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Weed management effect on growth and yield of sugarcane

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ABSTRACT

An experiment was conducted at Agricultural Research Station, Dhadesugur, UAS, Raichur, Karnataka during 2015-16 and 2016-17 to study the effect of weed control practices on growth and yield of sugarcane and its associated weeds. Dominant weeds were *Echinochloa* spp. *(E. crus-galli* and *E. colona), Dactyloctenium aegyptium, Eleusine indica, Brachiaria spp. (B. mutica* and *B. ramosa)* and *Digitaria sanguinalis* among grasses, *Eclipta alba, Chenopodium album, Physalis minima, Ageratum conyzoides, Parthenium hysterophorus* and *Portulaca oleracea* as broad-leaf weeds and *Cyperus* spp. *(C. rotundus* and *C. iria)* as sedges. Among the herbicidal treatments, pyrazosulfuron-ethy + metribuzin + 2,4-D sodium salt WDG (3000 g/ha) recorded significantly higher millable cane yield (119.5 t/ha) as compared to other treatments due to lower weed biomass (42.7 and 47.0 g/m2 at 45 and 75 DAP, respectively) and higher weed control efficiency at 45 and 75 DAP (86.4 and 85.5% at 45 and 75 DAP, respectively) during 2015-16. Similar trend was observed in 2016-17.

INTRODUCTION

India is the second largest producer of sugar in the world with over 4 mha of sugarcane growing area. It produces approximately 22 mt of sugar annually. Around 85% sugarcane production of India is from Uttar Pradesh, Maharashtra, Tamil Nadu, Andhra Pradesh, Karnataka and Gujarat (Takalkar and Pawar 2012). Sugarcane crop faces tough competition with weeds during 60 to 120 days of its planting which causes heavy reduction in cane yield ranging from 40-67% (Shauhan and Srivastava 2002). 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 stages, increase the weeds menace by many folds in the crop (Singh *et al.* 2008).

It is well-established that cultural method of weed management is most effective to control weeds but timely availability of agricultural labours is a problem. Herbicidal control of weeds has been suggested to be economical in sugarcane (Chaudhari *et al*. 2016). Several herbicides were tried in sugarcane with varying degree of success but the information on the combined use of herbicides along with inter cultivation are scarce. The present investigation was undertaken to study the effect of weed control treatments on growth and yield of sugarcane and its associated weeds.

MATERIALS AND METHODS

An experiment was conducted during 2015-16 and 2016-17 at Agricultural Research Station, Dhadesugur, University of Agricultural Sciences, Raichur, Karnataka. The soil of the experimental site was black soil and the pH (8.04), EC (0.47 ds/m), medium in organic carbon content (0.41%), low in nitrogen (189 kg/ha), medium in phosphorus (58.5 kg/ha) and potassium (287.5 kg/ha). Six treatments *viz.* pyrazosulfuron-ethyl 1% + metribuzin 35% + 2,4-D sodium salt 44% WDG (3000 g/ha), pyrazosulfuron-ethyl (30 g/ha), 2,4-D sodium salt (2.6 kg/ha), metribuzin (1.4 kg/ha), hand weeding at 30 and 60 days after planting (DAP) and weedy check were tested in a randomized block design with four replications. All herbicides were applied at 25 DAP of sugarcane (3 to 4 active leaf weed stage). Herbicides were applied as per the treatments with spray volume of 500 l/ha. One inter cultivation and earthing up at 90 DAP was common for all the treatments. Three budded setts of sugarcane variety '*Co-86032*' were planted in first week of November 2015 and 2016 and harvested in the third week of December 2016 and 2017.

Species wise, weed density was recorded at 15 DAP, 45 DAP and 75 DAP using quadrat of 1.0 m^2 from three randomly selected spots in each plot. Further, total weed biomass was recorded at 45 DAP and 75 DAP for calculating per cent weed control efficiency (WCE). Weed control efficiency (WCE) was calculated as follows.

Weed biomass in weedy check

Millable cane yield was recorded plot wise and expressed as millable cane yield per hectare. The data of each year was analysed separately. MSTAT was used for statistical analysis of data and means were separated using critical difference (CD) at p=0.05. The weed density and biomass values were transformed by square root transformation by adding 1.0 to original values before being subjected to ANOVA (Gomez and Gomez 1984).

