International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2021; 9(2): 324-326

Received: 01-12-2020
Accepted: 06-02-2021

Anoop Kumar Devedee
Research Scholar, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

RK Singh
Professor, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

RN Meena
Associate Professor, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Corresponding Author:
Anoop Kumar Devedee
Research Scholar, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Effect of different herbicide combinations with allelopathic plant extracts on physiological characters of sugarcane (*Saccharum officinarum* L.)

Anoop Kumar Devedee, RK Singh and RN Meena

DOI: https://doi.org/10.22271/chemi.2021.v9.i2e.11831

Abstract
A field experimented was conducted at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh during spring season of 2018-19 and 2019-20 to study the effect of different herbicide combinations with allelopathic plant extracts on physiological character of sugarcane. The results reveals that the physiological characters of sugarcane namely number of physiologically active leaves, leaf area index and chlorophyll content (SPAD value) were failed with application of different herbicide combination with allelopathic plant extracts during both the years of study. However, maximum values was observed in weed free (3 hand weeding at 30, 60 and 90 DAP) during both the years.

Keywords: Allelopathic, chlorophyll, leaf area physiological and sugarcane

Introduction
Sugarcane, an old energy source for human beings and more recently, a replacement of fossil fuels for motor vehicles, was first grown in South East-Asia and Western India. India ranks second in sugarcane grown area and production after Brazil. Sugarcane accounts for an area and production of around about 5.04 m ha and 411.16 mt, respectively and average productivity of 81.5 t ha^{-1} in India (IISR, 2020) [3]. Uttar Pradesh has the prime position in area and production of sugarcane, accounting for about 2.18 m ha area and 179.71 mt of production (IISR, 2020) [3]. In India, productivity of sugarcane is low as compared to other sugarcane growing countries of the world due to higher weed infestation.
Now a day's dependence and enormous use of single herbicide or herbicides having the same mode of action may result in the development of resistance in weeds and accumulation of residue in the soil in long term via continuous use of the same herbicide in same season. So there is urgent need to controlling of weeds through allelopathic plant extracts combined with herbicides is a new option (Cheema and Khaliq, 2000) [1]. In the development of any new weed control strategy, safety and efficacy are the two primary concerns. Therefore, safety (in relation to plants, environment and human health) and efficacy (in relation to environmental tolerance, level of damage to the weed and ability to be integrated within the crop production system) are the major criteria in the selection of suitable allelopathy extracts (Singh *et al*., 2005) [7].
However, information regarding controlling of weeds by different herbicide combination with allelopathic plant extracts for sugarcane in Uttar Pradesh is lacking. Keeping in view the above discussed facts of sufficient information and Sparce related research, the present investigation was undertaken to find out the effect of different herbicide combination with allelopathic plant extracts for weed management in sugarcane.

Materials and Methods
An experiment was conducted during two successive spring season of 2018-19 and 2019-20, at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh (situated at 25º10' N latitude and 83º03' E longitude with an altitude of 128.93 m above mean sea level).

The soil was sandy clay loam in texture having a pH of 7.26, EC 0.29 (dSm^{-1}), low in organic carbon (0.40%) and low available nitrogen (226.83 kg ha^{-1}), medium in available phosphorus (17.70 kg ha^{-1}) and potassium (236.92 kg ha^{-1}). The experiment was conducted in randomized block design with replicate thrice consisted of twelve treatments *viz.* (T_1) Halosulfuron methyl + Metribuzin, (T_2) Halosulfuron methyl + Metribuzin (75% R.D) + 25% SWE, (T_3) Halosulfuron methyl + Metribuzin (75% of R.D) + 25% SUWE, (T_4) Halosulfuron methyl + Metribuzin (75% of R.D) + 25% PWE, (T_5) Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SWE + 25% SUWE, (T_6) Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SWE + 25% PWE, (T_7) Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SUWE + 25% PWE, (T_8) Halosulfuron methyl + Metribuzin (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE, (T_9) Halosulfuron (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE, (T_{10}) Metribuzin (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE, (T_{11}) Weed free (3 hand Weeding) and (T_{12}) Weedy check (control). The treatments were allocated randomly to each plot. Urea, di ammonium phosphate and murate of potash were used as a source of nitrogen, phosphorus and potassium. The crop was uniformly fertilized with 180 kg N, 80 kg P_2O_5 and 60 kg K_2O ha^{-1} giving a full dose of phosphorus and potassium as basal and nitrogen applied as basal as well as top dressing. The total rainfall experienced during the crop growth season was 824.5 mm in 2018-19 and 1197 mm in 2019-20. Effective rainfall was also brought into concern for irrigation. Seed canes were obtained from healthy cultivar Co 239 (Karan 6), which is fit for the spring season. Canes were cut into 3 budded setts and treated with 0.25% solution of emissan for 10-15 minutes to check any fungal disease. The crop was planted in the 2nd week of April during both the years. The herbicide combination with allelopathic plant extracts spray was applied at 3, 30 and 60 days after planting. The treated setts were set horizontally at 75 cm distance from row to row. After planting, the setts were covered with loose soil. Other crop management methods were accompanied as per the recommendation of the area.

