



Weed dynamics in wheat as affected by weed management practices under Doon valley conditions

Naziya Khan, Roop Kishore, Gaurav Verma, Afjal Ahmad, Ramakant Mishra and Sanjay Kumar*
Doon (P.G) College of Agriculture Science and Technology, Dehradun, Uttarakhand 248011, India
*GBPUA&T., Krishi Vigyan Kendra Dhakrani Dehradun, Uttarakhand 248 142, India

*Email: sanjaygbpuat@gmail.com

Article information

DOI: 10.5958/0974-8164.2020.00034.9

Type of article: Research note

Received : 30 January 2020

Revised : 11 April 2020

Accepted : 13 April 2020

Key words

Herbicides

Weeds

Weed control efficiency

Wheat

Yield

ABSTRACT

A field experiment was conducted at Agronomic Research Station of Doon (P.G) College of Agriculture Science and Technology, Rampur (Selaqui) Dehradun, Uttarakhand during 2018-19 to study the effect of different herbicides in wheat. The experimental soil was sandy loam in texture, slightly acidic in nature with low in N, high in available P and medium in K. The results revealed that post-emergence application of sulfosulfuron 25 g/ha, followed by metsulfuron-methyl 4.0 g/ha gave the highest yield of wheat which was at par with manual weeding at 30, 60 and 90 DAS. Based on the results, hand weeding at 30, 60 and 90 days after sowing in wheat recorded the lowest values of weed count and biomass with the highest weed control efficiency, and also showed superiority over rest of the treatments. Among the herbicides, sulfosulfuron at 25 g/ha applied as post-emergence produced grain yield of wheat 3.49 t/ha, which increased the grain yield of wheat to the tune of 24.2, 35.8, 46.0, 49.8 and 103% over carfentrazone, clodinafop propargyl, pendimethalin, pinoxaden and weedy check, respectively.

Wheat (*Triticum aestivum* L.) is the most important cereal crop of India next to rice and accounts for 31.5% of the total food grain basket of the country. An area of wheat 30.6 mha, with the production of 98.4 mt and average productivity of 3.21 t/ha in India was reported (Anonymous 2017). In Uttarakhand, area under wheat during 2016-17 was 3.4 lakh ha with an annual production of 8.82 lakh tons with productivity of 2.58 t/ha (Anonymous 2017). Weeds emerge with crop if not controlled in the critical stages of crop growth and these may cause reduction in yield from 10 to 40% depending upon the intensity and kind of weed infestation in crop. Weed control by manual weeding is highly expansive which can't be feasible and also non availability of agricultural labour is another crucial issue. Therefore, we need to select or opt the suitable chemical / herbicidal management in wheat based production system to sustain the profitability at reasonable cost. Herbicides offer most ideal, practical, effective and economical means of reducing early weed competition and crop production losses. However, continuous use of the same herbicides leads to built up of resistance in weeds. It is therefore, necessary to combine or change

the method and strategies of weed control. Hence, the present investigation was undertaken.

A field experiment was carried out during 2018-19 Rabi season at Agronomic Research Station of Doon (P.G) College of Agriculture Science and Technology, Selaqui, Dehradun, Uttarakhand. The soil of the experimental field was sandy loam in texture with pH (6.47), low in available N(212.54 kg/ha), high (44.1 kg/ha) in P and medium (147 kg/ha) in K. Wheat (HD-2967) was shown on 2nd fortnight of November by using seed rate of 100 kg/ha at 5 cm depth with rows 22.5 cm apart. The experiment was laid out in randomized block design (RBD) with three replications comprising eight treatments, viz. weedy check, hand weeding (HW) at 30, 60 and 90 DAS, sulfosulfuron 25 g/ha, pinoxaden 5.0% EC 40 g/ha, carfentrazone-ethyl 40% DF 20 g/ha, pre-emergence pendimethalin 30% EC 750 g/ha, clodinafop 15% WP 60 g/ha, and metsulfuron-methyl 20% WG 4 g/ha were used. The crop was fertilized with recommended doses of N-P-K of 120-60-40 kg/ha through urea, single superphosphate and murate of potash, respectively. Half dose of nitrogen and full dose of P and K were applied as basal dose.

