Int.J.Curr.Microbiol.App.Sci (2021) *10*(03): 14-20

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 10 Number 03 (2021)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2021.1003.003

Response of *Rumex denticulate* under Varying Irrigation Level and Weed Management Options in Wheat (*Triticum aestivum* L.)

Kairovin Lakra*

Department of Agronomy, CSAUAT, Kanpur, (UP), India

**Corresponding author*

Keywords

Absolute density, Irrigation, Herbicides, *Rumex*, WCE

Article Info

Accepted:
04 February 2021
Available Online:
10 March 2021

A B S T R A C T

Toothed dock (*Rumex denticulate* L) is a problematic weed found in wheat crop. The study was conducted to investigate the competitive effects of *Rumex dentatus* sown at varying densities in association with wheat (*Triticum aestivum* L.) under field conditions. The experiment was conducted at Kanpur during *Rabi* 2017-18 and 2018-19 to study the effect of irrigation regimes and weed management on *R. denticulate* in wheat under split-plot design with four replication having four irrigation regimes and eight factors of weed management. Application of two irrigations at CRI and active tillering stage (I_1) significantly reduces the density of *R. denticulate* and their fresh and dry weight with highest weed control efficiency (WCE) over irrigation at CRI+ jointing+ booting+ flowering+ milking stage (I_4), irrigation at CRI + active tillering + booting + flowering stage (I_3) and irrigation at CRI + jointing + booting (I_2), respectively. Among herbicidal treatments, lowest density, fresh and dry weight of *R. denticulate* and the highest WCE was recorded with the post-emergence application of broadway (carfentrazone ethyl 20% + sulfosulfuron 25%WG) @ 100 g/ha at 35 DAS as compared to other treatments. However, none of the herbicidal treatments as effective as hand at 20 and 40 DAS.

Introduction

Wheat (*Triticum aestivum* L.) is the major cereal of world and a basic food for more than one third of the world population. It is a prime source of carbohydrates and protein which has served as a staple diet for mankind. Ecologically, wheat is adapted to a variety of growing environments including salinity. However, different biotic and abiotic factors cause reduction in growth and development of wheat and its extents depending upon their nature and intensity. Among various factors weeds are on the top (Singh *et al.*, 2020) they compete with the available growth resources (Amare *et al.*, 2014 and Singh *et al.*, 2018) and have the potential to cause massive reductions in crop yield. Before the advent of herbicides, weeds were managed by tillage, manual weeding and diversified crop rotations. Over time, herbicides have become the preferred method of weed control in many countries. Currently, in India, herbicides are widely used for weed control in many crops. Scarcity of farm labour and higher wages has accelerated adoption of herbicides in India.

Although herbicides provide cost-effective weed control and save labour, overreliance on herbicides with a similar mode of action can rapidly lead to development of herbicide resistance in weeds. Development of resistance is the result of heavy reliance on same herbicides over the years (Verma *et al.,* 2015).

Both grassy and broad-leaved weeds infest wheat. Among broad-leaved weeds *R. denticulate* are the major one under irrigated condition in wheat under rice–wheat system in India. It is highly competitive weeds and can adversely affect the crop growth and yield under heavy infestation (Singh *et al.,* 2017, Singh *et al,*. 2018 and Dhanda *et al.*, 2020). The yield reduction by weeds in wheat may be up to 62 to 92 % depending upon weed type, density, timing of emergence, wheat density, wheat cultivar and soil and environmental factors (Mukherjee, 2018 and Rasool *et al.*, 2019) and sometimes completes crop failure (Singh and Singh, 2004). Besides reduction in yield and quality of wheat, heavy *Rumex* population can cause hindrance in combine harvesting. Clodinafop and fenoxaprop control only grasses, whereas sulfosulfuron controls grasses and some of the broad-leaved weeds (Verma *et al.,* 2017 and Singh *et al.,* 2017). In areas where the farmers are using herbicides like clodinafop, sulfosulfuron and fenoxaprop, the broad-leaved weed flora particularly *Rumex* has increased enormously. Under these conditions, broad-spectrum weed control is essential and for that combinations of herbicides with other agronomic practices are needed (Singh *et al.,* 2017a). Because, *R. denticulate* is highly competitive to wheat and adversely affect its performance in different agro-climatic condition. Therefore, focus of the present research on wheat was planned to investigate the effect of weed management options on *R. denticulate* under varying irrigation schedule.