Statistical analysis and interpretation of data

Data recorded on relative composition of weeds in the experiment was subjected to analysis by using Fisher's method of analysis of variance (ANOVA) and interpreted as outlined by Gomez and Gomez (1984) [2]. The levels of significance used in 'F' and 't' test was p= 0.05. Critical difference values were calculated where F test was found significant.

Results and Discussions

The outcomes of the study showed that different herbicide combination with allelopathic plant extracts failed to show any significant effect on number of physiological active leaves, leaf area index and chlorophyll content (SPAD values) at different intervals except number of physiological active leaves at 200 DAP during 2019-20 are presented in Table 1-3. In general, the physiologically active leaves and leaf area index showed an increasing trend up to grand growth stage (200 DAP) and decline thereafter irrespective of the treatments.

Further, perusal of data (Table 1) advocated that crop grown with any of the herbicide combination with allelopathic plant extracts had marginally higher physiologically active leaves in comparison to weedy plot. The highest physiologically active leaves was recorded in crop given three hoeings at 30, 60 and 90 days after planting (weed free) at all the crop growth stages though it did not differ significantly from any of the treatments except 200 DAP during second year. The maximum number of physiologically active leaves was recorded with pre-emergence application of halosulfuron methyl + metribuzin at all growth stages during both the year of study. These results are related with those of Mohamed *et al*. (1990) [5] and Singh *et al*. (2001) [6].

Data enumerated in Table 2 varied non-significant values with herbicide combination with allelopathic plant extracts on leaf area index. Perusal of the data revealed that three Hoeings at 30, 60 and 90 DAP (weed free) exerted maximum leaf area index as compared to other treatments at all the growth stages in both the years. Among the herbicide and combinations with allelopathic plant extracts treatments, the maximum leaf area index (3.69 and 4.92) was recorded with pre-emergence application of halosulfuron methyl + metribuzin at 120 DAP. Similar trend was observed in the first year at 200 DAP and second year at harvest stage. During second year of the experiment at 200 DAP and first year at harvest stage maximum leaf area was observed with application of halosulfuron methyl + metribuzin (50% R.D) + 25% SWE + 25% SUWE having values of 6.34 and 3.71. However, least leaf area index was observed with weedy check (control) at all growth stages during both the years of the study. The results are in accordance with the earlier findings of Kumar and Srivastava (1991) [4].

A cursory glance of Table 3 revealed that maximum value of chlorophyll content was observed with pre-emergence application of halosulfuron methyl + metribuzin (75% R.D) + 25% SWE at all growth stages during both the years except at 90 DAP and at harvest in first year experimentation. However, least chlorophyll content was observed with weedy check (control) at all growth stages during both the years of the study. The results are in accordance with the earlier findings of Kumar and Srivastava (1991) [4].

