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Management of complex weeds in sugarcane by ametryn + trifloxysulfuron

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ABSTRACT

Field experiment was conducted to evaluate the bio-efficacy of ametryn 73.15% + trifloxysulfuron 1.85% W.G for the management of grasses, sedge and broad-leaf weeds in sugarcane. The experiment consisted of nine treatments laid out in randomized block design with three replications. *Cyperus rotundus*, *Ipomoea* spp, *Brachiaria reptans*, *Echinochloa colona*, *Digitaria sanguinalis* and *Dactyloctenium aegyptium* were observed as major weeds. Among herbicide treatments, the lowest density of total weeds was observed with ametryn + trifloxysulfuron at 1500 g/ha though the differences were non-significant when compared with its lower dose *i.e.* 1250 g/ha at 15 and 45 days after application (DAA). Application of ametryn + trifloxysulfuron 1250 and 1500 g/ha recorded significantly lower weed dry weight over any other herbicidal treatment at 15 and 45 days. Highest weed control efficiency of total weeds at both 15 and 45 DAA were recorded with the application of ametryn + trifloxysulfuron 1500 g/ha which was closely followed by 1250 g/ha. The highest cane yields (9.04 t/ha and 10.51 t/ha) were recorded from weed free plot being at par with hand weeding thrice at 30, 60 and 90 DAP.

Key words: Millable cane, Sugarcane, Weed control efficiency, Weed density, Yield

Sugarcane is one of the most important cash crop grown throughout the country. It is tall and relatively strong class of perennial grasses that are known to have a high sugar content. In sugarcane weeds have been estimated to cause 12 to 72% reduction in cane yield depending upon the severity of infestation (Anonymous 2013). Various workers have estimated loss in cane yield due to weeds form 12 to 83% (Kanwar *et al.* 1992 and Sathyavelu *et al.* 2002). Delayed germination, slow initial growth and lateral spread, wide row space and adequate supply of nutrients and moisture in sugarcane provide favorable environment for weed infestation. Sugarcane suffers from weed competitions, which reduces its yield upto 15-75% and even more. It is well known that cultural methods of weed management is most effective to control weeds but timely availability of labours is a problem besides increase in wages. Therefore, chemical control of weeds is considered economical in sugarcane (Kumar *et al.* 2014). Several herbicides have been tried in sugarcane with varying degree of success, but information on combined use of chemical or pre-mix combination of herbicide is scarce. Keeping this in view, the present investigation was undertaken to study the combined use of two chemical in spring planted sugarcane.

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MATERIALS AND METHODS

Field Experiment was conducted during 2012-13 and 2013-14 at N.E. Borlaug Crop Research Centre, GBPUA&T, Pantnagar to evaluate the bio-efficacy of ametryn 73.15% + trifloxysulfuron 1.85% WG for the control of grasses, sedge and broad-leaf weeds in sugarcane. Experiment with nine treatments comprised with three doses of ametryn + trifloxysulfuron 731.5 + 18.5, 914.4 + 23.1 and 1097.2 + 27.7 g/ha and trifloxysulfuron 10 30 g/ha, atrazine 50 WP 1000 g/ha, 2,4-D di-ethyl amine salt 58% SL 3500 g/ha as commercial standards as well as hand weeding thrice at 30, 60 and 90 days after planting (DAP) of sugarcane crop, weed free and weedy check (Table 1) with three replication was laid out in randomized block design.

Three budded sets of sugarcane variety '*Co. Pant 90223'* was planted on March 03, 2012 and March 06, 2013 with recommended package of practices at a row spacing of 75 cm. Herbicides as pre-emergence were applied as spray using 600 liters of water per hectare. Recommended package of practices were followed to raise the crop. Observations on population and dry weight of weeds were taken at 15 and 45 DAA. The data on density (no./m^2) and dry weight (g/m^2) of total grasses, sedges and broad-leaved weeds were taken at 15 and

45 days after application (DAA) of treatments and subjected to log transformation prior to statistical analysis. Yield attributes and yield (t/ha) of sugarcane was recorded at the time of harvesting.