RESULTS AND DISCUSSION

The dominant weeds in experimental field were *Echinochloa* spp. *(E. crus-galli* and *E. colona), Dactyloctenium aegyptium, Eleusine indica, Brachiaria* spp. *(B. mutica* and *B. ramosa)* and *Digitaria sanguinalis* among grasses, *Eclipta alba, Chenopodium album, Physalis minima, Ageratum conyzoides, Parthenium hysterophorus* and *Portulaca oleracea* among broad-leaved weeds and *Cyperus* spp. *(C. rotundus* and *C. iria)* among sedges.

Post-emergence application of pyrazosulfuron-ethyl 1% + metribuzin 35% + 2,4-D sodium salt 44% WDG (3000 g/ha) was on at par with twice hand weeded check (**Table 1**), but significantly superior to metribuzin (2000 g/ha), 2,4-D sodium salt (3250 g/ha) and pyrazosulfuron-ethyl (300 g/ha) in terms of reducing weed density. Similar trend was observed in 2016-17 (**Table 2)**.

Table 1. Effect of weed control treatments on weed density (no./m^2) in sugarcane (1st season-2015-16)

Treatment	Grasses			Broad-leaved weeds			Sedges		
	15 DAP	45 DAP	75 DAP	15 DAP	45 DAP	75 DAP	15 DAP	45 DAP	75 DAP
Pyrazosulfuron-ethyl + metribuzin + 2,4-D sodium salt WDG (3000 g/ha)	15.3 (4.03)	2.48 (1.87)	3.08 (2.02)	13.8 (3.85)	1.31 (1.52)	1.62 (1.62)	1.25 (1.50)	0.16 (1.08)	0.20 (1.09)
Pyrazosulfuron-ethyl (300 g/ha)	14.20 (3.90)	21.23 (4.71)	26.5 (5.25)	13.53 (3.81)	9.50 (3.24)	11.9 (3.59)	1.42 (1.56)	2.25 (1.80)	2.81 (1.95)
2,4-D sodium salt (3250 g/ha)	13.8 (3.85)	20.92 (4.68)	30.29 (5.59)	15.7 (4.08)	11.77 (3.57)	14.8 (3.98)	1.25 (1.50)	6.25 (2.69)	7.88 (2.98)
Metribuzin (2000 g/ha)	13.8 (3.85)	10.26 (3.36)	12.7 (3.70)	15.4 (4.05)	10.60 (3.41)	13.1 (3.76)	1.67 (1.63)	4.52 (2.35)	5.60 (2.57)
Hand weeding at 30 and 60 DAP	14.6 (3.94)	5.13 (2.48)	6.16 (2.68)	15.5 (4.07)	1.86 (1.68)	2.88 (1.97)	1.25 (1.50)	0.12 (1.06)	0.14 (1.07)
Weedy check	16.5 (4.19)	32.8 (5.81)	39.3 (6.35)	15.9 (4.11)	30.64 (5.62)	36.8 (6.15)	1.65 (1.63)	7.25 (2.87)	8.70 (3.11)
LSD (p=0.05)	NS	0.65	0.65	NS	0.52	0.89	NS	0.42	0.53

Figures in the parentheses are square root transformed values ($\sqrt{x+1}$); DAP: Days after planting

Table 2. Effect of weed control treatments on weed density (no/m^2) in sugarcane (2nd season-2016-17)

Treatment	Grasses			Broad-leaved weeds			Sedges		
	15 DAP	45 DAP	75 DAP	15 DAP	45 DAP	75 DAP	15 DAP	45 DAP	75 DAP
Pyrazosulfuron-ethyl + metribuzin + 2,4-D sodium salt WDG (3000 g/ha)	14.3 (3.91)	1.75 (1.66)	2.19 (1.79)	12.8 (3.71)	1.34 (1.53)	1.68 (1.64)	1.20 (1.48)	0.19 (1.09)	0.24 (1.11)
Pyrazosulfuron-ethyl (300 g/ha)	12.74 (3.71)	20.47 (4.63)	29.3 (5.50)	13.1 (3.76)	9.53 (3.24)	13.6 (3.82)	2.52 (1.88)	2.27 (1.81)	3.25 (2.06)
2,4-D sodium salt (3250 g/ha)	12.5 (3.67)	23.11 (4.91)	30.91 (5.65)	13.5 (3.81)	11.75 (3.57)	14.45 (3.93)	1.20 (1.48)	6.21 (2.69)	7.64 (2.94)
Metribuzin (2000 g/ha)	11.4 (3.52)	11.73 (3.57)	14.3 (3.91)	12.3 (3.64)	10.61 (3.41)	12.9 (3.73)	1.52 (1.59)	4.12 (2.26)	5.03 (2.45)
Hand weeding at 30 and 60 DAP	12.8 (3.72)	6.12 (2.67)	7.34 (2.89)	11.7 (3.56)	1.94 (1.71)	4.08 (2.25)	1.20 (1.48)	0.16 (1.08)	0.19 (1.09)
Weedy check	14.7 (3.96)	31.08 (5.66)	37.3 (6.19)	13.9 (3.85)	30.23 (5.59)	36.3 (6.11)	1.45 (1.57)	6.87 (2.81)	8.24 (3.04)
LSD (p=0.05)	NS	0.81	1.25	NS	0.62	0.89	NS	0.52	0.56