Table 1: Effect of different herbicide combinations with allelopathic plant extracts on physiological active leaves (no.) of sugarcane

Treatment		Dose (g a.i. ha^{-1})	120 DAP		200 DAP		At harvest	
			2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
T_1	Halosulfuron methyl + Metribuzin	67 .5+ 652.5	11.08	10.69	13.62	14.89	8.43	7.33
T_2	Halosulfuron methyl + Metribuzin (75% R.D) + 25% SWE	50.62 + 421.8	10.06	10.43	12.27	13.54	7.75	7.18
T_3	Halosulfuron methyl + Metribuzin (75% of R.D) + 25% SUWE	50.62 + 421.8	10.04	10.15	12.04	13.31	7.52	6.99
T_4	Halosulfuron methyl + Metribuzin (75% of R.D) + 25% PWE	50.62 + 421.8	10.19	10.30	12.09	13.36	7.57	6.67
T_5	Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SWE + 25% SUWE	33.6 + 281.25	11.00	10.16	13.23	14.50	8.38	7.24
T_6	Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SWE + 25% PWE	33.6 + 281.25	10.73	10.65	12.62	13.89	8.10	6.86
T_7	Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SUWE + 25% PWE	33.6 + 281.25	10.18	10.00	12.41	13.68	7.89	6.92
T_8	Halosulfuron methyl + Metribuzin (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE	16.8 + 140.62	10.29	10.29	12.13	13.40	7.94	6.77

T_9	Halosulfuron (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE	16.8	10.00	9.92	11.48	12.75	7.29	6.62
T_{10}	Metribuzin (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE	140.62	10.22	9.54	11.75	13.02	7.23	6.66
T_{11}	Weed free (3 hand Weeding)	-	12.03	10.97	14.26	15.53	9.07	7.42
T_{12}	Weedy check (control)	-	10.94	9.54	10.93	10.53	8.08	6.73
SEm±		-	0.42	0.34	0.62	0.53	0.38	0.26
LSD (*P=0.05*)		-	NS	NS	NS	1.56	NS	NS

SWE- Sorghum water extract, SUWE- Sunflower water extract, PWE- Parthenium water extract

Table 2: Effect of different herbicide combinations with allelopathic plant extracts on leaf area index of sugarcane

Treatment		Dose (g a.i. ha^{-1})	120 DAP		200 DAP		At harvest	
			2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
T_1	Halosulfuron methyl + Metribuzin	67 .5+ 652.5	3.69	4.92	5.99	6.28	3.62	3.89
T_2	Halosulfuron methyl + Metribuzin (75% R.D) + 25% SWE	50.62 + 421.8	3.52	4.78	5.52	5.89	3.52	3.79
T_3	Halosulfuron methyl + Metribuzin (75% of R.D) + 25% SUWE	50.62 + 421.8	3.50	4.75	5.50	5.87	3.51	3.78
T_4	Halosulfuron methyl + Metribuzin (75% of R.D) + 25% PWE	50.62 + 421.8	3.44	4.70	5.44	5.81	3.44	3.74
T_5	Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SWE + 25% SUWE	33.6 + 281.25	3.67	4.86	6.12	6.34	3.71	3.86
T_6	Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SWE + 25% PWE	33.6 + 281.25	3.42	4.71	5.45	5.82	3.45	3.71
T_7	Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SUWE + 25% PWE	33.6 + 281.25	3.41	4.64	5.41	5.78	3.41	3.68
T_8	Halosulfuron methyl + Metribuzin (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE	16.8 + 140.62	3.39	4.66	5.36	5.73	3.36	3.59
T_9	Halosulfuron (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE	16.8	3.24	4.50	5.31	5.68	3.34	3.60
T_{10}	Metribuzin (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE	140.62	3.31	4.47	5.29	5.66	3.32	3.58
T_{11}	Weed free (3 hand Weeding)	-	3.85	4.96	6.17	6.55	3.87	4.05
T_{12}	Weedy check (control)	-	3.21	4.24	5.19	5.53	3.19	3.45
SEm±		-	0.21	0.14	0.22	0.23	0.16	0.12
LSD (*P=0.05*)		-	NS	NS	NS	NS	NS	NS

SWE- Sorghum water extract, SUWE- Sunflower water extract, PWE- Parthenium water extract

