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Oscar Toppo
Z.A.R.S. Powarkheda, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

Pawan K Amrate
Department of Plant Breeding & Genetics, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

A Chatterjee
Z.A.R.S. Powarkheda, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

Ansingh Ninama
Z.A.R.S. Powarkheda, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

Corresponding Author:
Pawan K Amrate
Department of Plant Breeding & Genetics, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

Topramezone 10g/l + atrazine 300 g/l sc an herbicide for controlling narrow and broad-leaved weeds in sugarcane

Oscar Toppo, Pawan K Amrate, A Chatterjee and Ansingh Ninama

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Abstract
To control narrow and broad-leaved weeds in sugarcane, bio efficacy of Topramezone 10g/l + Atrazine 300 g/l SC in different doses along with other herbicides were tested in field conditions during 2016-17. In this experiment, all the treatments of herbicide found to be significant in reducing the weed count and increasing the cane yield in comparison to untreated control. In all the treatments, Topramezone 10g/l + Atrazine 300 g/l SC @ 3500 ml or 1085 g a.i. per ha was found to be superior in controlling all kind of weeds in the sugarcane. The weed control efficiency of above treatment was 72.65, 80.80, 69.11, 90.71, 92.3, 85.17, 83.51 and 77.58 percent for *Echinochloa colonum, Cynadon dactylon, Panicum fasiculatum, Parthenium spp, Amaranthus viridis, Euphorbia spp, Commellina benghalensis* and *Altrenentra sessalis*, respectively. Topramezone 10g/l + Atrazine 300 g/l SC @ 3500 ml or 1085 g a.i./ha was also responded with maximum yield as recorded 107.03 t/ha against 76.53 t/ha in untreated control.

Keywords: Sugarcane, herbicide, topramezone, yield

Introduction
Sugarcane (*Saccharum officinarum* L.) also known as "Wonder cane" is very important cash cum industrial crop in India. It has vast capability to grow in almost all agro-ecological situations. The cane is majorly used in production of white sugar, bio-fuels, ethanol and cogeneration of electricity. It plays very important role in Indian economy with occupation of about 2.57 percent (5 M ha.) of total cropped area and contributes with nearly 10 percent of agricultural GDP [1]. Because of perennial crop, weed infestation is always a create problem with considerable yield reduction. Moreover, the delayed germination of crop, slow initial growth, wide row space and enough supply of nutrients always contributes towards more weed populations in the crop. It has been recorded that weeds in sugarcane can cause 12 to 72 percent yield reduction depending on the severity [2]. Many researchers have also been assessed losses in cane yield ranging between 12 to 83 percent due to weeds in sugarcane [3] [4]. In Madhya Pradesh, sugarcane cultivation is restricted to few districts and productivity is also low as compared to other states. In present scenario large scale weed management by cultural methods is becoming very difficult due to low availability of labour and increasing cost issue. It has been also estimated that the weed management in sugarcane by application herbicides is an economic measure [5]. So far, many herbicides have been experimented and recommended for weed management in sugarcane. In continuation, an attempt was experimented to reveal efficacy of some herbicides against broad and narrow leaved weeds complex under field conditions in sugarcane.

Material and methods
During (2016-17) a field experiment was conducted to evaluate bio-efficacy of some herbicides in controlling grasses, sedge and broad-leaf weeds in sugarcane at Zonal Agricultural Research Station, Powarkheda, Hoshangabad (MP). This trial included Topramezone 10g/l+ Atrazine 300 g/l SC and other herbicides with different doses along with untreated control. The experiment was laid out in randomized block design with three replications. Three budded sets of sugarcane variety, Co-06027 was planted in the month of January, 2016 with gross plot size of 7.2 × 6.0 m^2 and spacing between row to row kept 120

cm. During the whole cropping period, all recommended packages and practices were followed. Herbicides were applied as pre-emergence within five days after planting with using spray volume of 600 liters per hectare. The number of weed flora were counted at 30, 45 and 60 DAS by using quadrate (1 × 1 m^2) placed randomly in all the plots of the experimental field and weed population was expressed in number/ m^2. The weeds were collected from net plot area and allowed to sun-dry and calculation of weed control efficiency was done as mentioned below.

