The Pharma Innovation Journal 2022; 11(6): 137-140

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(6): 137-140

www.thepharmajournal.com
Received: 06-02-2022
Accepted: 15-05-2022

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Control of *Cyperus rotundus* L. (*Purple nutsedge*) and annual weeds in Spring Maize (*Zea mays* L.) with halosulfuron-methyl and other weed control methods

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Abstract
The field experiment entitled "Control of *Cyperus rotundus* L. (Purple nutsedge) and annual weeds in Spring Maize (*Zea mays* L.) with halosulfuron-methyl and other weed control methods*"* was conducted during Spring season of 2021 at LPU Research Farm, Phagwara, Punjab. The experimental trial was conducted in Radomised Block Design with 15 treatments and 4 replications. The treatments were post-emergence application of halosulfuron-methyl from 45 g/ha, 52.5 g/ha, 60 g/ha, 67.5 g/ha, 75 g/ha,82.5 g/ha, 90 g/ha (T_1 to T_7), earthing up (T_8), 2,4-D amine 0.58 kg/ha as post-em (T_9), atrazine + pendimethalin (1.0 kg + 0.75 kg/ha) as pre-em (T_{10}), tembotrione 110 g/ha as post-em (T_{11}), black plastic mulch (T_{12}), atrazine band (0.33 kg/ha) + straw mulch (T_{13}), two hand weedings (T_{14}), unweeded (control) (T_{15}). From T_1 to T_9 pre-em application of atrazine + pendimethalin (1.0 kg + 0.75 kg/ha) was done to encourage growth of *Cyperus rotundus* by controlling annual weeds. The weed count per sq. m and dry matter of *Cyperus rotundus* recorded to be significantly less in post-em. application of halosulfuron-methyl from 67.5 g/ha to 90 g/ha, 2,4-D amine @ 0.58 kg/ha and black plastic mulch than all other treatments. Also these treatments recorded less dry matter accumulation among all other treatments. The periodic annual weed count (per sq. m) and dry matter accumulation in treatment of 2,4-D amine and tembotrione 110 g/ha recorded to be less and at par with all other weed control treatments except unweeded (control). Also unweeded (control) recorded higher dry matter accumulation by annual weeds than all other treatments. The plant height and dry matter accumulation/plant were significantly higher under the treatments of halosulfuron from 67.5 g/ha to 90 g/ha, 2,4-D amine and black plastic mulch. Significantly more number of leaves per plant were found in treatments of halosulfuron from 67.5 g/ha to 90 g/ha, 2,4-D amine and black plastic mulch than unweeded (control). The number of cobs/plant, cob girth (cm) and test weight recorded to be more in treatments of halosulfuron from 67.5 g/ha to 90 g/ha, 2,4-D amine and black plastic mulch. Significantly highest grain yield was recorded in plots treated with halosulfuron @ 90, 82.5, 75 and 62.5 g/ha (80.6 q/ha, 80.1 q/ha, 78.0 q/ha and 76.2 q/ha resp.) followed by 2,4-D amine (75.0 q/ha) and black plastic mulch (74.6 q/ha). The percent increase of grain yield over control in halosulfuron @ 90, 82.5, 75 and 62.5 g/ha was found to be 42.9%, 42.6%, 41.0% and 39.6% respectively).

Keywords: *Cyperus rotundus*, halosulfuron-methyl, weeds

Introduction
India is one of the largest producers of cereals in the world. Maize is the third important cereal crop after wheat and rice. The largest producer of maize in the world is USA and other maize growing countries are China, Brazil, Mexico, Indonesia, India, France and Argentina. The major maize growing states in India are Madhya Pradesh, Andhra Pradesh, Maharashtra, Bihar, Karnataka, Uttar Pradesh, Rajasthan and Himachal Pradesh. India`s production of maize is about 3 ton ha^{-1} and by it takes 91st place among 168 maize producing countries. The scientific name of maize is *Zea mays* L. having chromosome number 2n = 20 belong to the family Poaceae. It is an annual and C4 type plant. The origin of maize is Central America and Mexico. Maize in India is mainly grown as *Kharif*, *Rabi* and *Spring* season crop. The sowing of spring season maize is done in northern region of India. In Punjab, the spring season maize is sown commonly in districts like Hoshiarpur, Kapurthala, SBS Nagar, Jalandhar and Ropar. The maize grains are great source of vitamins such as vitamin A, C and E, rich source of energy, high carbohydrate content such as glucose, fructose and sucrose which ranges up to 1 to 3%.