Materials and Methods

The field experiment was conducted during winter (rabi) season of 2012-13 at Students Instructional Farm of Chandra Shekhar Azad University of Agriculture & Technology, Kanpur. (U.P). It is situated at an elevation of 125.9 meter above mean sea level 26º20" 35" North latitude and 80º18'35" East longitude of Indo-Gangetic Plain in the Central part of Uttar Pradesh. The soil of experimental site is sandy loam, pH (7.1), low in OC (0.35%), available nitrogen (172.4 kg/ha), sulphur (15.7 kg/ha) and zinc (0.456 ppm), and medium in available phosphorus (12.8 kg/ha) and potassium (156.5 kg/ha). The experiment was laid out in Split Plot Design and replicated four times having 32 treatment combinations. The wheat variety ʽK-9423ʼ was sown at row distance of 22.5 cm by opening slits with seed-drill machine. Treatments consisted of four irrigation schedule *viz.* irrigation at CRI and active tillering stage (I_1), irrigation at CRI + jointing + booting (I_2), CRI + active tillering + booting + flowering stage (I_3) and irrigation at CRI + jointing + booting + flowering + milking stage (I_4) were assigned to main plots and weed management practices *viz.* W_1-weedy check, W_2-two hand weeding at 20 and 40 DAS, W_3-sulfosulfuron @25 g/ha at 35 DAS, W_4- pendimethalin (pre-em) *fb* WCPL-15@400 g/ha at 35 DAS, W_5- broadway (carfentrazone ethyl 20% + sulfosulfuron 25%WG) @ 100 g/ha at 35 DAS, W_6-halauxafen + penxasulam 23.5% @ 75 g/ha at 35 DAS, W_7- halauxafen - methyl 1.21% w/w + fluroxypyr @ at 35 DAS and W_8-clodinafop- propargyl 15% + metsulfuron 1% @ 400 g/ha 35 DAS were allocated to sub plots. The experimental crop was sown in lines 22.5 cm a part using 100 kg/ha seed by opening slits with seed-drill machine. All the plots were treated alike for inputs and agronomic practices except treatments. The density of *R. denticulate* was determined by quadrate method. The quadrate (0.25 m^2) was thrown randomly at three places in each plot at 60 and 90 DAS. Absolute density of *R. denticulate* was calculated with the help of following formula:

$$\text{Absolute density (AD)} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats employed}}$$

The *R. denticulate* inside the quadrate was counted and the average of three quadrates was taken. The *R. denticulate* present within the quadrate from each plot were taken for fresh and dry matter accumulation. These samples were first dried under the sun and then kept in oven at 70 ± 5^0C until a constant weight was achieved. The dried samples were weighed and the final dry weight of *R. denticulate* was expressed as g/m^2. Weed control efficiency was calculated at 60 and 90 DAS using following formula:

$$\text{W.C.E. (\%)} = \frac{\text{D.M.C} - \text{D.M.T.}}{\text{D.M.C.}} \times 100$$

Where, D.M.C. =Dry matter production of *P. minor* per unit area in weedy check. D.M.T. = Dry matter production of *R. denticulate* per unit area in the treatment to be compared. To judge significant differences between means of two treatments, the critical difference (C.D.) was worked out by analysis of variance technique given by Gomez and Gomez (1984).