To study the phytotoxic effect of this herbicides on crop, visual rating on the scale of 0 -10 for two treatments of ametryn + trifloxysulfuron *i.e.* 1500 and 3000 g/ha was made and compared with untreated check. The residual effect on succeeding crop (Lentil) was also observed.

RESULTS AND DISCUSSION

Weed flora

The major weeds of experimental field in weedy plots were *Cyperus rotundus, Ipomoea* spp., *Brachiaria reptans, Echinochloa colona, Digitaria sanguinalis* and *Dactyloctenium aegyptium*. The other weeds with very low density were *Trianthema monogyna, Digera arvensis, Cloeme viscosa* and *Echinochloa crusgalli.*

Efficacy on density and dry weight of weeds

All the weed control treatments caused significant reduction in the density of total weeds over weedy check during both the years. The highest reduction in the density of total weeds occurred with the execution of three hand weeding at 30, 60 and 90 days after planting (DAP). Among the herbicidal treatments, the lowest density of total weeds were observed with ametryn + trifloxysulfuron 1500 g/ha though the differences were non-significant when compared with its lower dose at 1250 g/ha at 15 and 45 DAA during both the years. Application of ametryn + trifloxysulfuron at all the rates effectively controlled the *C. rotundus* (sedge), *Ipomea* spp., *T. monogyna, D. arvensis* and *C. viscose* (broad-leaf weed) and *Echinochloa* spp., *D. sanguinalis, D. aegyptium*, and *B. reptans* (grassy weeds) (Table 1 and 2).

The dry weight of total weeds varied significantly due to weed control measures. All the weed control treatments recorded significantly lower dry weight of total weeds in comparison to weedy check (Table 3). The lowest dry weight of all the weeds were recorded with three hand weeding at 30, 60 and 90 DAP at both the stages. Application of ametryn + trifloxysulfuron1250 and 1500 g/ha recorded significantly lower weed dry weight over any other herbicidal treatment at 15 and 45 days. Mahadevaswamy and Martin (2001) also reported lowest weed population and weed dry matter with pre-emergence weedicides (atrazine /metribuzin/ pendimethalin) followed by hand weeding and hoeing at 45 days after ratoon initiation.

Weed control efficiency

Highest weed control efficiency of total weeds at both 15 and 45 DAA were recorded with the application of ametryn + trifloxysulfuron 1500 g/ha which was closely followed by ametryn + trifloxysulfuron 1250 g/ha. However, the minimum weed control efficiency was recorded with the