Weeds compete with crop for limiting resources like light, space, water and nutrients which cause reduction in the crop production and yield. Weeds cause 45% reduction in yield whereas the insects cause 30%, diseases cause 20% and other pests cause 5%. Ehsas *et al*., (2016) [3]

observed that many weed species compete with corn plants found to be decreasing the yield more than 65% when the weed control practices are late. *Cyperus rotundus* L. is commonly known as dila/motha is a problematic perennial weed of maize and other *Kharif* crops. The *C. rotundus* tubers can be found up to 8 inches deep inside the soil and can develop their fibrous root system up to 2 m deep into the soil. The infestation of *C. rotundus* is done through tubers. Mechanical control of this weed is very difficult as it sprouts immediately after hoeing as the tubers are very rich in food reserves. Chemical weeding can help to control this weed very effectively in maize, especially with 2,4-D sodium salt (Walia *et al* 2010) [6]. A new herbicide i.e Sepra 75 EG (halosulfuron -methyl) is very effective for its control and very safe to maize crop grown during the *Spring* and summer. The critical period of maize for weed control is reported between 3 to 5 leaf stage. The delay in weed management significantly reduces the crop growth and yield.

Materials and Methods

The field experiment entitled "Control of *Cyperus rotundus* (Purple nutsedge) and annual weeds in Spring Maize (*Zea mays* L.) with halosulfuron-methyl and other weed control methods*"* was conducted at the experimental farm of School of Agriculture, Lovely Professional University, Phagwara, Punjab during spring season of 2021.This study was carried out during the *kharif* session of 2021. The experimental farm is situated at latitude of 31º15.491'N and longitude of 75º42.476'E. The experimental field soil was sandy loam in texture and soil reaction recorded were pH (7.9), EC (0.24 ds/m), available N (376 kg/ha), available P (22 kg/ha) and available K (270 kg/ha). The experimental trial was conducted in Radomised Block Design with 15 treatments and 4 replications. The treatments were post-emergence application of halosulfuron-methyl from 45 g/ha, 52.5 g/ha, 60 g/ha, 67.5 g/ha, 75 g/ha, 82.5 g/ha, 90 g/ha (T_1 to T_7), earthing up (T_8), 2,4-D amine 0.58 kg/ha as post-em (T_9), atrazine + pendimethalin (1.0 kg + 0.75 kg/ha) as pre-em (T_{10}), tembotrione 110 g/ha as post-em (T_{11}), black plastic mulch (T_{12}), atrazine band (0.33 kg/ha) + straw mulch (T_{13}), two hand weedings (T_{14}), unweeded (control) (T_{15}). From T_1 to T_9 pre-em application of atrazine + pendimethalin (1.0 kg + 0.75 kg/ha) was done to encourage growth of *Cyperus rotundus* by controlling annual weeds. Spring maize hybrid PMH10 was sown on end of Feb. 2021 with plant to plant spacing of 20 cm and row to row spacing of 60 cm. The plot size was 5m x 2.8m. Recommended dose of fertilizer was applied i.e. 125 kg N per hectare, 60 kg P_2O_5 per hectare. Full dose of P and one third dose of N was applied as basal dose and remaining dose was applied in two equal splits at knee-high and pre-tasseling stage. Data regarding count of *C. rotundus* and annual weeds and their dry matter accumulation was taken by using quadrat of 30 cm x 30 cm. Data for plant height was recorded by using measuring tape. The data regarding dry matter accumulation by weeds and crop was recorded after oven drying the sample at 55^0C. The test weight of grains was recorded for 1000 grains after weighing on electric balance.