Results and Discussion

Effect on density and weight of *R. denticulate*

The total and absolute density, fresh and dry weight of *R. denticulate* was increased up to 60 DAS and thereafter a decreasing trend was noticed, irrespective of irrigation and the herbicides application (Table 1&2). It might be due to the fact that at later stages, growth of *P. minor* ceased due to senescence and completion of life cycle that resulted in reduced density, fresh and dry weight. The density, fresh and dry weight of *R. denticulate* were recorded under different irrigation was significantly reduced as compare to weedy check. Decrease in number of irrigation significantly decreased the population and weight of *R. denticulate* The maximum density, fresh and dry weight of *R. denticulate* was recorded with the application of irrigation at CRI + jointing + booting + flowering + milking stage (I_4) followed by irrigation at irrigation at CRI + active tillering + booting + flowering stage (I_3), which facilitates an adequate growing environment to *R. denticulate*. Irrigation at CRI and active tillering stage (I_1) was recorded minimum density, fresh and dry weight of *R. denticulate* as compared to other irrigation treatments. The increase in density and weight of weeds at higher rate of irrigation resulted from the greater availability of moisture was reported by Verma *et al.,* (2008) and Waheed *et al.,* (2017). Maximum density of weeds were observed under more number of irrigations, which facilitates an adequate growing environment to the weeds (Verma *et al.,* 2017) and reduction in the weed density under lower number of irrigation due is to inadequate supply of moisture (Verma *et al.,* 2015). Reduction in the fresh and dry weight of *R. denticulate* was observed under lower number of irrigation due to inadequate supply of moisture (Verma *et al.,* 2017).

All the weed control treatments significantly reduced density, fresh and dry weight of *R. denticulate* as compared to weedy check at 60 and 90 DAS. The impact of various herbicide treatments on *R. denticulate* was taken through their impact on density, fresh and dry weight per square meter. It was observed that the combined application of post-emergence herbicide treatments had significant advantage over alone post-emergence herbicide and sequential herbicide treatments in controlling *R. denticulate*. The lowest density, fresh and dry weight of *R. denticulate* was observed with broadway (carfentrazone-ethyl 20% + sulfosulfuron 25% WG) 100 g/ha at 35 DAS fb clodinafop- propagyl 15% + metsulfuron 1% 400 g/ha at 35 DAS, pendimethalin (pre-em) *fb* WCPL-15 400 g/ha at 35 DAS, halauxafen + penxasulam 23.5 % 75 g/ha at 35 DAS, sulfosulfuron 25 g/ha at 35 DAS and halauxafen 1.21% w/w + fluroxpyr at 35 DAS, respectively (Table 1&2). All the herbicide treatments significantly decreased the weed density and weight of *R. denticulate* than the weedy check plots. The post emergence application of sulfosulfuron 25 g/ha at 35 DAS, alone and had higher values for density and weight of *R. denticulate* certainly due to occurrence of resistance problem. This is in conformity with the results of Singh *et al.*, (2017a) which reported that pre emergence application of pendimethalin or acceptable control of *R. denticulate*, however not adequate to control second flush of weeds after first irrigation. Significantly lowest density of *R. denticulate* was recorded with the post- emergence application of sulfosulfuron at 25 g/ha + metsulfuron methyl at g/ha and clodinafop + metsulfuron-methyl 64 g/ha. Results are corroborated with the research results of Rana *et al.*, (2017), Singh *et al.*, (2017) and Dhanda *et al.*, (2020). Among the weed management treatments, hand weeding at 20 and 40 DAS (weed free) recorded the lowest density and dry weight of *Rumex dentatus* when compared to the herbicidal treatments. These results are shows the close conformity with the research findings of Verma *et al.*, (2015), Singh *et al.*, (2020) and Zargar *et al.*, (2020) he was reported the superiority of hand weeding over herbicidal treatments.

Table.1 Effect of irrigation and herbicides on density, fresh and dry weight of *R. denticulate* (pooled data of two years)