WCE (%) = {(DW_c - DW_T)/ DW_c} x 100

Where, WCE = Weed control efficiency, DW_C = Dry matter accumulation of weeds in unweeded control, DW_T = Dry matter accumulation of weeds in treated plot

The higher dose of Topramezone 10g/l+ Atrazine 300 g/l SC was also evaluated for any phytotoxicity effect on sugarcane crop. Phyto-toxicity like chlorosis, necrosis, wilting, scorching, hyponasty and epinasty was recorded at 1, 3, 5, 7 and 10 days after herbicide application by using following scale:

Phytotoxicity Rating Scale (PRS)					
Crop response/ injury	**Rating**	**Crop response/ injury**	**Rating**	**Crop response/ injury**	**Rating**
0-00 Percent	0	31-40 percent	4	71-80 percent	8
1-10 percent	1	41-50 percent	5	81-90 percent	9
11-20 percent	2	51-60 percent	6	91-100 percent	10
21-30 percent	3	61-70 percent	7	-	-

Table 1: Details of treatments including phytotoxicity doses

Tr. No.	Treatment details	Dose/ha	
		a.i (g)	Formulation (ml)
1.	Topramezone 10g/l + Atrazine 300 g/l SC	775	2500
2.	Topramezone 10g/l + Atrazine 300 g/l SC	930	3000
3.	Topramezone 10g/l + Atrazine 300 g/l SC	1085	3500
4.	Topramezone 336 g/l SC	25.2	75
5.	Atrazine 50% WP	1000	2000
6.	2,4-D 58% SL	3500	6300
7.	Control	-	--
8.	Topramezone 10g/l + Atrazine 300 g/l SC*	1860	6000

*Applied for Phytotoxicity observations

Result of Bio-efficacy of Topramezone 10g/l + Atrazine 300 g/l SC and other herbicides are presented in table 2, 3, 4 and 5.

Table 2: Effect of different herbicidal application on monocot weeds in sugarcane during 2016-17

Treatments	Monocot weeds / sq.m.														
	Echinochloa colonum					*Cynadon dactylon*					*Panicum fasiculatum*				
	30 DAS	45 DAS	60 DAS	DWB (g/m^2)	WCE %	30 DAS	45 DAS	60 DAS	DWB (g/m^2)	WCE %	30 DAS	45 DAS	60 DAS	DWB (g/m^2)	WCE %
Topramezone 10 g/l + Atrazine 300 g/l SC @ 2500 ml/ha	4.00	5.67	6.33	2.35	54.53	3.94	4.33	5.24	1.64	53.62	5.56	6.33	7.90	2.32	34.15
Topramezone 10 g/l + Atrazine 300 g/l SC @ 3000 ml/ha	2.33	3.20	4.33	1.60	68.78	1.64	2.64	3.95	1.32	66.70	2.04	3.52	4.11	1.21	66.74
Topramezone 10 g/l + Atrazine 300 g/l SC @ 3500 ml/ha	1.84	2.62	3.77	1.40	72.65	0.29	1.56	2.10	0.70	80.80	1.28	2.67	3.55	1.04	69.11
Topramezone 336 g/l SC @ 75 ml/ha	2.82	4.16	5.00	1.85	63.86	2.47	3.33	4.71	1.57	58.79	3.16	4.33	6.07	1.78	49.88
Atrazine 50% WP @ 2000 kg/ha	5.24	5.96	6.67	2.47	51.50	4.33	5.67	6.60	2.06	42.31	5.97	6.24	7.37	2.17	37.56
2,4-D 58% SL @ 6300 ml/ha	8.00	9.64	10.60	3.93	23.51	6.82	8.67	9.28	3.09	22.72	7.47	8.62	9.36	2.75	22.26
Control	10.67	12.33	13.85	5.13	-	8.07	10.00	11.97	3.99	-	9.56	10.56	12.15	3.57	-
SE (m)	-	-	0.82	0.30	-	-	-	0.90	0.29	-	-	-	0.78	0.22	-
C.D. 5%	-	-	2.47	0.92	-	-	-	2.72	0.87	-	-	-	2.34	0.68	-