Table 1. Density of weeds as influenced by different treatments at 15 DAA

Treatment	*C. rotundus*		*Ipomoea* spp.		*B. reptans*		*E. colona*		*D. sanguinalis*		*D. aegyptium*		Others		Total	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Ametryn + trifloxysulfuron	2.3 (9.3)	2.4 (10.7)	1.0 (2.7)	1.3 (2.7)	2.4 (13.3)	2.7 (13.3)	2.4 (10.7)	1.7 (12.0)	2.5 (12.0)	1.9 (10.7)	1.2 (4.0)	1.8 (5.3)	1.3 (4.0)	1.9 (6.7)	4.0 (56)	4.1 (61.3)
Ametryn + trifloxysulfuron	1.8 (5.3)	1.9 (6.7)	0.0 (0.0)	0.5 (1.3)	1.6 (6.7)	1.8 (5.3)	1.9 (6.7)	1.9 (6.7)	2.1 (8.0)	1.8 (5.3)	0.5 (1.3)	0.5 (1.3)	0.5 (1.3)	1.0 (2.7)	3.0 (29)	3.0 (28.0)
Ametryn + trifloxysulfuron	1.2 (4.0)	1.3 (4.0)	0.0 (0.0)	0.0 (0.0)	1.2 (4.0)	1.0 (2.7)	1.2 (4.0)	1.8 (5.3)	1.2 (4.0)	1.3 (4.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	2.7 (16)	2.7 (16.0)
Trifloxysulfuron	1.0 (2.7)	0.5 (1.3)	0.0 (0.0)	0.0 (0.0)	2.5 (13.3)	1.7 (12.0)	3.5 (34.7)	3.4 (33.3)	3.1 (24.0)	3.3 (28.0)	0.5 (1.3)	0.0 (0.0)	2.1 (8.0)	1.9 (6.7)	4.4 (84)	4.4 (81.3)
Atrazine	2.4 (25.3)	2.4 (25.3)	1.0 (2.7)	0.5 (1.3)	2.3 (9.3)	1.7 (8.0)	2.3 (9.3)	1.7 (8.0)	1.9 (6.7)	1.9 (6.7)	1.0 (2.7)	0.5 (1.3)	1.8 (5.3)	1.8 (5.3)	4.1 (61)	3.9 (56.0)
2,4-D dimethyl amine salt	1.9 (6.7)	1.7 (8.0)	0.0 (0.0)	0.0 (0.0)	2.4 (10.7)	2.3 (9.3)	3.5 (37.3)	3.6 (34.7)	2.9 (17.3)	2.2 (18.7)	0.5 (1.3)	0.0 (0.0)	1.3 (4.0)	1.0 (2.7)	4.3 (77)	4.3 (73.3)
Hand weeding thrice	1.0 (2.7)	1.8 (5.3)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.5 (1.3)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.3 (4)	1.8 (5.3)
Weed free	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0)	0.0 (0.0)
Untreated check	2.9 (22.7)	2.4 (24.0)	1.9 (6.7)	1.8 (5.3)	1.7 (12.0)	1.9 (10.7)	3.4 (33.3)	3.4 (32.0)	2.9 (22.7)	3.2 (24.0)	2.7 (24.0)	2.9 (22.7)	2.7 (18.7)	3.0 (21)	4.9 (140)	4.9 (140.0)
LSD (P=0.05)	NS	NS	0.9	1.0	1.6	1.5	1.4	1.8	0.8	NS	1.2	1.0	1.2	0.9	0.40	0.4

Figures in parentheses indicate original values which were transformed to $\log_e(\sqrt{x+1})$, Doses of treatments are mentioned in Table 3