Treatments	Density (No. m^{-2})				Absolute density (No. m^{-2})			
	2017-18		2018-19		2017-18		2018-19	
	60 DAS	90 DAS	60 DAS	90 DAS	60 DAS	90 DAS	60 DAS	90 DAS
Irrigation schedule								
I_1-Two irrigation (CRI+ active tillering)	9.34	8.50	8.45	7.66	3.11	2.83	2.82	2.55
I_2-Three irrigation(CRI+ jointing+ booting)	11.24	10.44	10.35	9.60	3.75	3.48	3.45	3.20
I_3- Four irrigation (CRI+ Active tillering+ booting+ flowering)	13.36	12.39	12.47	11.55	4.45	4.13	4.16	3.85
I_4-Five irrigation (CRI+ jointing+ booting+ flowering+ milking)	13.99	13.02	13.10	12.18	4.66	4.34	4.37	4.06
CD (P=0.05)	1.71	1.66	1.70	1.64	0.57	0.55	0.72	0.77
Weed management practices								
W_1-Weedy check	21.70	20.67	20.68	19.71	7.23	6.89	6.89	6.57
W_2- Two hand weeding (20 and 40 DAS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W_3-Sulfosulfuron @25 g ha^{-1} at 35 DAS	15.12	14.10	14.10	13.14	5.04	4.70	4.70	4.38
W_4- Pendimethalin (pre-em) *fb* WCPL-15@400 g ha^{-1} at 35 DAS	12.27	11.25	11.25	10.29	4.09	3.75	3.75	3.43
W_5-Broadway (carfentrazone ethyl 20%+ sulfosulfuron 25%WG) @ 100 g *a.i.* ha^{-1}at 35 DAS	8.47	7.45	7.45	6.49	2.82	2.48	2.48	2.16
W_6- Halauxafen + penxasulam 23.5% @ 75 g *a.i.* ha^{-1} at 35 DAS	12.19	11.17	11.17	10.21	4.06	3.72	3.72	3.40
W_7- Halauxafen - methyl 1.21% w/w + fluroxypyr @ at 35 DAS	15.35	14.33	14.33	13.37	5.12	4.78	4.78	4.46
W_8- Clodinafop- propargyl 15% + metsulfuron 1% @ 400 g *a.i.* ha^{-1} 35 DAS	10.77	9.74	9.75	8.78	3.59	3.25	3.25	2.93
CD (P=0.05)	1.26	1.27	1.25	1.22	0.75	11.27	0.57	0.55

Table.2 Effect of irrigation and herbicides on *P. minor* indices and yield of wheat (pooled data of two years)

Treatments	Fresh weight (g/m^2)				Dry weight (g/m^2)			
	2017-18		2018-19		2017-18		2018-19	
	60 DAS	90 DAS	60 DAS	90 DAS	60 DAS	90 DAS	60 DAS	90 DAS
Irrigation schedule								
I_1-Two irrigation (CRI+ active tillering)	13.54	11.88	12.99	11.08	3.35	2.72	2.92	2.28
I_2-Three irrigation(CRI+ jointing+ booting)	16.58	14.93	16.04	14.12	3.86	3.23	3.43	2.79
I_3- Four irrigation (CRI+ Active tillering+ booting+ flowering)	17.37	15.72	16.83	14.91	4.37	3.68	3.94	3.24
I_4-Five irrigation (CRI+ jointing+ booting+ flowering+ milking)	18.27	16.62	17.73	15.82	4.57	3.88	4.15	3.45
CD (P=0.05)	2.97	2.78	2.91	2.70	0.85	0.82	0.82	0.78
Weed management practices								
W_1-Weedy check	29.52	27.63	28.90	26.71	8.94	8.40	8.45	7.90
W_2- Two hand weeding (20 and 40 DAS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W_3-Sulfosulfuron @25 g ha^{-1} at 35 DAS	18.73	16.84	18.11	15.92	4.25	3.46	3.76	2.96
W_4- Pendimethalin (pre-em) *fb* WCPL-15@400 g ha^{-1} at 35 DAS	16.76	14.87	16.14	13.95	3.87	3.08	3.38	2.58
W_5-Broadway (carfentrazone ethyl 20%+ sulfosulfuron 25%WG) @ 100 g *a.i.* ha^{-1}at 35 DAS	14.43	12.54	13.81	11.62	3.42	2.63	2.93	2.13
W_6- Halauxafen + penxasulam 23.5% @ 75 g *a.i.* ha^{-1} at 35 DAS	16.71	14.82	16.09	13.90	3.86	3.07	3.37	2.57
W_7- Halauxafen - methyl 1.21% w/w + fluroxypyr @ at 35 DAS	18.89	17.00	18.27	16.08	4.28	3.49	3.79	2.99
W_8- Clodinafop- propargyl 15% + metsulfuron 1% @ 400 g *a.i.* ha^{-1} 35 DAS	16.48	14.59	15.86	13.67	3.67	2.88	3.18	2.38
CD (P=0.05)	1.76	1.76	1.72	1.73	0.44	0.41	0.43	0.40