*DWB – Dry Weed Biomass

Table 3: Effect of different herbicidal application on dicot weeds in sugarcane during 2016-17

Treatments	Dicot weeds / sq.m.														
	Parthenium spp					Amaranthus viridis					Euphorbia spp				
	30 DAS	45 DAS	60 DAS	DWB (g/m^2)	WCE %	30 DAS	45 DAS	60 DAS	DWB (g/m^2)	WCE %	30 DAS	45 DAS	60 DAS	DWB (g/m^2)	WCE %
Topramezone 10g/l + Atrazine 300 g/l SC @ 2500 ml /ha	4.14	5.62	7.17	2.24	77.51	4.62	5.67	6.59	2.34	78.72	4.33	5.00	7.77	2.60	44.74
Topramezone 10g/l + Atrazine 300 g/l SC @ 3000 ml /ha	2.72	3.67	3.78	1.18	88.16	1.33	2.37	3.78	1.34	87.71	1.67	2.33	3.19	1.08	77.17
Topramezone 10g/l + Atrazine 300 g/l SC @ 3500 ml /ha	1.33	2.00	3.01	0.93	90.71	0.67	1.50	2.43	0.88	92.30	0.33	1.82	2.10	0.69	85.17

Topramezone 336 g/l SC @ 75 ml/ha	3.33	4.52	5.26	1.65	83.71	2.83	3.62	4.86	1.73	84.34	2.16	3.56	4.61	1.56	66.83
Atrazine 50% WP @ 2000 kg/ha	4.46	5.48	6.53	2.04	79.73	5.83	6.83	7.17	2.56	76.98	6.90	7.67	8.59	2.86	39.04
2,4-D 58% SL @ 6300 ml/ha	6.54	8.46	9.77	3.05	69.84	8.33	9.82	10.58	3.79	66.07	8.40	9.93	10.71	3.60	23.61
Control	8.83	9.39	11.64	3.65	-	10.36	13.67	14.10	5.03	-	9.82	12.62	14.08	4.70	-
SE (m)	-	-	0.57	0.18	-	-	-	0.71	0.24	-	-	-	0.63	0.20	-
C.D. 5%	-	-	1.72	0.56	-	-	-	2.13	0.73	-	-	-	1.89	0.62	-

*DWB – Dry Weed Biomass

Table 4: Effect of different herbicidal application on dicot weeds in sugarcane during 2016-17

Treatments	Dicot weeds / sq.m.														
	Commellina benghalensis					*Altrenentra sessalis*					*Portulaca oleracea*				
	30 DAS	45 DAS	60 DAS	DWB (g/m^2)	WCE %	30 DAS	45 DAS	60 DAS	DWB (g/m^2)	WCE %	30 DAS	45 DAS	60 DAS	DWB (g/m^2)	WCE %
Topramezone 10g/l + Atrazine 300 g/l SC @ 2500 ml/ha	4.40	4.02	4.67	1.64	73.82	2.04	3.05	4.00	1.30	67.33	2.86	3.34	4.33	1.78	58.50
Topramezone 10g/l + Atrazine 300 g/l SC **@** 3000 ml/ha	2.44	3.21	3.67	1.40	79.58	2.13	3.00	3.33	1.09	72.09	1.17	2.78	2.67	1.07	74.24
Topramezone 10g/l + Atrazine 300 g/l SC @ 3500 ml/ha	1.63	2.20	3.00	1.04	83.51	1.76	2.25	2.67	0.87	77.58	0.75	1.06	2.00	0.80	81.90
Topramezone 336 g/l SC @ 75 ml/ha	4.32	4.87	5.00	1.75	71.96	3.30	3.98	5.33	1.74	55.46	1.96	2.80	3.33	1.33	68.43
Atrazine 50% WP @ 2000 kg/ha	3.33	6.76	7.67	2.67	57.53	3.31	5.64	7.33	2.39	42.06	5.63	6.10	6.67	2.67	36.87
2,4-D 58% SL @ 6300 ml/ha	6.86	8.83	9.67	3.38	45.98	5.84	7.48	9.33	3.05	24.70	4.46	5.32	7.00	2.80	33.16
Control	9.35	12.46	18.00	6.28	-	8.90	10.83	13.00	4.25	-	6.33	8.62	10.67	4.27	-
SE (m)	-	-	0.40	0.14	-	-	-	0.52	0.28	-	-	-	0.42	0.18	-
C.D. 5%	-	-	1.19	0.42	-	-	-	1.56	0.82	-	-	-	1.26	0.52	-