Result and Discussion

Effect on *C. rotundus*

It is evident from the data of Table1 that plots treated with higher dose of halosulfuron-methyl (67.5 to 90 g/ha), 2, 4-D amine salt (0.58kg/ha) and black plastic mulch were best and most effective than other treatments of weed control. Also the C. *rotundus* population was reported to be less in weedy check due to the high population of annual weeds which smoothered the C. *rotundus* plants. The *Cyperus rotundus* control was improved with successive increase in dose of halosulfuron-methyl from 45 g to 90 g/ha.

Among weed control treatment, the lowest dry matter accumulation was recorded in plots with the application of halosulfuron at 90 & 82.5 g/ha (2.14 & 2.20 q/ha) followed by haolsulfuron at 75 g/ha (2.31 q/ha), black plastic mulch (2.37 q/ha), halosulfuron at 67.5 g/ha (2.40 q/ha) and 2,4-D amine salt @ 0.58 kg/ha and all these treatments were found at par and significantly superior than two hand weeding and earthing treatments (Table 1). The plots treated with highest dose of halosulfuron- methyl (@90 & 82.7 g/ha) resulted in lowest dry matter accumulation among all weed control treatments. It may be concluded that control of *C. rotundus* improve with increase in dose of halosulfuron-methyl. The dry matter of target weed i.e. *C. rotundus* was significantly less in unweeded (control) due to its smothering by annual weeds as compared to all weed control treatments. Similar observations were recorded by Kumar M (2018) [5] at Bihar.

Effect on annual weeds

The count of annual weeds was less in all weed control treatments due to the general application of atrazine + pendimethalin in T_1 to T_9 treatments, 2,4-D amine, plastic mulch, tembotrione and hand weeding in respective treatments (Table 1). The treatment of 2, 4-D amine salt (0.58 kg/ha) and tembotrione 110 g/ha were reported to record lowest annual weed count i.e. 46.6 per m^2 and 48.8 per m^2 followed by halosulfuron-methyl at (90 and 82.5 g/ha) (56.6 and 57.7 per m^2 respectively) and these treatments were found statistically at par with other weed control treatments. The highest weed population was found in the unweeded (control) which was 216.5 per m^2 at harvest and it was significantly higher than all other weed control treatments.

The plots treated with 2,4-D amine salt @ 0.58 kg/ha (2.3 q/ha) recorded lowest dry matter accumulation by annual weeds which being statistically at par with all weed control treatments except two hand weeding and earthing up treatment (Table 1). However, unweeded (control) recorded significantly higher annual weed dry matter than all weed control treatments. Lowest dry matter was accumulated in 2,4-D amine treatment may be due to the control of *C. rotundus* and broad leaf weeds by this treatment. Similar findings were recorded by Akhtar *et al.*, (2017) in spring maize.

Effect on crop plant

The data recorded in Table 2 shows the effect of different weed control treatments on plant height (cm), number of leaves per plant and dry matter aacumulation per plant (g). The treatment with higher dose of halosulfuron-methyl at 90 g/ha & 82.5 g/ha recorded to be significantly superior in terms of maize plant height as compared to all other weed control treatments except halosulfuron-methyl at 67.5 and 75 g/ha, plastic mulch and 2,4-D amine salt @ 0.58 kg/ha. The plant height observed in weedy check was significantly inferior to all weed control treatments. Similar results were recorded by Kaur *et al.*, (2020) [4] at North-Western India.

Significantly more leaves/ plant were obtained in halosulfuron

at 90 g/ha than its application at 45, 52.5 and 60 g/ha, earthing up, hand weeding and atrazine + pendi (1.0 + 0.75 kg/ha) and former treatments i.e 90 g/ha of halosulfuron-methyl were at par with all other weed control treatments. However, unweeded (control) recorded significantly less number of leaves/plant as compared to other treatments.