Table 2. Density of weeds as influenced by different treatments at 45 DAA

Treatment	*C. rotundus*		*Ipomoea* spp.		*B. reptans*		*E. colona*		*D. sanguinalis*		*D. aegyptium*		Others		Total	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Ametryn + trifloxysulfuron	3.6 (38.7)	3.6 (37.3)	0.0 (0.0)	0.0 (0.0)	2.3 (9.3)	2.4 (10.7)	2.1 (8.0)	2.3 (9.3)	2.3 (9.3)	2.4 (10.7)	0.7 (2.7)	1.0 (2.7)	1.8 (5.3)	1.9 (6.7)	4.2 (73)	4.4 (77)
Ametryn + trifloxysulfuron	2.6 (21.3)	2.3 (25.3)	0.0 (0.0)	0.0 (0.0)	1.9 (6.7)	1.8 (5.3)	1.8 (5.3)	1.2 (4.0)	1.9 (6.7)	1.9 (6.7)	0.5 (1.3)	0.5 (1.3)	1.0 (2.7)	0.0 (0.0)	3.6 (44)	3.3 (43)
Ametryn + Trifloxysulfuron	2.4 (13.3)	2.4 (14.7)	0.0 (0.0)	0.0 (0.0)	1.0 (2.7)	0.0 (0.0)	1.0 (2.7)	0.5 (1.3)	1.2 (4.0)	1.0 (2.7)	0.5 (1.3)	0.0 (0.0)	0.5 (1.3)	0.0 (0.0)	3.2 (24)	2.9 (19)
Trifloxysulfuron	2.3 (9.3)	2.4 (10.7)	0.0 (0.0)	0.5 (1.3)	2.3 (24.0)	3.4 (33.3)	3.7 (41.3)	3.6 (38.7)	3.3 (33.3)	3.3 (28.0)	2.1 (8.0)	2.1 (8.0)	1.7 (5.3)	1.8 (5.3)	4.8 (117)	4.8 (125)
Atrazine	4.2 (69.3)	4.2 (70.7)	0.0 (0.0)	0.0 (0.0)	2.1 (8.0)	2.3 (9.3)	1.9 (6.7)	1.8 (5.3)	1.8 (5.3)	1.9 (6.7)	1.0 (2.7)	1.3 (4.0)	1.2 (4.0)	1.0 (2.7)	4.6 (93)	4.6 (99)
2,4- D Dimethyl amine salt	2.4 (25.3)	3.4 (33.3)	0.0 (0.0)	0.0 (0.0)	2.8 (22.7)	3.4 (30.7)	3.7 (42.0)	3.8 (44.0)	3.5 (32.0)	2.4 (25.3)	1.8 (5.3)	2.0 (6.7)	1.8 (5.3)	1.3 (4.0)	4.9 (131)	5.0 (144)
Hand weeding thrice	2.9 (17.3)	2.8 (22.7)	0.0 (0.0)	0.0 (0.0)	0.5 (1.3)	1.0 (2.7)	0.0 (0.0)	0.0 (0.0)	1.0 (2.7)	0.0 (0.0)	0.5 (1.3)	0.0 (0.0)	0.9 (2.7)	2.0 (6.7)	3.2 (25)	3.3 (32)
Weed free	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0)	0.0 (0)
Untreated check	4.0 (61.3)	4.2 (66.7)	2.4 (10.7)	2.7 (13.3)	3.1 (24.0)	3.4 (29.3)	3.7 (44.0)	3.8 (42.7)	3.4 (30.7)	2.9 (26.7)	1.9 (6.7)	2.3 (9.3)	3.3 (26.7)	4.2 (70.7)	5.5 (240)	5.6 (259)
LSD (P=0.05)	1.9	1.4	0.9	0.5	1.6	0.7	1.36	0.9	0.8	1.5	1.3	1.1	1.3	0.95	0.5	0.5

Figures in parentheses indicate original values which were transformed to $\log_e (\sqrt{x+1})$, Doses of treatments are mentioned in Table 3

Table 3. Dry weight and weed control efficiency as influenced by different treatments

Treatment	Dose		Dry weight (g) 2012				Dry weight (g) 2013			
	g/ha (a.i.)	Product (g or ml/ha)	15 DAA	WCE (%)	45 DAA	WCE (%)	15 DAA	WCE (%)	45 DAA	WCE (%)
Ametryn + trifloxysulfuron	731.5 +18.5	1000 g	4.0 (52.1)	71.6	3.7 (40.1)	79.6	3.9 (51.3)	68.4	3.7 (41.9)	78.4
Ametryn + trifloxysulfuron	914.37+23.12	1250 g	3.4 (29.9)	83.7	2.9 (18.4)	90.6	3.3 (26.7)	83.6	2.9 (18.2)	90.1
Ametryn + trifloxysulfuron	1097.25+27.75	1500 g	2.5 (11.4)	93.8	2.2 (8.2)	95.8	2.2 (8.7)	94.6	2.0 (6.5)	96.6
Trifloxysulfuron	30	300 ml	4.4 (80.7)	56.0	5.0 (144.9)	26.4	4.4 (82.0)	49.6	5.0 (147.2)	24.2
Atrazine	1000	2000 g	4.2 (63.9)	65.2	3.7 (41.2)	79.1	4.2 (65.5)	59.7	3.7 (39.0)	79.9
2,4- D dimethyl amine salt	3500	6034 ml	4.5 (91.7)	50.0	4.9 (139.8)	29.0	4.6 (95.2)	41.4	4.9 (137.8)	29.0
Hand weeding thrice	-	-	1.4 (4.2)	97.7	0.5 (0.7)	99.6	1.3 (3.1)	98.1	0.5 (0.8)	99.6
Weed free	-	-	0.0 (0.0)	100.0	0.0 (0.0)	100.0	0.0 (0.0)	100.0	0.0 (0.0)	100.0
Untreated check	-	-	5.2 (183.6)	00.0	5.3 (196.8)	00.0	5.1 (162.6)	00.0	5.3 (194.2)	00.0