Table 5: Effect of different herbicidal application on sugarcane yield (t/ha) during 2016-17

Treatments	Sugarcane Yield (t/ha)	Percent yield Increase
Topramezone 10g/l + Atrazine 300 g/l SC @ 2500 ml/ha	97.00	26.73
Topramezone 10g/l + Atrazine 300 g/l SC **@** 3000 ml/ha	102.30	33.67
Topramezone 10g/l + Atrazine 300 g/l SC @ 3500 ml/ha	107.03	39.85
Topramezone 336 g/l SC @ 75 ml/ha	98.00	28.05
Atrazine 50% WP @ 2000 kg/ha	89.20	16.55
2,4-D 58% SL @ 6300 ml/ha	85.23	11.36
Control	76.53	-
SE (m)	1.48	-
C.D. 5%	4.36	-

Result and Discussion

Effect on monocot weeds Majorly three weeds *i. e. Echinochloa colonum, Cynadon dactylon, Panicum fasiculatum* were observed in different treatments. Weed count was significantly reduced by all the herbicidal treatments in comparison to untreated control. Topramezone 10 g/l + Atrazine 300 g/l SC @ 3500 ml /ha was found to be best as recorded lowest weed populations of 3.77, 2.10 and 3.55 in comparison to highest weed density viz. 13.85, 11.97 and 12.15 of *Echinochloa colonum, Cynadon dactylon, Panicum fasiculatum* in control, respectively at 60 days after sowing of sugarcane. On the basis of dry weed biomass, the highest weed control efficiency i.e. 72.65, 80.80 and 69.11 percent was also recorded by above treatment for the entire three weeds, respectively. However, weed control efficiency of Topramezone 10 g/l + Atrazine 300 g/l SC @ 3500 ml/ha and 3000 ml/ha was significantly at par to each other.

Effect on dicot weeds During evaluation six dicot weeds were observed and among this, five i.e. *Parthenium spp, Amaranthus viridis, Euphorbia spp, Commellina benghalensis* and *Altrenentra sessalis* were found to be prominent in all the treatments. All the herbicidal treatments were found to be significantly effective in controlling the weeds in compare to untreated control. The lowest weed count viz. 3.01, 2.43, 2.10, 3.00 and 2.67 were recorded from treatment of Topramezone 10 g/l + Atrazine 300 g/l SC @ 3500 ml/ha as against highest in untreated viz. 11.64, 14.10, 14.08, 18.00 and 13.00 for *Parthenium spp, Amaranthus viridis, Euphorbia spp, Commellina benghalensis* and *Altrenentra sessalis*, respectively at 60 day after sowing. The maximum weed control efficiency i.e. 90.71, 92.30, 85.17, 83.51 and 77.58 percent was also recorded by above treatment for the entire five weeds, respectively. Similarly, as in the monocot's weeds, weed control efficiency of both higher doses i.e Topramezone 10 g/l + Atrazine 300 g/l SC @ 3500 ml/ha and 3000 ml/ha were significantly at par.