The plots treated with higher dose of halosulfuron i.e. 90 & 82.5 g/ha (409.5 & 405.7 g/plant) observed to be significantly superior to halosulfuron 45 g/ha and 52.5 g/ha in terms of accumulation of dry matter per plant and statistically at par with the application of halosulfuron at 75, 67.5 and 60 g/ha (397.2, 359.0 and 355.1 g/plant), 2,4-D amine salt @ 0.58 kg/ha (382.6 g/plant) and plastic mulch (380.0 g/plant) as compared to other weed control treatments. Unweeded (control) treatment recorded significantly less dry matter accumulation per plant than all other weed control treatments.

Effect on yield attributes and yield of crop

The data in Table 3 represents, yield and yield attributes as affected by different weed control treatments. Significantly higher number of cobs/plant were observed in treatment with higher dose of halosulfuron-methyl @ 90 & 82.5 g/ha (1.31 & 1.30 cobs/plant) which was reported to be statistically at par with halosulfuron at 75, 67.5 & 60 g/ha (1.28, 1.25 & 1.23 cobs/plant resp.), 2,4-D amine salt @ 0.58 kg/ha (1.24 cobs/plant), black plastic mulch (1.24 cobs/plant) and tembotrione 110 g/ha (1.21 cobs/plant) and all these treatments were significantly superior as compared to two hand weeding, atrazine + pendimethalin (1.0 kg + 0.75kg/ha), earthing up and unweeded (control) treatments (1.10, 1.10, 1.08 & 1.02 cobs/plant respectively) which may be due to more crop-weed competition in these treatments.

Higher cob girth was recorded in treatment of halosulfuron-methyl @ 90 g/ha (5.29 cm) which was significantly more than all weed control treatments. Halosulfuron-methyl @ 82.5, 75 and 67.5 g/ha (5.0 cm, 4.90 cm and 4.84 cm), 2,4-D @ 0.58 kg/ha (4.84 cm) and black plastic mulch (4.79 cm) which were at par among themselves and produced significantly more cob girth than unweeded (control) (3.76 cm). Unweeded (control) recorded lowest cob girth due to more weed population and less plant growth.

Test weight was recorded to be significantly higher in treatment with the spray of halosulfuron-methyl @ 90, 82.5 & 75 g/ha (250.0 g, 248.0 g & 245.0 g) than all other treatments except 2,4-D amine salt 0.58 kg/ha (241.0 g) and plastic mulch (240.0 g). Some treatments like halosulfuron at 60 & 52.5 g/ha (233.0 & 227.0), tembotrione 110 g/ha (226.0 g) & straw mulch (225.0 g) were found at par and these treatments produced significantly lowest test weight than all other weed control treatment. Control treatments recorded significantly less test weight due to highest weed count, less cob girth. Subramanyan (2017) at Tirupati, Andhra Pradesh reported similar findings.

The highest grain yield was recorded in the plots treated with halosulfuron-methyl @ 90, 82.5, 75 & 62.5 g/ha (80.6, 80.1, 78.0 & 76.2 q/ha respectively), 2,4-D amine salt @ 0.58 kg/ha (75.0 q/ha) and black plastic mulch (74.6 q/ha) which were at par and all these treatments were found to be significantly superior as compared to unweeded (control) treatment (46 q/ha). Unweeded (control) treatment was found to be significantly inferior to all treatments and resulted in lowest grain yield than all weed control treatments. The percent increase of grain yield in treatments with halosulfuron-methyl @ 90, 82.5, 75 & 62.7 g/ha was 42.9, 42.6, 41.0 & 39.6 percent respectively, 2,4-D amine salt @ 0.58 kg/ha with 38.7 percent and also black plastic mulch with 38.3 percent as compared to unweeded (control). Other weed control treatments also resulted in significantly higher grain yield as compared to control. The performance of halosulfuron @ 52.5 & 45 g/ha (71.0 & 69.9 q/ha respectively), tembotrione @ 110 g/ha (70.4 q/ha), straw mulch (69.7 q/ha) and two hand weedings (66.8 q/ha) were at par with each other. The lowest grain yield in unweeded (control) due to highest weed count and dry matter accumulation by weeds, lowest plant height and dry matter accumulation, lesser no. of cobs/plant and lowest cob girth. Similar results was found by Kumar (2018) [5] at Bihar in spring maize by spraying halosulfuron-methyl resulted in higher grain yield, Bashir *et al.*, (2015) obtained maximum yield with the application of halosulfuron-methyl at Faisalabad, Pakistan.