Figures in parentheses indicate original values which were transformed to $\log_e (\sqrt{x+1})$

application of 2,4-D dimethyl amine salt 58% SL 3500 g/ha at both the stages of observations Table 3.

Effect on cane yield

Weeds in untreated weedy plot on an average reduced the cane yield up to 61.8 and 60.5% during 2012 and 2013, respectively, when compared with weed free plot (Table 4). The highest cane yields (9.04 t/ha and 10.51 t/ha) were recorded from weed free plot being at par with hand weeding thrice at 30, 60 and 90 DAP. Singh *et al*. (2011) and Suganthi *et al*. (2013) observed higher cane length number of internodes and cane weight with weed free situations Application of ametryn + trifloxysulfuron 1250 and 1500 g/ha being at par recorded higher cane yield as compared to its lower dose and any other herbicidal treatment. The higher cane yield under these treatments might be due to more cane length and millable cane. The results corroborated with the findings of Chauhan and Srivastava (2002) whorecorded increase in cane yield up to 52% in weed free conditions due to better crop environment. This might be due to effective control of weeds, which provide congenial environment for the crop.

Phytotoxicity and effect on succeeding crop

There were no phytotoxicity symptoms *viz*. stunting, chlorosis, necrosis, epinasty and hyponasty after the application of ametryn + trifloxysulfuron either at 1500 g/ha and 3000 g/ha during the entire crop season.

Table 4. Yield attributing characters and cane yield as influenced by ametryn + trifloxysulfuron

Treatment	Dose		No of millable cane (2 m row length)		Cane length (cm)		Weight/cane (kg)		Cane yield (t/ha)	
	g/ha (a.i.)	Product (g or ml/ha)	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
Ametryn + trifloxysulfuron	731.5 +18.5	1000 g	81.1	97.5	180.7	241.1	0.6	1.3	68.3	79.5
Ametryn + trifloxysulfuron	914.37+23.12	1250 g	85.5	99.7	182.9	250.3	0.7	1.4	75.1	87.0
Ametryn + trifloxysulfuron	1097.25+27.75	1500 g	90.0	101.8	186.5	253.7	0.8	1.5	82.3	95.5
Trifloxysulfuron	30	300 ml	89.0	88.8	170.3	235.9	0.4	1.1	51.7	64.5
Atrazine	1000	2000 g	73.3	91.0	171.5	238.9	0.5	1.2	65.9	74.0
2,4- D dimethyl amine salt	3500	6034 ml	66.3	86.2	159.4	234.7	0.3	0.9	50.9	63.5
Hand weeding thrice	-	-	108.7	145.2	187.1	254.3	0.9	1.6	89.8	10.3
Weed free	-	-	111.3	153.8	188.5	255.2	1.0	1.8	90.4	10.5
Untreated check	-	-	55.7	84.5	128.4	233.5	0.2	0.8	34.5	41.5
LSD (P=0.05)			21.8	26.6	30.1	14.0	0.3	0.3	8.0	8.7

The study revealed that none of the doses of ametryn + trifloxysulfuron sprayed on sugarcane crop showed any phytotoxicity symptoms on succeeding (lentil) crop. Per cent germination recorded at 15 days after sowing, plant height and grain yield of lentil crop were also recorded almost similar in all the treatments including untreated check plot during both the years. There was no residual effect of ametryn + trifloxysulfuron found on lentil crop. It was concluded that + trifloxysulfuron 1500 g/ha provide excellent control of weeds and it produced higher yield attributes and cane yield under north Indian conditions.

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