Effect on Cane yield the cane in different treatments revealed that all chemical treatments were significantly superior over control. The highest cane yield was harvested from the plot treated with Topramezone 10 g/l + Atrazine 300 g/l SC @ 3500 ml/ha (107.03 t/ha) followed by Topramezone 10 g/l + Atrazine 300 g/l SC @ 3000 ml/ha (102.30 t/ha).

Phytotoxic effect on plants No phytotoxicity symptoms on any plant was observed from application of Topramezone 10g/l + Atrazine 300 g/l SC @ 6000 ml/ha.

Previously, many workers found that herbicidal application is important weed management practices in sugarcane. The highest cane yield was recorded with the treatment of Metribuzine 70 percent WP @ 1 Kg/ha (POE) along with 2,4

D sodium salt 80 percent WP tank mixed [6]. The highest pooled cane yield was obtained with pre-emergence application of metribuzin 1.4 kg/ha *and* 2,4-D 1.6 kg/ha at 45 days after ratoon initiation [7]. Weed control efficacy of Topramezone + Atrazine was recorded in maize and this combination was also gave higher yield in comparison to control [8].

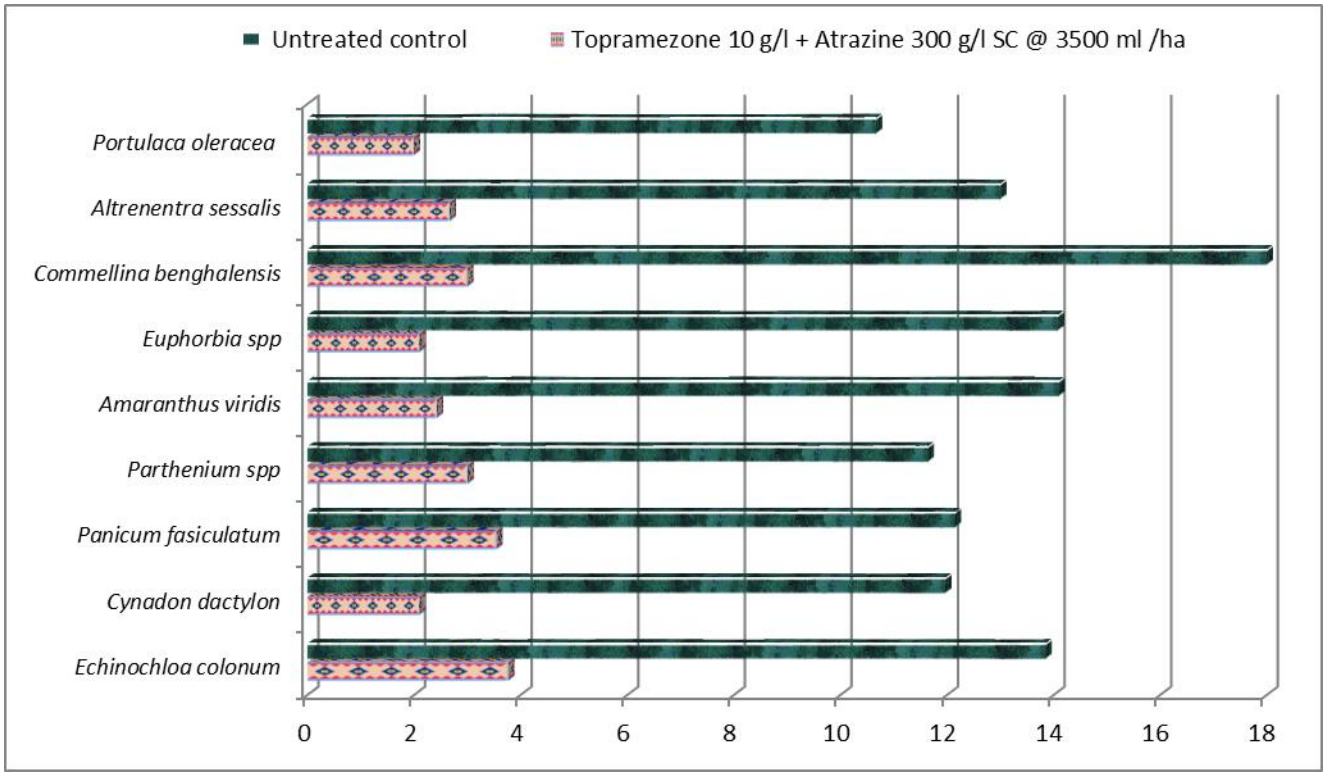

Fig 1: Weed count per meter^2 in untreated control and Topramezone 10g/l + Atrazine 300 g/l SC @ 3500 ml /ha in sugarcane

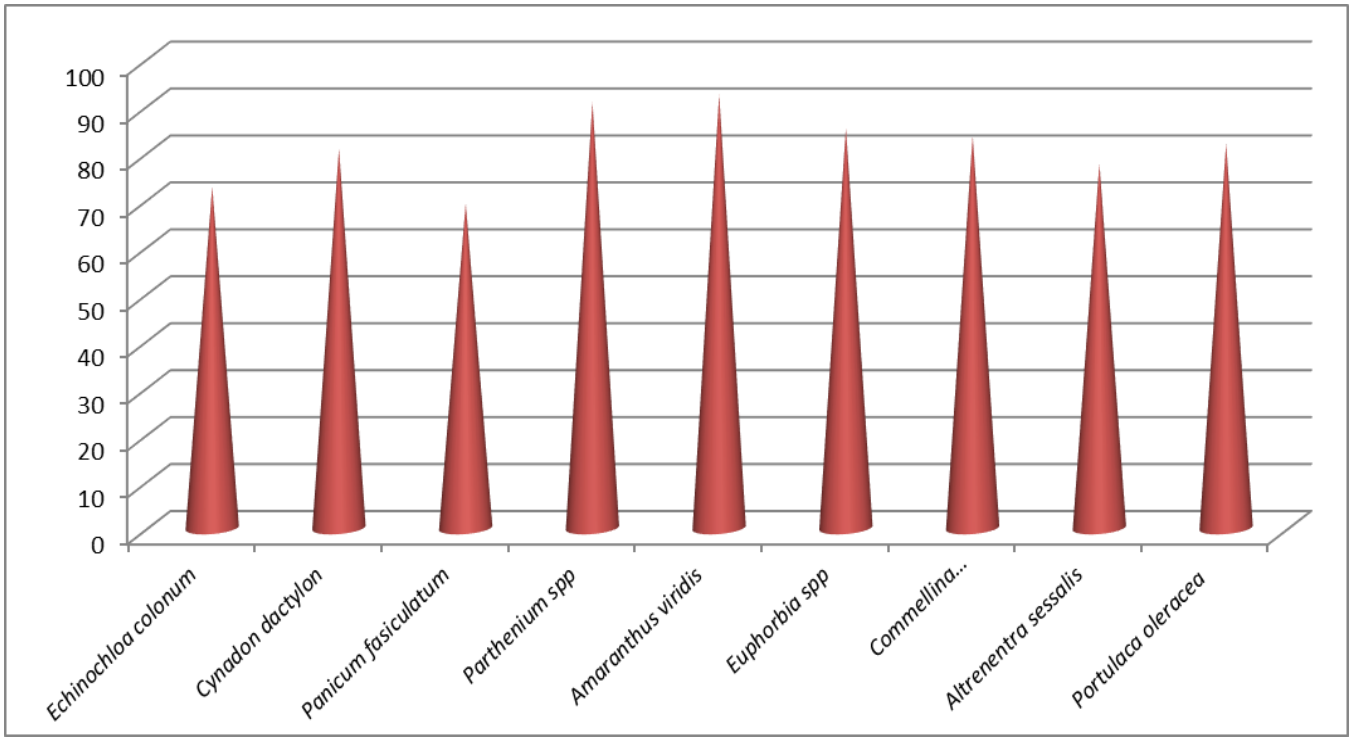

Fig 2: Weed control efficiency of Topramezone 10g/l + Atrazine 300 g/l SC @ 3500 ml/ha in sugarcane.