Table 1: Effect of different weed control treatments on count of *C. rotundus* and annual weeds (m^{-2}) and their dry matter accumulation (q/ha)

Treatments	Count of weeds at harvest (m^{-2})		Dry matter accumulation by weeds (q/ha) at harvest	
	Count of *C. rotundus*	Count of annual weeds	By *C. rotundus*	By annual weeds
T1: Halosulfuron-methyl 45 gm/ha, post-em.	44.1	61.0	3.48	3.10
T2: Halosulfuron-methyl 52.5 gm/ha, post-em.	40.1	60.0	3.34	3.00
T3: Halosulfuron-methyl 60 gm/ha, post-em.	38.6	58.8	3.20	2.93
T4: Halosulfuron-methyl 67.5 gm/ha, post-em.	34.8	58.8	2.40	2.81
T5: Halosulfuron-methyl 75 gm/ha, post-em.	31.0	56.6	2.31	2.73
T6: Halosulfuron-methyl 82.5 gm/ha, post-em.	29.0	57.7	2.20	2.60
T7: Halosulfuron-methyl 90 gm/ha, post-em.	28.0	56.6	2.14	2.55
T8: Earthing up (45 DAS)	52.5	67.7	4.24	3.40
T9: 2, 4-D Amine salt (0.58 kg/ha), post-em (30 DAS)	37.4	46.6	2.46	2.30
T10: Atrazine + pendimethalin (1.0 kg + 0.75kg/ha), pre-em	50.8	60.0	3.93	3.11
T11: Tembotrione 110 gm/ha, post-em (30 DAS)	42.1	48.8	3.51	2.34
T12: Black plastic mulch	36.7	57.7	2.37	2.55
T13: Atrazine band (0.33kg/ha) + straw mulch	39.0	60.0	3.88	3.10
T14: Two hand weedings	54.3	54.4	4.40	3.30
T15: Unweeded (Control)	0.5	216.5	0.19	5.55
C.D. at 5%	3.4	26.0	0.75	0.96

Table 2: Effect of weed control treatments on plant height (cm), number of leaves per plant and dry matter accumulation per plant (g) at harvest

Treatments	Plant height (cm)	No. of leaves/plant	Dry matter accumulation/plant (g)
T1: Halosulfuron-methyl 45 gm/ha, post-em.	134.6	12.88	344.8
T2: Halosulfuron-methyl 52.5 gm/ha, post-em.	135.1	12.88	348.6
T3: Halosulfuron-methyl 60 gm/ha, post-em.	139.8	13.13	355.1
T4: Halosulfuron-methyl 67.5 gm/ha, post-em.	150.8	13.50	359.0
T5: Halosulfuron-methyl 75 gm/ha, post-em.	155.5	13.88	397.2
T6: Halosulfuron-methyl 82.5 gm/ha, post-em.	161.8	14.13	405.7
T7: Halosulfuron-methyl 90 gm/ha, post-em.	165.7	14.25	409.5
T8: Earthing up (45 DAS)	124.6	11.88	329.5
T9: 2, 4-D Amine salt (0.58 kg/ha), post-em (30 DAS)	146.0	13.50	382.6
T10: Atrazine + pendimethalin (1.0 kg + 0.75kg/ha), pre-em	129.2	12.00	344.2
T11: Tembotrione 110 gm/ha, post-em (30 DAS)	138.9	13.25	353.8
T12: Black plastic mulch	150.9	13.63	380.0
T13:Atrazine band (0.33kg/ha) + straw mulch	141.3	13.50	350
T14: Two hand weedings	130.4	12.25	348.6
T15: Unweeded (Control)	93.6	8.75	167.6
C.D. at 5%	20.2	1.07	53.7

Table 3: Effect of weed control treatments on number of cobs/plant, cob girth (cm), test weight (g) and yield (q/ha)

