International Journal of Agricultural Sciences ☞DOI:10.15740/HAS/IJAS/17.1/59-64
Volume 17 | Issue 1 | January, 2021 | 59-64 ■ ISSN : 0973-130X Visit us : *www.researchjournal.co.in*

RESEARCH PAPER

On farm performance of different weed control methods of wheat in front line demonstrations in Hathras district of Uttar Pradesh

Shyam Singh
Krishi Vigyan Kendra (BUAT), Banda (U.P.) India
(Email: shyamsingh15350@gmail.com)

Abstract : Present study entitled "On farm performance of different weed control methods of wheat in front line demonstrations in Hathras district of Uttar Pradesh" was conducted during two consecutive *Rabi* seasons of years 2012-13 and 2013-14 at farmer's fields of district Hathras, to find out the best suitable weed control method of wheat for the area. Front line demonstrations (FLDs) on wheat crop were conducted on an area of 12.8 ha with active participation of 32 farmers of 23 different villages with improved technologies composed HD-2967 variety and recommended package of practices. Two different weed control technologies *viz.,* Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS and Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS, were demonstrated. The results revealed that both the treatment gave higher grain yield, gross return and net return as compared to farmers practice (Sulfosulfuron 75 WG @33.3 g/ha at 40 DAS). The maximum grain yield (47.40q/ha with HI of 40.79%) was obtained during the year 2013-14 when Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS was applied which was 20.90 per cent higher than the yield of farmers practice. This was followed by treatment of Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS which gave yield of 47.20q/ha with an increment of 17.12 per cent over farmers practice. The similar trend was also reported for biological yield of wheat. Economic analysis of different weed control methods also showed the highest net returns (INR. 45072 ha^{-1}) for application of Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS treatment. Among the demonstrated technologies, both were found effective to weed management and profitable over farmers practice. The increment in net return due to weed control treatments was recorded highest (31.89%) during the year 2013-14 when Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS was applied which also gave the maximum increase in gross return of Rs. 5.7 per rupee additionally invested. It was concluded that one hand weeding at 45 DAS should be done with application of Sulfosulfuron 75 WG @33.3 g/ha or premixed weedicide Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS should be used for obtaining higher grain yield, straw yield, gross and net income with higher B: C ratio from wheat under Hathras conditions of Uttar Pradesh.

Key Words : Wheat, FLD, Weed control, Gross/ Net return, Cost of cultivation, Net return, B:C ratio, Sulfosulfuron, Metsulfuron

View Point Article : Singh, Shyam (2021). On farm performance of different weed control methods of wheat in front line demonstrations in Hathras district of Uttar Pradesh. *Internat. J. agric. Sci.*, **17** (1) : 59-64, **DOI:10.15740/HAS/IJAS/17.1/59-64**.

Article History : **Received :** 18.09.2020**; Revised :** 14.11.2020**; Accepted :** 17.12.2020

INTRODUCTION

Wheat (*Triticum aestivum* L.) being the staple food of more than one-third population of the earth, contributes highest in acreage and production among all grain crops (including rice, maize, etc.) grown in the world. India ranks first in area (43.77 million ha) coverage followed by China, while in production India ranks second (99.87 mt) after China during year 2017 (Anonymous, 2019). In India U.P. ranked first (32.75 mt and 32.04 % of country's production) in percentage share of wheat production and contributes more than 35 per cent among the total food grains production (Anonymous, 2019). A record wheat production (99.87 mt) in India was reported during 2017-18 which was approximately eight times over the production level in 1964-65 (12.3 mt). This record production of wheat may be attributed to improved varieties and adoption of scientific package of practices including weed management practices. However, to meet the food requirement of our growing population, sustained research efforts are further needed to keep the upward trend in wheat production. Hathras district is situated at 27.5^0 North latitude and 78.0^0 East longitudes and falls in Aligarh division of Uttar Pradesh. District enjoys moderate climate throughout the year. It is characterized by hot summer, cold winter and moderate rainy season. The annual rainfall is about 656 mm. The soil of the district Hathras is alluvial soils. In general the whole area is an Indo Gangetic Plain. The wheat is main crop of Hathras but mustard and potato, also cultivated at large scale in *Rabi*. Wheat is grown mainly in cropping rice-wheat, *Bajra*-wheat and pulse-wheat sequences under irrigated condition. The area under wheat in Hathras is about 79000 ha with productivity of 39.99 q/ha. The package of practices followed by the farmers is not very scientific, like they use imbalance nutrients, faulty weedicide with wrong method and time.