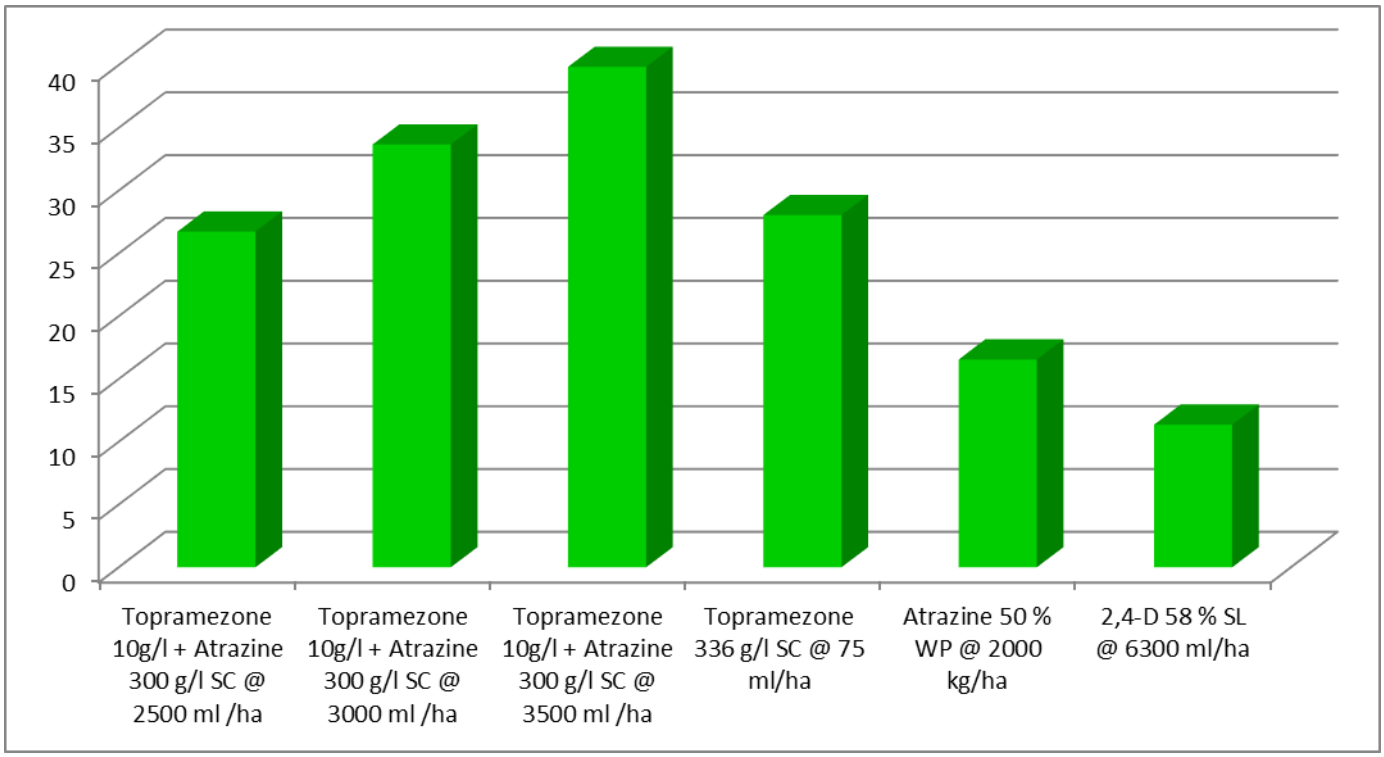

Fig 3: Percent yield increase of sugarcane by the application of different treatments.

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