Table.3 Effect of irrigation and herbicides on weed control efficiency (WCE)

Treatments	WCE (%)			
	2017-18		2018-19	
	60 DAS	90 DAS	60 DAS	90 DAS
Irrigation schedule				
I_1-Two irrigation (CRI+ active tillering)	62.5	67.6	65.4	71.1
I_2-Three irrigation(CRI+ jointing+ booting)	56.8	61.5	59.4	64.7
I_3- Four irrigation (CRI+ Active tillering+ booting+ flowering)	51.1	56.2	53.4	59.0
I_4-Five irrigation (CRI+ jointing+ booting+ flowering+ milking)	48.9	53.8	50.9	56.3
Weed management practices				
W_1-Weedy check	100.0	100.0	100.0	100.0
W_2- Two hand weeding (20 and 40 DAS)	52.5	58.8	55.5	62.5
W_3-Sulfosulfuron @25 g ha^{-1} at 35 DAS	56.7	63.3	60.0	67.3
W_4- Pendimethalin (pre-em) *fb* WCPL-15@400 g ha^{-1} at 35 DAS	61.7	68.7	65.3	73.0
W_5-Broadway (carfentrazone ethyl 20%+ sulfosulfuron 25%WG) @ 100 g *a.i.* ha^{-1}at 35 DAS	56.8	63.5	60.1	67.5
W_6- Halauxafen + penxasulam 23.5% @ 75 g *a.i.* ha^{-1} at 35 DAS	52.1	58.5	55.1	62.2
W_7- Halauxafen - methyl 1.21% w/w + fluroxypyr @ at 35 DAS	58.9	65.7	62.4	69.9
W_8- Clodinafop- propargyl 15% + metsulfuron 1% @ 400 g *a.i.* ha^{-1} 35 DAS	100.0	100.0	100.0	100.0

Weed control efficiency (WCE)

Weed control efficiency (WCE) denotes the relative efficiency of weed control treatments compared to weedy check (Table 3). Irrigation at CRI and active tillering stage (I_1) was recorded highest weed control efficiency of *R. denticulate* as compare to I_4 (irrigation at CRI + jointing + booting + flowering + milking), I_3 (irrigation at CRI + active tillering + booting + flowering) and I_2 (irrigation at CRI + jointing + booting), respectively. Reduction in the number of irrigation increases the weed control efficiency was reported by Verma *et al.*, (2008) and Verma *et al.*, (2017).

Among herbicidal treatments, application of broadway (carfentrazone- ethyl 20% + sulfosulfuron 25% WG) 100 g/ha at 35 DAS was recorded the highest weed control efficiency of *R. denticulate fb* the WCE with clodinafop- propagyl 15% + metsulfuron 1% 400 g/ha at 35 DAS. Among herbicidal treatments, the lowest weed control efficiency was recorded in plots treated with sulfosulfuron 25 g/ha at 35 DAS followed by sequential application of pendimethalin (pre-em) *fb* WCPL-15 400 g/ha at 35 DAS. Highest weed control efficiency indicate its relative performance of particular set of treatment (Chhokar *et al.*, 2007, Verma *et al.*, 2017 and Zagar *et al.*, 2020). However, hand weeding at 20 and 40 DAS (weed free) treatments proved superiority over herbicidal treatments. Highest WCE associated with hand weeding can be attributed to its effective control of *R. denticulate*. These findings established support from Singh *et al.*, (2017a), Sharma *et al.*, (2020) and Singh *et al.*, (2020).