Wheat growers are facing various problems responsible for low productivity, among these weed problem is major as weed competes with the crop for moisture, nutrients, space, light etc. Moreover, they increase production cost, decrease yield of the crop and decrease the quality of farm produce. The weed in India are causing substantial losses to agriculture production and the annual losses in terms of money come to the Rs. 1650 crores (Joshi, 2002). Slow growth of wheat plants during early growth stage permits the growth of various weed flora at the time of germination. Weeding at an early stage of crop growth in wheat is a very important practice because heavy infestation of weeds hampers the crop growth as well as greater reduction in wheat yield. The prominent weeds noted in wheat field are Phalaris minor, *Cyperus rotundus*, *Cynodon dactylon, Chenopodium album, Anagallis arvensis*, *Avena fatua, Convolvulus arvensis* and *Lathyrus* spp etc., Which alone causes 33 per cent reduction in wheat yield under rice-wheat is one of the most important cropping system of the district. More than 90 per cent farmers are using Isoproturon and Sulfosulfuron weedicides which are unable to effective control of wide range of weeds. The cultivators are not aware of proper dose of herbicides, time of application, economics and their persistence in the soil. Several selective herbicides are available in the market, which are treated to be effective for wheat crop. The farmers have to make decisions about the selection of right type of herbicides, timely and uniform spray using flat fan nozzles, herbicides rotation and crop rotation strategies to control weeds.

Front line demonstrations, conducted under the close supervision of scientists, is a farmer participatory extension methodology to validate and disseminate new technology in a new areas, where physical and socio-economic circumstances of the farmers are considered and a systematic dialogue between farmers and scientists took place. Front line demonstration helps in finding the appropriate substitute for the current technology. The productivity of wheat per unit area could be increased by adopting recommended scientific and sustainable management practices using a suitable weed control method. Taking into account the above considerations, Front line demonstrations were carried out in a systematic manner on farmer's field to show the worth of new technology, find out the best suitable weed control method of wheat for the area and convincing farmers to adopt it for enhancing productivity of wheat.

MATERIAL AND METHODS

Front line demonstrations on weed control method of wheat were conducted as the mandatory work of K. V. K. during *Rabi* seasons of the years 2012-13 and 2013-14 at farmer's fields. The trials were laid out in the fields of 32 farmers of 23 different villages of five blocks of Hathras district in Uttar Pradesh, with improved technologies composed HD-2967 variety and recommended package of practices (Table A).

Every weed control technology was applied in 0.4

ha area at all thirty two locations of FLDs in order to have better representation of the district. The wheat growing farmers were selected in villages having a handsome area under wheat to achieve the better exposure to maximum farmers of the district. After selection of farmers a training programme on scientific cultivation of wheat was conducted to upgrade the knowledge and skill of farmers and ensuring correct usage and method. Each demonstration was conducted in a plot of 0.40 ha area in order to have better impact of the technologies demonstrated against the local checks. Total 32 demonstrations were conducted and a total area of 12.80 ha in 23 different villages was put under demonstrations trials.

As depicted in Table B all standard packages of practices were applied in demonstration plots. The farmers were provided with 40 kg seed of HD-2967 variety and weedicides to lay out the trials. Rest of the inputs for treatment was arranged by farmers themselves during both the years. The soil of each trial plot was tested for pH, EC, OC. and macro nutrients N, P and K. The soil of all demonstration plots was sandy loam and low in nitrogen and phosphorus and medium in potash. The pH was reported in the range of 7.3 to 8.4. The crop was uniformly fertilized with 120 kg N, 60 kg P_2O_5 and 40 kg K_2O and 25 kg $ZnSO_4$ per hectare. One third of N, full P_2O_5, K_2O and $ZnSO_4$ were applied as basal and remaining dose of N was top-dressed in two equal splits at 30 (CRI stage) and 50 (maximum tillering stage) days after sowing. Sowing was done with seed drill at inter-row spacing of 22.5 cm using 100 kg/ha treated seed on 15th to 25th November during both the years. Five irrigations at 20-25, 40-45, 70-75, 90-95 and 110-115 DAS were applied to trial plots. The weedicides was applied as per treatment. No disease and insect incidence occurred in crop.