Remaining half dose of nitrogen was top dressed after the 1st irrigation. Herbicides were applied as pre-emergence at (0-3) DAS and post-emergence was at 34 DAS with manually operated knapsack sprayer with spray volume of 600 L/ha. Weed population and weed dry weight was recorded in each plot in quadrat of 1 x 1 m² and subjected to square root transformation before analysis. Data on wheat yield and yield parameters were also recorded at crop maturity. Weed index was calculated by the formula proposed by Gill and Kumar (1969).

Weed flora

In experimental crop, the most dominant weed species were; *Chenopodium album*, *Vicia sativa*, *Medicago denticulata*, *Fumaria parviflora*, *Rumex dentatus*, *Anagallis arvensis* as broad-leaved weeds and *Phalaris minor*, *Cynodon dactylon* and *Poa annua* among narrow-leaved weeds. All the weed control practices had significant differences on weed control during the period of experimentation in wheat crop.

Effect on weeds

Total weed density and weed biomass were affected significantly due to weed management practices (**Table 1**). Total weed count and weed biomass ranged from 0.53/m² and 0.26 g m² in plots with three hands weeding at 30, 60 and 90 DAS and to 249.5/m² and 7.51 g/m² in weedy check, respectively. Among the herbicide, post-emergence application of sulfosulfuron 25 g/ha followed by metsulfuron-methyl 4 g/ha proved its superiority over rest of the treatments and was at par with hand weeding at 30, 60 and 90 DAS. The reduction in biomass was mainly attributed to lower weed count under these treatments because of higher weed control efficiency. Lowest weed count and weed biomass also observed by Kumar *et al.* (2009) under post-emergence application of sulfosulfuron at 25 g/ha in wheat.

Weed control efficiency

Weed control efficiency (WCE) indicates genuine magnitude of reduction in weed dry matter by various weed control treatments. The WCE of various treatments was carried out at 90 DAS using the formula proposed by Gautam *et al.* (1975). Among the herbicides, sulfosulfuron 25 g/ha applied as post-emergence recorded the highest WCE of 99.7% which was at par with hand weeding at 30, 60 and 90 DAS treatment. Whereas, clodinafop 60 g/ha as PoE recorded lower WCE (59%) among the herbicides. The finding is in close conformity with the Kumar *et al.* (2013).

Effect on wheat crop

Herbicide application had significant effect on wheat grain and straw yield (**Table 1**). The highest grain yield of wheat (3.63t/ha) was recorded in hand weeding at 30, 60 and 90 DAS. Among the herbicides, sulfosulfuron at 25 g/ha applied as post-emergence produced grain yield of 3.49 t/ha, which increased the grain yield of wheat to the tune of 24.2, 35.8, 46.0, 49.8 and 103% over carfentrazone, clodinafop propargyl, pendimethalin, pinoxaden and weedy check, respectively. However, carfentrazone, clodinafop propargyl, pendimethalin and pinoxaden being at par with each other, increased the yield of wheat significantly as compared to weedy check. Sulfosulfuron 25 g/ha and metsulfuron-methyl 4 g/ha yielded similar to that of hand weeding at 30,60 and 90 DAS condition. The lowest weed index (3.9%) was observed in sulfosulfuron at 25 g/ha. Whereas, highest reduction in grain yield was found to the tune of 52.6% under weedy check conditions. The results are in close conformity with those of Sujoy *et al.* (2006) and Pandey and Kumar (2005).

Economics

Sulfosulfuron at 25 g/ha applied as post-emergence remunerated highest net return of ₹

Table 1. Effect of different weed management practices on weed count, weed biomass, yield and yield attributes of wheat

Treatment	Total weed density (no./m ²)	Weed biomass (g/m ²)	WCE (%)	Effective tillers/m ²	No. of spikelet/spike	No. of grains/s pike	Test weight (g)	Weed index (%)
Sulfosulfuron 25 g/ha as post-emergence	6.07(35.9)	1.24(0.56)	99.7	140.7	3.7	37.1	45.01	3.9
Pinoxaden 40 g/ha as post-emergence	13.01(168.3)	2.45(5.03)	68.1	97.6	2.6	30.7	44.70	35.8
Carfentrazone 20 g/ha as post-emergence	11.40(129.1)	2.19(3.82)	72.7	122.5	2.9	33.1	44.8	22.6
Pendimethalin 750 g/ha as pre-emergence	8.55(72.23)	1.46(1.14)	84.3	91.7	3.5	31.1	43.52	34.2
Clodinafop 60 g/ha as post-emergence	13.49(181.2)	2.51(5.33)	59.2	83.0	3.2	34.7	44.07	29.2
Metsulfuron 4 g/ha as post-emergence	7.64(57.5)	1.25(0.57)	97.6	125.6	3.5	35.2	43.90	17.9
Three hand weeding at 30, 60 and 90 DAS	1.23(0.53)	1.12(0.26)	99.8	145.0	3.8	43.6	45.80	0.0
Weedy check	15.82(249.5)	2.91(7.51)	0	71.4	2.4	30.2	40.81	52.6
LSD (p=0.05)	1.78	4.82	-	80.7	0.7	8.39	4.09	8.05