References

Amare, T., Sharma, J.J. and Zewdie, K. 2014. Effect of weed control methods on weeds and wheat yield. *World Journal of Agricultural Research* 2(3): 124–128.

Chhokar, R.S., Sharma, R.K., Jat, G.R., Pundir, A.K. and Gathala, M.K. 2007. Effect of tillage and herbicides on weeds and productivity of wheat under rice–wheat growing system. *Crop Protection* 26: 1689–1696.

Gomez, K.A. and Gomez, A.A. 1984. *Statistical Procedures for Agricultural Research*. Wiley, New York.

Mukherjee, D. 2018. Effect of various weed management practices on wheat productivity under new alluvial zone. *Journal of Crop and Weed* 14(2): 188–194.

Nanher, A.H., Singh, R., Yadav, S. and Tyagi, S. 2015. Effects of weed control treatments on wheat crop and associated weeds. *Trends in Biosciences* 8(2): 421–428.

Rana, S.S., Badiyala, D. and Brari, P. 2017. Evaluation of herbicide combinations for controlling complex weed flora in wheat. *Indian Journal of Weed Science* 49(4): 335–340.

Sharma, N., Kumar, A., Sharma, B.C., Chand, L., Sharma, V. and Kumar, M. 2020. Effects of sowing dates and weed management on productivity of irrigated wheat. *Indian Journal of Agricultural Sciences* 90(3): 556–559.

Singh, A., Jain, K.K. and Upadhyaya, S.D. 2018. Effect of weed control methods on weeds and wheat under *eucalyptus tereticornis* based agroforestry system. *Int. J. Curr. Microbiol. App. Sci* 7(8): 2856–2867.

Singh, R. and Singh, B. 2004. Effect of irrigation time and weed management practices on weeds and wheat yield. *Indian Journal of Weed Science* 36(1 & 2): 25–27.

Singh, R.P., Verma, S.K. and Kumar, S. 2017a. Crop establishment methods and weed management practices affects crop growth, yield, nutrients uptake and weed dynamics in wheat. *International Journal of Bio-resource and Stress Management*, 8(3): 393–400.

Singh, R.P., Verma, S.K. and Kumar, S. 2020. Weed management for enhancing yield and economics of wheat in Eastern India. *Indian Journal of Agricultural Sciences* 90(7): 1352–1355.

Singh, R.P., Verma, S.K., Kumar, S. and Lakara, K. 2017. Impact of tillage and herbicides on the dynamics of broad leaf weeds in wheat. *International Journal of Agriculture, Environment and Biotechnology* 10(6): 643–651.

Verma, S.K., Singh, R.P. and Kumar, S. 2017. Effects of irrigation and herbicides on the growth, yield and yield attributes of wheat. *Bangladesh Journal of Botany* 46(3): 839–845.

Verma, S.K., Singh, S.B., Raim O.P. and Singh, G. 2008. Effect of mulching and irrigation on weeds and yield of summer greengram in saline soil. *Indian journal of Agricultural Sciences* 78(12):1082–85.

Verma, S.K., Singh, S.B., Prasad, S.K., Meena, R.N. and Meena, R.S. 2015. Influence of irrigation regimes and weed management practices on water use and nutrient uptake in wheat. *Bangladesh Journal of Botany* 44(3): 437–442.

Waheed, Z., Usman, K. and Ali. I. 2017. Response of wheat to varying densities of *Rumex dentatus* under irrigated condition of Dera Ismail Khan, Pakistan. *Sarhad Journal of Agriculture* 33(1): 1–7.

Zargar, M., Bayat, M. and Astarkhanova, T. 2020. Study of post- emergence-directed herbicides for redroot pigweed control in winter wheat in southern Russia. *Journal of Plant Protection Research* 60(1): 7–13.

How to cite this article:

Kairovin Lakra. 2021. Response of *Rumex denticulate* under Varying Irrigation Level and Weed Management Options in Wheat (*Triticum aestivum* L.). *Int.J.Curr.Microbiol.App.Sci.* 10(03): 14-20. doi: https://doi.org/10.20546/ijcmas.2021.1003.003