metribuzin at 0.080 kg/ha or ametryn at 2.0 kg/ ha with two hoeings done at 60 and 90 DAP were most effective against most of the weeds and were at par with three hoeings at 30, 60 and 90 days after planting among themselves.

Key words : Herbicides, Integrated weed management, Sugarcane, Weed-control efficiency.

Sugarcane is a multiple product commodity crop and has a unique agro-industrial potential. Yield reduction due to weeds in spring planted sugarcane has been reported to the extent of 10-70% (Srivastava and Kumar 1996,Verma 2000). Widely spaced crop of sugarcane allows wide range of weed flora to grow profusely in the interspaces between the rows. Frequent irrigations and fertilizer application during early growth stage increase weed menace by many folds in the crop. It is well-established that cultural method of weed management is most effective to control weeds but timely availability of agricultural labourers is a problem. Herbicidal control of weeds has been suggested to be economical in sugarcane (Narwal and Malik 1980, Chauhan *et al.* 1984). Several herbicides have, however, been tried in sugarcane with varying degree of success but the information on the combined use of chemical and cultural practices are scarce. The present investigation was undertaken to study the effective integrated weed management practices for spring planted sugarcane.

MATERIALS AND METHODS

A field experiment was conducted during 2003-04 and 2004-05 at Crop Research Centre, Pantnagar, Uttarakhand, India. The soil was clay loam, medium in organic carbon (0.67%), available phosphorus (42.2 kg/ ha) and medium in available potassium (264.6 kg/ha). Twelve treatments (Table 1) consisting of ametryn alone at 2.0 kg/ha, applied one day after planting or preemergence ametryn at 2.0 kg/ha followed by hoeing at 60 days after planting (DAP), ametryn 2.0 kg/ha followed by hoeings at 60 and 90 DAP, ametryn at 2.0 kg/ha fo1lowed by 2,4-D at 1.0 kg/ha at 70 DAP, ametryn at 2.0 kg/ha followed by metsulfuron methyl (MSM) at 4 g/ha at 70 DAP, metribuzin at 0.080 kg/ha followed by hoeing at 60 DAP, metribuzin at 0.080 kg/ha followed by hoeings at 60 and 90 DAP, glyphosate at 1.5 kg/ha before sugarcane emergence followed by hoeing at 60 DAP, atrazine at 2.0 kg/ha applied after first irrigation followed by hoeing, metribuzin at 1.0 kg/ha applied after first irrigation followed by hoeing along with three hoeings at 30, 60 and 90 DAP and weedy check were replicated thrice in a randomized block design. Three budded setts of sugarcane variety Co-Pant 90223 were planted on March 20, 2003 and February 27, 2004 at a row spacing of 75 cm. Herbicides as per treatments were applied as spray using 600 litres of water per hectare. Data pertaining to density and dry matter accumulation by weeds were subjected to square root transformation (by adding 1.0 to original values) prior to statistical analysis. The weed control efficiency of the treatment was calculated by using the formula:

$$\text{Weed control efficiency (\%)} = \frac{\text{Dry matter of weeds in weedy plot} - \text{Dry matter of weeds in treated plot}}{\text{Dry matter of weeds in weedy plot}} \times 100$$

RESULTS AND DISCUSSION

Effect on weeds

The major weeds in the experimental field in weedy plots at 105 days after planting were *Echinochloa* spp (22.22%), *Cyperus rotundus* (48.38%), *Celosia argentia* (13.62%), and *Ipomoea* spp (5.73%). The other weeds having low density (10.03%) were *Brachiaria mutica, Cleome viscosa, Cynodon dactylon, Dactyloctenium aegyptium, Digitaria sanguinalis* and *Phyllanthus niruri.*

All the weed control measures led to significant reduction in total weed population and weed dry weight

Table 1. Effect of treatments on weed density at 105 days stage in sugarcane

Treatment	Application stage (DAP)	Dose (kg/ha)	Weed density (No./m^2)				Total
			C. rotundus	*Echinochloa* spp	*C. argentia*	*Ipomoea* spp.	
Ametryn	1	2.0	11.70(136)	5.19 (26)	4.58 (20)	3.60 (12)	14.56 (211)
Ametryn *fb* hoeing	1 *fb* 60	2.0	8.42 (70)	3.16 (9)	2.82 (7)	3.00 (8)	10.19 (103)
Ametryn *fb* hoeing	1 *fb* 60 & 90	2.0	6.0 (35)	2.23 (4)	0.0 (0)	1.73 (2)	6.78 (45)
Ametryn *fb* 2,4-D	1 *fb* 70	2.0 fb 1.0	10.24(104)	3.74 (13)	2.44 (5)	2.00 (3)	11.70 (136)
Ametryn *fb* MSM	1 *fb* 70	2.0 fb 0.040	11.04(121)	5.09 (25)	2.00 (3)	1.73 (2)	12.76 (163)
Metribuzin *fb* hoeing	1 *fb* 60	0.80	8.06 (64)	3.0 (8)	2.64 (6)	2.82 (7)	9.69 (93)
Metribuzin *fb* hoeing	1 *fb* 60 & 90	0.80	5.19 (26)	1.73 (2)	0.0 (0)	1.41 (1)	5.83 (33)
Glyphosate *fb* hoeing	BE *fb* 60	1.50	6.32 (39)	3.60 (12)	3.87 (14)	3.16 (9)	9.21 (84)
Atrazine	PI	2.0	7.14 (50)	3.60 (12)	2.0 (3)	2.23 (4)	8.66 (74)
Metribuzin	PI	1.0	6.78 (45)	2.64 (6)	2.23 (4)	3.00 (8)	8.36 (69)
Hoeing	30, 60 & 90	-	4.35 (18)	1.73 (2)	2.23 (4)	1.73 (2)	5.56 (30)
Weedy	-	-	11.66(135)	7.93 (62)	6.24 (38)	4.12 (16)	16.73 (279)
LSD (P=0.05)			1.33	1.06	0.9	1.08	1.41