Figures in the parentheses are square root transformed values ($\sqrt{x+1}$); DAP: Days after planting

Similarly, hand weeding twice at 30 and 60 DAP recorded significantly lower weed biomass and higher weed control efficiency, which was on a par with the post-emergence application of pyrazosulfuron-ethyl 1% + metribuzin 35% + 2,4-D sodium salt (3000 g/ha) compared to application of metribuzin (2000 g/ha), 2,4-D Sodium salt (3250 g/ha) and pyrazosulfuron-ethyl (300 g/ha) during the both the years (**Table 3 and 4**).

Table 3. Weeds biomass (g/m^2) and WCE as affected by different treatments in sugarcane (1st season-2015-16)

Treatment	Weed biomass (g/m^2) at 45 DAP				WCE	Weed biomass (g/m^2) at 75 DAP				WCE
	Grasses	BLW	Sedges	Total	(%)	Grasses	BLW	Sedges	Total	(%)
Pyrazosulfuron-ethyl + metribuzin + 2,4-D sodium salt WDG (3000 g/ha)	18.5 (4.42)	15.5 (4.06)	8.7 (3.11)	42.7 (6.61)	86.4	21.5 (4.74)	16.2 (4.15)	9.3 (3.20)	47.0 (6.92)	85.5
Pyrazosulfuron-ethyl (300 g/ha)	98.5 (9.97)	18.5 (4.42)	14.2 (3.90)	131.2 (11.5)	58.2	102.5 (10.17)	19.2 (4.49)	14.8 (3.97)	136.5 (11.73)	57.8
2,4-D sodium salt (3250 g/ha)	100.2 (10.06)	21.8 (4.77)	45.2 (6.80)	167.2 (12.97)	46.7	105.0 (10.30)	26.5 (5.24)	46.8 (6.91)	178.3 (13.39)	44.8
Metribuzin (2000 g/ha)	51.00 (7.21)	18.5 (4.42)	42.8 (6.62)	112.3 (10.6)	64.2	55.2 (7.50)	25.2 (5.12)	43.2 (6.65)	123.6 (11.16)	61.8
Hand weeding at 30 and 60 DAP	14.0 (3.87)	10.5 (3.39)	3.5 (2.12)	28.0 (5.39)	91.1	15.2 (4.02)	11.2 (3.49)	4.3 (2.29)	30.7 (5.63)	90.5
Weedy check	148.6 (12.23)	105.0 (10.30)	60.3 (7.83)	313.9 (17.7)	-	152.5 (12.39)	108.5 (10.5)	62.3 (7.96)	323.3 (18.01)	-
LSD (p=0.05)	0.85	0.64	0.71	1.21	5.24	0.84	0.42	0.65	0.92	6.21

Figures in the parentheses are square root transformed values ($\sqrt{x+1}$); DAP: Days after planting; BLW = Broad-leaved weeds

Table 4. Weed biomass (g/m2) and weed control efficiency (WCE) as affected by treatments in sugarcane (2nd season-2016-17)

Treatment	Weed biomass (g/m^2) at 45 DAP				WCE (%)	Weed biomass (g/m^2) at 75 DAP				WCE (%)
	Grasses	BLW	Sedges	Total		Grasses	BLW	Sedges	Total	
Pyrazosulfuron-ethyl + metribuzin + 2,4-D sodium salt WDG (3000 g/ha)	15.8 (4.10)	13.2 (3.77)	7.1 (2.85)	36.1 (6.09)	87.1	17.2 (4.27)	12.5 (3.68)	6.8 (2.79)	36.5 (6.12)	86.3
Pyrazosulfuron-ethyl (300 g/ha)	99.2 (10.0)	19.4 (4.52)	15.1 (4.01)	133.7 (11.6)	52.2	103.5 (10.22)	19.8 (4.56)	15.3 (4.04)	138.6 (11.82)	47.9
2,4-D sodium salt (3250 g/ha)	97.8 (9.94)	20.2 (4.60)	46.8 (6.91)	164.8 (12.88)	41.1	99.0 (10.00)	19.2 (4.49)	47.8 (6.99)	166 (12.92)	40.7
Metribuzin (2000 g/ha)	54.1 (7.42)	18.5 (4.42)	43.5 (6.67)	116.1 (10.82)	58.5	57.5 (7.65)	18.5 (4.42)	46.2 (6.87)	122.2 (11.10)	56.4
Hand weeding at 30 and 60 DAP	12.6 (3.69)	8.2 (3.03)	4.2 (2.28)	25.0 (5.10)	91.1	12.0 (3.60)	5.0 (2.45)	4.0 (2.23)	21.0 (4.69)	92.1
Weedy check	132.5 (11.6)	93.2 (9.71)	54.3 (7.43)	280.0 (16.8)	-	125.9 (11.26)	88.5 (9.46)	51.6 (7.25)	266.0 (16.34)	-
LSD (p=0.05)	0.52	0.68	0.74	0.98	4.98	0.58	0.68	0.84	0.74	7.24