Treatments	No. of cobs/plant	Cob girth (cm)	Test weight (g)	Grain yield q/ha
T1: Halosulfuron-methyl 45 gm/ha, post-em.	1.13	4.62	221.0	69.9
T2: Halosulfuron-methyl 52.5 gm/ha, post-em.	1.15	4.69	227.0	71.0
T3: Halosulfuron-methyl 60 gm/ha, post-em.	1.23	4.71	233.0	72.3
T4: Halosulfuron-methyl 67.5 gm/ha, post-em.	1.25	4.84	245.0	76.2
T5: Halosulfuron-methyl 75 gm/ha, post-em.	1.28	4.90	248.0	78.0
T6: Halosulfuron-methyl 82.5 gm/ha, post-em.	1.30	5.00	250.0	80.1
T7: Halosulfuron-methyl 90 gm/ha, post-em.	1.31	5.29	256.0	80.6
T8: Earthing up (45 DAS)	1.08	4.30	219.0	60.8
T9: 2, 4-D Amine salt (0.58 kg/ha), post-em (30 DAS)	1.24	4.84	241.0	75.0
T10: Atrazine + pendimethalin (1.0 kg + 0.75kg/ha), pre-em	1.10	4.36	200.0	62.4
T11: Tembotrione 110 gm/ha, post-em (30 DAS)	1.21	4.69	226.0	70.4
T12: Black plastic mulch	1.24	4.79	240.0	74.6
T13: Atrazine band (0.33kg/ha) + straw mulch	1.15	4.52	225.0	69.7
T14: Two hand weedings	1.10	4.41	210.0	66.8
T15: Unweeded (Control)	1.02	3.76	180.0	46.0
C.D. at 5%	0.14	0.17	17.0	5.9

Conclusion

The result of the study concluded that the higher doses of halosulfuron-methyl i.e 67.5 g/ha to 90 g/ha, 2,4-D amine salt @ 0.58 kg/ha and black plastic mulch treatments recorded higher plant height, more no. of leaves/plant, highest dry matter accumulation/plant, highest grain yield and other yield attributes as a result of decreased weed population i.e *Cyperus rotundus* and annual weeds per sq.m and less dry matter accumulation by these weeds.

References

1. Akhtar P, Kumar A, Kumar J, Sharma N, Stanzen L, Sharma A, *et al*. Bio-efficacy of Post Emergent Application of Tembotrione on Mixed Weed Flora in Spring Maize (*Zea mays* L.) Under Irrigated Sub-tropical Shiwalik Foothills of J&K, India. Int. J Curr. Microbiol. App. Sci. 2017;6(12):1619-1626.
2. Bashir F, Nadeem MA, Tanveer A, Abbas T. Impact of row spacing and reduced herbicide doses along with adjuvant on weeds in maize (*Zea mays* L.). Current Sci. perspectives. 2015;1(14):112-118.
3. Ehsas J, Desai LJ, Ahir NB, Joshi JR. Effect of integrated weed management on growth, yield, and yield attributes and weed parameters on summer maize (*Zea mays* L.) under South Gujarat condition. International Journal of Science, Environment and Technology. 2016;5(4):2050-2056.
4. Kaur R, Das TK, Singh R, Jaidka M, Shekhawat K. Managing weeds using sequential herbicides in maize for improving crop growth and productivity under irrigated conditions in North-Western India. Maydica. 2020;65(2):10.
5. Kumar M. Halosulfuron Methyl 75% WG (Sempra)–A New Herbicide for the Control of *Cyperus rotundus* in Maize (*Zea mays* L.) Crop in Bihar. Int. J Curr. Microbiol. App. Sci. 2018;7(3):841-846.
6. Singh S, Walia US, Kaur R, Singh SL. Chemical control of *Cyperus rotundus* in maize. Indian J Weed Sci. 2010;42(3, 4):189-192.
7. Nazreen S, Subramanyam D, Sunitha N, Umamahesh V. Nutrient Uptake of Maize and Its Associated Weeds as Influenced by Sequential Application of Herbicides. Int. J Pure App. Biosci. 2017;5(6):496-500.