MSM=Metsulfuron-methyl

PI= Applied after first irrigation followed by hoeing; BE-Before sugarcane emergence and after weed emergence; DAP=days after planting

Figures in parentheses indicate original values, which were transformed to $\sqrt{x+1}$ for analyses.

during both the years (Table 1). Crop given three hoeings at 30, 60 and 90 days after planting (DAP), pre-emergence application of metribuzin at 0.080 kg/ha supplemented with two hoeings at 60 and 90 DAP, application of glyphosate at 1.5 kg/ha before sugarcane emergence but after emergence of weeds followed by one hoeing at 60 DAP and atrazine at 2.0 kg/ha or metribuzin at 1.0 kg/ha applied just after hoeing were more effective in reducing *C. rotundus*. These treatments were also effective for the control of *Echinochloa* spp. Significant reduction of *Echinochloa* spp. was also observed with pre-emergence application of ametryn at 2.0 kg/ha or metribuzin at 0.8 kg/ha supplemented with hoeing at 60 DAP. Complete control of *Celosia argentia* was recorded with three hoeings and pre-emergence application of ametryn at 2.0 kg/ha or metribuzin at 0.8 kg/ha followed by two hoeings at 60 and 90 DAP. Other weed management practices also caused significantly lower density of *C. argentia* as compared to weedy check. Similar trend was also noticed for the control of *Ipomoea* spp. Effective control of this weed was noticed with ametryn at 2.0 kg/ha as pre-emergence followed by application of 2, 4-D at 1.0 kg/ha or metsulfuron methyl (MSM) at 4.0 g/ha at 70 DAP, pre-emergence application of metribuzin at 0.8 kg/ha or ametryn at 2.0 kg/ha supplemented with two hoeing at 60 and 90 DAP and three hoeings done at 30, 60 and 90 DAP. Among weed management treatments, lowest density as well as dry weight of total weeds were recorded under the treatment of three hoeing at 30, 60 and 90 DAP and it was at par with pre-emergence application of metribuzin at 0.80 kg/ha or ametryn 2.0 kg/ha supplemented with two hoeings at 60 and 90 DAP, respectively except total weed dry weight in pre-emergence application of ametryn at 2.0 kg/ha supplemented with two hoeings. Maximum weed-control efficiency of 96.5% was recorded in crop given three hoeings at 30, 60 and 90 DAP and it was very closely followed by the application of metribuzin 0.80 kg/ha or ametryn 2.0 kg/ha supplemented with two hoeings.

Effect on Crop

Uncontrolled weeds on an average caused 69.20% reduction in the cane yield when compared with three hoeings given at 30, 60 and 90 DAP stages (Table 2). Cane yield was significantly increased when any of the weed control measures was adopted as compared to weedy condition. The highest cane yield was recorded with three hoeings at 30, 60 and 90 DAP treatment, which was closely followed by pre-emergence application of metribuzin at 0.80 kg/ha or ametryn at 2.0 kg/ha supplemented with two hoeings given at 60 and 90 DAP. The higher cane yield under these treatments was because of higher values of cane length and millable cane/ha which were in conformity with the findings of Singh *et al.* (2001).

It may be concluded that pre- emergence application of ametryn at 2.0 kg/ha or metribuzin at 0.80 kg/ha supplemented with two hoeings given at 60 and 90 DAP were

Table 2. Effect of treatments on weed dry weight, yield attributing characters and cane yield

Treatment	Application stage (DAP)	Dose (kg/ha)	Weed dry weight (g/m^2)	Weed control efficiency (%)	Cane length (cm)	Cane girth (cm)	Millable cane (%/ha)	Cane yield (t/ha)
Ametryn	1	2.0	15.01 (224.5)	53.4	198.0	6.7	60.5	43.4
Ametryn fb hoeing	1 fb 60	2.0	11.37 (128.4)	73.3	222.0	7.2	95.7	78.5
Ametryn fb hoeing	1 fb 60 & 90	2.0	6.39 (31.9)	93.3	235.0	7.1	108.0	90.2
Ametryn fb 2,4-D	1 fb 70	2.0 fb 1.0	12.58 (157.5)	67.3	207.0	6.7	73.0	61.6
Ametryn fb MSM	1 fb 70	2.0 fb 0.040	12.67 (159.6)	66.8	209.0	6.9	72.3	57.5
Metribuzin fb hoeing	1 fb 60	0.80	10.99 (119.8)	75.1	224.0	7.1	97.3	80.3
Metribuzin fb hoeing	1 fb 60 & 90	0.80	5.17 (25.8)	94.6	241.0	6.9	111.3	93.1
Glyphosate fb hoeing	BE fb 60	1.50	11.87 (140.0)	70.9	219.0	7.0	93.0	76.2
Atrazine	PI	2.0	9.48 (88.9)	96.5	229.0	6.8	100.7	84.3
Metribuzin	PI	1.0	9.05 (81.05)	81.5	232.0	6.9	102.3	86.6
Hoeing	30, 60 & 90	-	4.18 (16.5)	83.1	238.0	7.1	114.0	95.8
Weedy	-	-	21.97 (482.1)	0.0	187.0	6.8	48.3	29.5
LSD (P=0.05)			1.53	-	4.7	NS	6.6	7.7

most effective in sugarcane crop against most of the weeds and resulted in cane yield at par with three hoeings done at 30, 60 and 90 DAP.

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