Figures in the parentheses are square root transformed values ($\sqrt{x+1}$); DAP: Days after planting; BLW = Broad-leaved weeds

Table 5. Sugarcane yield and yield attributes as affected by different herbicidal treatments

Treatment	1st season-2015-16				2nd season –2016-17			
	No. of millable canes/ha	Length of millable cane (cm)	Cane diameter (cm)	Cane yield (t/ha)	No. of millable canes/ha	Length of millable cane (cm)	Cane diameter (cm)	Cane yield (t/ha)
Pyrazosulfuron-ethyl + metribuzin + 2,4-D sodium salt WDG (3000 g/ha)	95963	255.3	3.01	119.5	97521	260.1	3.05	122.7
Pyrazosulfuron-ethyl (300 g/ha)	93652	245.6	2.95	110.2	95325	250.2	2.98	111.2
2,4-D sodium salt (3250 g/ha)	93021	241.3	2.85	105.2	94125	245.2	2.85	106.2
Metribuzin (2000 g/ha)	93125	242.3	2.91	108.5	94250	248.1	2.95	109.5
Hand weeding at 30 and 60 DAP	98000	261.5	3.13	121.0	99500	265.5	3.14	125.5
Weedy check	58000	231.5	2.77	75.2	58900	225.3	2.74	76.2
LSD (p=0.05)	2138	7.32	0.14	1.52	1824	6.45	0.10	1.35

DAP= Days after planting

On an average, weeds competition throughout the crop period caused 38.5% reduction in the millable cane yield when compared with hand weeding twice at 30 and 60 DAP (**Table 5**). Singh *et al.* (2012**)** stated that, on an average, presence of total weeds throughout the crop period caused 55.94% reduction in the ratoon cane yield. Post-emergence application of pyrazosulfuron-ethyl + metribuzin + 2,4-D sodium salt (3000 g/ha) recorded significantly the highest number of canes (95963/ha, 97521/ha), length of millable cane (255.3 cm, 260.1 cm), cane diameter (3.01 cm, 3.05 cm) and higher millable cane yield (119.5 t/ha, 122.7 t/ha) during 2015-16 and 2016-17.

It was concluded that application of pyrazosulfuron-ethyl p + metribuzin p + 2,4-D Sodium salt p (3000 g/ha) at 20-25 DAP followed by one intercultivation and earthing up at 90 DAP was most effective for managing weeds in sugarcane.

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REFERENCES

Chaudhari PM, Ghodke SK, Ombase KC. Potdar DS and Pawar SM. Integrated weed management in sugarcane ratoon crop. *International Journal of Agriculture Sciences* **8**(41): 1841–1843

Gomez KA and. Gomez AA (1984). *Statistical Procedures for Agricultural Research* (2 ed.). John wiley and sons, New York, 680 p.

Singh Rohitashav, Kumar Jitendra, Kumar Pravendra, Tej Pratap, Singh VK, Ram Pal and Panwar Suman. 2012. Effect of integrated weed management practices on sugarcane ratoon and associated weeds. *Indian Journal of Weed Science* **44**(3): 144–146.

Shauhan RS and Srivastava SN. 2002. Influence of weed management practises on weed growth and yield of sugarcane. *Indian Journal of Weed Science* **34**(3&4): 318–319.

Singh R, Shyam R, Tripathi SS and Kumar S. 2008. Integrated weed management studies in spring planted sugarcane. *Indian Journal of Weed Science* **40**(1&2): 85–87.

Takalkar BJ and Pawar BH 2012. World sugar scenario, constraints before sugar industry and strategies for improving sugarcane and sugar yields. pp 11–15. In: *Bhartiya Sugar.* May.