DAS-Days after sowing; WCE - Weed control efficiency, *Data in parentheses are original values. Values are square root ($\sqrt{x+1}$)

Table 2. Effect of different weed management practices on economics in wheat

Treatment	Grain yield (t/ha)	Straw yield (t/ha)	Cost of cultivation (x10 ³ ₹/ha)	Net returns (x10 ³ ₹/ha)	B:C ratio
Sulfosulfuron 25 g/ha as post-emergence	3.49	4.26	30.11	53.45	2.78
Pinoxaden 40 g/ha as post-emergence	2.33	3.21	30.49	26.95	1.88
Carfentrazone 20 g/ha as post-emergence	2.81	3.02	29.76	35.67	2.20
Pendimethalin 750 g/ha as pre-emergence	2.39	3.76	30.11	30.90	2.03
Clodinafop 60 g/ha as post-emergence	2.57	2.94	29.45	31.19	2.06
Metsulfuron 4 g/ha as post-emergence	2.98	4.02	29.26	43.81	2.50
Three hand weeding at 30, 60 and 90 DAS	3.63	4.52	35.45	51.87	2.46
Weedy check	1.72	2.76	29.15	15.01	1.51
LSD (p=0.05)	0.52	0.93	-	-	-

DAS-Days after sowing, prices of wheat ₹ 18450/t, straw ₹ 4500/t

53452/ha, which was higher by ₹ 38444, 26504, 22548, 22257, 1778, 9642 and ₹ 1584 with weedy check, pinoxaden, pendimethalin, clodinafop propargyl, carfentrazone, metsulfuron-methyl and hand weeding, respectively (**Table 2**). Benefit: Cost ratios were also followed the trend as the net returns. The highest B:C ratio of 2.78 was observed with sulfosulfuron at 25 g/ha as against lowest (1.51) in weedy check. The highest cost of cultivation in wheat involved where the weeds controlled by hand weeding.

Thus, it was concluded that in the valley conditions of Dehradun, post-emergence application of sulfosulfuron 25 g/ha gave excellent weed suppression in wheat crop which was at par with three hand weeding. It also produced maximum grain yield over rest of the herbicides. Except sulfosulfuron and metsulfuron-methyl, none of the herbicide could reach the performance of hand weeding at 30, 60 and 90 DAS in respect of weed count, weed biomass, yield and yield attributes of wheat.

REFERENCES

- Anonymous. 2017. *Annual report*. Directorate of Economics and Statistics. DAC. Ministry of Agriculture and Farmers Welfare, Govt. of India.
- Gautam KC, Mani VS and Sharma RK. 1975. A note on efficiency, selectivity and residual toxicity of some soil applied herbicide in soybean. *Indian Journal of Weed Science* 7(10): 72–76.
- Gill HS and Kumar Vijay. 1969. Weed index: A new method for reporting control trials. *Indian Journal of Agronomy* 14(1): 96–98.
- Kumar Sanjeev, Malik RS, Ashok Yadav and Malik RK. 2009. Performance of cultivars and sulfosulfuron against weeds in wheat, *Indian Journal of Weed Science* 39(1&2): 44–47.
- Kumar S, Rana SS, Rajesh and Chandler N. 2013. Herbicide combinations for broad – spectrum weed control in wheat. *Indian Journal of Weed Science* 45(1): 29–33.
- Pandey IB and Kumar K. 2005. Response of wheat (*Triticum aestivum* L.) to seeding methods and weed management. *Indian Journal of Agronomy* 50(1): 48–51.
- Sujoy D, Sarkar AK, Bhattacharya SP and Saha A. 2006. Effect of various weed management practices in wheat. *Environment and Ecology* 24(3): 620–622.