Table 3: Effect of different herbicide combinations with allelopathic plant extracts on chlorophyll content by SPAD reading of sugarcane

Treatment		Dose (g a.i. ha^{-1})	90 DAP	120 DAP		150 DAP		180 DAP	
			2018-19	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
T_1	Halosulfuron methyl + Metribuzin	67 .5+ 652.5	57.07	58.36	55.34	57.23	53.45	55.68	55.68	58.88
T_2	Halosulfuron methyl + Metribuzin (75% R.D) + 25% SWE	50.62 + 421.8	59.23	60.52	57.50	59.39	55.61	57.84	57.84	61.04
T_3	Halosulfuron methyl + Metribuzin (75% of R.D) + 25% SUWE	50.62 + 421.8	56.97	58.26	55.24	57.13	53.35	55.58	55.58	58.78
T_4	Halosulfuron methyl + Metribuzin (75% of R.D) + 25% PWE	50.62 + 421.8	58.19	59.48	56.46	58.35	54.57	56.80	56.80	60.00
T_5	Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SWE + 25% SUWE	33.6 + 281.25	56.29	57.58	54.56	56.45	52.67	54.90	58.23	58.10
T_6	Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SWE + 25% PWE	33.6 + 281.25	59.79	60.42	57.40	59.29	55.51	57.74	57.74	60.94
T_7	Halosulfuron methyl + Metribuzin (50% of R.D) + 25% SUWE + 25% PWE	33.6 + 281.25	56.41	57.60	54.68	56.57	52.79	55.02	55.02	58.22
T_8	Halosulfuron methyl + Metribuzin (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE	16.8 + 140.62	56.36	57.56	54.63	56.52	52.74	54.97	54.97	58.17
T_9	Halosulfuron (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE	16.8	56.72	57.91	54.99	56.88	53.10	55.33	55.33	58.53
T_{10}	Metribuzin (25% of R.D) + 25% SWE+ 25% SUWE + 25% PWE	140.62	54.73	55.92	54.33	54.89	52.44	53.34	53.34	56.54
T_{11}	Weed free (3 hand Weeding)	-	55.54	56.73	53.81	55.70	51.92	54.15	54.15	57.35
T_{12}	Weedy check (control)	-	54.60	55.80	52.87	54.76	50.98	53.21	53.21	56.41
SEm±		-	1.21	1.16	1.14	1.16	1.14	1.16	1.32	1.16
LSD (*P=0.05*)		-	NS	NS	NS	NS	NS	NS	NS	NS

SWE- Sorghum water extract, SUWE- Sunflower water extract, PWE- Parthenium water extract

Conclusion

From data presented it might reasonably be argued that the physiological characters of sugarcane namely number of physiologically active leaves, leaf area index and chlorophyll content (SPAD value) failed with different herbicide combination with allelopathic plant extracts during both the years of study.

References

1. Cheema ZA, Khaliq A. Use of Sorgaab and sorghum mulches for weed control in alfalfa, Pakistan Journal of Agricultural Sciences 2000;37:140-144.
2. Gomez AK, Gomez AA. Statistical Procedures for Agriculture Res. Awiley-Inter Sci. Publication. Johan Wiley and Sons, New York 1984, 680.
3. IISR. Sugarcane and sugar production in India. Available at: www.iisr.nic.in/services-facilities/statnew.htm 2020.
4. Kumar S, Srivastava SNL. Evaluation of pre-emergence and non-selective herbicides in sugarcane. Annals of Applied Biology 1991;118:68-69.
5. Mohammed S, Sen DN. Biology and ecophysiology of *Trianthema portulacastrum* L. (Molluginaceae) in arid ecosystem. Folia Geobotanica & Phytotaxonomica 1990;25(2):145-157.
6. Singh A, Virk AS, Singh J. Efficacy of a new herbicide for the control of weeds in sugarcane, Sugar Tech 2001;3(1&2):63-64.
7. Singh R, Sen D, Singh VK, Rana NS, Kumar S. Effect of weed management practices on spring-planted sugarcane. Indian Journal of Agronomy 2005;50(3):236-238.