Table A: Details of front line demonstrations

Details	2012-13	2013-14
No. of farmers	20	12
No. of villages	14	9
Area (ha)	8.0	4.8
Variety	HD-2967	HD-2967
Demonstrated treatment	(Sulfosulfuron 75WG+Metsulfuron 5WG) @30g a.i./ha at 35 DAS	Sulfosulfuron 75WG@25g a.i/ha at 30DAS +one hand weeding at 45DAS
Farmers practice	Sulfosulfuron 75 WG @33.3 g/ha at 40DAS	Sulfosulfuron 75 WG @33.3 g/ha at 40DAS

Table B : Package of practices of wheat applied to demonstration trials

Intervention	Demonstrated package
Year and season	*Rabi* 2012-13and 2013-14
Farming situation	Irrigated
Variety	HD-2967 is a variety released by PAU, Ludhiana in 2011, which is most suitable for North Eastern plain zones of India, which includes a part of Uttar Pradesh also. It is an early maturing variety (125-135 days). It is suitable for irrigated condition and it gives an average yield of 45-50 quintals per hectare.
Seed treatment	Seed treated with Bavistin @ 2.5 g/kg seed
Time of sowing	15th to 25th November every year
Sowing method	Line sowing at 22.5 cm with Ferti. cum seed drill
Seed rate	100 kg/ha
Fertilizer dose	120:60:40:25 (NPK&Zn kg/ha)
Irrigations	20-25, 40-45, 70-75, 90-95 and 110-115 DAS
Weed management	(T_1) Farmers practice- (Sulfosulfuron 75 WG @33.3 g/ha) at 35 DAS (T_2) Sulfosulfuron 75 WG + Metsulfuron methyl 5 WG @ 30g a.i./ha at 35 DAS. (T_3) Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS.
Harvesting and threshing	7-15 April both the years

The crop was harvested manually at maturity (second week of April/135-140 DAS) and threshed with a power operated thresher during both the years. Grain and straw yields of wheat were determined from a 20 m^2 area in each pre-demarcated plots. After three days sun-drying in the field, the total biomass (grain + straw) was weighed and threshed. Grain yield was reported at 14 per cent moisture content. Straw yield was reported on a dry weight basis.

Production economics including all farm operations were calculated based on prevailing market price of inputs like seeds, fertilizers, etc. and sale price of wheat grain and straw. The net return was calculated by subtracting cost of cultivation from the gross return. The B: C (Benefit: Cost) ratio was calculated by dividing gross income with cost of cultivation. Frequent visit of all trials was made by scientists of Krishi Vigyan Kendra, Hathras. Field day was also conducted at trials plot at maturity stage of the crop.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Grain and straw yield:

The data of grain and straw yield under new tested weed control technologies and farmers practice is given in Table 1. It is evident from the data that both the demonstrated new technologies produced higher grain yield than farmers practice. The highest grain yield (47.40q/ha) with higher HI (40.79%) was recorded in the demo plots of Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS which was 20.90 per cent higher than the yield of farmers practice (Sulfosulfuron 75 WG @33.3 g/ha). The grain yield of plots treated with another technology, Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS was also recorded (47.20q/ha with 41.74% HI) 17.12 per cent higher than the farmers practice. The minimum grain yield was reported under farmers practice plot and it was 40.30q/ha during the year 2012-13 and 39.20q/ha during 2013-14 with a HI of 39.02 per cent and 38.87 per cent, respectively. Better control of weeds under these treatments might have reduced the crop-weed competition which favoured higher uptake of nutrients and water by wheat crop, which helped the plant to put optimum growth characters, enhanced photosynthetic activity and partitioning of assimilates, resulting in improved yield attributes like spikelets per spike, grain weight per plant and test weight. These growth and yield attributes eventually produced higher grain and straw yields under these treatments. Kulshrestha *et al.* (2003) also suggested that the herbicide mixture Sulfosulfuron 75 + metsulfuron methyl 5 WG @ 32 g a.i. ha^{-1} g a.i. ha^{-1} effectively control both grassy and broad leaf weeds at different growth stages and also produced significantly higher number of effective tillers, grain and straw yield of wheat. These findings are in close conformity with those reported by Chaudhari *et al.* (2017) who reported that the Sulfosulfuron plus metsulfuronmethyl 32 g/ha as post-emergence application (25-30 DAS) provided excellent control of mixed weed flora with better yield of wheat as compared to Sulfosulfuron alone. Yadav *et al*. (2016) have also reported similar findings of higher wheat grain yields with sequential application of herbicides as compared to alone herbicides. The lower yield in Sulfosulfuron 75 WG @33.3 g/ha used by farmers may be due to adverse effect on crop growth and most of the yield attributes. Kumar *et al.* (2001); Pandey *et al.* (2002) and Pandey *et al.* (2006) also reported that the metribuzin and Sulfosulfuron at higher doses had adverse effects on growth and yield of wheat.

Harvest index:

No different trend with respect to the effect of weed management on harvest index was obtained. However,

Table 1 : Grain yield, straw yield and HI as affected by weed control methods

Year	Treatments of demonstration	Demonstration				Farmers practice (Sulfosulfuron 75 WG @33.3 g/ha)				Increase in grain yield (%)
		Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	HI %	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	HI %	
2012-13	Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS.	47.20	65.87	113.07	41.74	40.30	62.98	103.28	39.02	17.12
2013-14	Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS	47.40	68.80	116.2	40.79	39.20	61.64	100.84	38.87	20.90
	Mean	47.3	67.335	114.635	41.265	39.75	62.31	102.06	38.945	19.01

the highest harvest index was obtained (41.74 %) under treatment Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS, followed by Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS. Lowest harvest index (38.87%) was observed under farmers practice (Sulfosulfuron 75 G@33.3 g/ha) treatment. The higher grain and straw yields of treatments comprising Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS and Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS indicated their superiority in controlling weeds in comparison to farmers practice treatment. Use of two herbicides and herbicide plus hand weeding reduced weed competition resulting in availability of more moisture, plant nutrients and space to the crop. It is apparent that weeds significantly affected the yield attributing characters which cumulatively resulted in lower biological and grain yield. Nanher *et al.* (2015) and Yadav *et al.* (2019) also suggested that different weed control treatments do not influence the harvest index of wheat upto the level of significance.

Economic returns:

It is evident from the data that the remarkably highest net income of Rs. 45072/- with B:C ratio of 2.19 was recorded with treatment Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS which was closely followed by Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS (41082 with B: C ratio of 2.12). Lowest net return of Rs. 33745/ - with B: C ratio of 1.99 during the year 2012-13 and Rs. 34173 with B:C ratio of 1.96 during the year 2013-14, was obtained with farmers practice (Sulfosulfuron 75 WG @33.3 g/ha) (Table 2 and 3).

The data of economic analysis clearly indicated that the use of Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS recorded the highest gross returns (Rs. 82872), net returns (Rs. 45072) and B:C ratio (2.19), which was closely followed by the other tested technology Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS. With a gross returns (Rs. 77882), net returns (Rs. 41082) and B:C ratio (2.12). This might be because of less weed-crop competition for light, nutrients, space and moisture in these weed

Table 2 : Income from grain yield, straw yield and gross income (Rs./ha) as affected by weed control methods

Year	Grain yield (q/ha)	Sale price of grain (Rs./q)	Income from grain (Rs./ha)	Straw yield (q/ha)	Sale price of straw (Rs./q)	Income from straw (Rs./ha)	Gross income (Rs./ha)
Demonstration							
2012-13	47.20	1350	63720	65.87	215	14162	77882
2013-14	47.40	1400	66360	68.80	240	16512	82872
Mean	47.3	1375	65037	67.33	227.5	15318	80355
Farmers practice							
2012-13	40.30	1350	54405	62.98	215	13540	67945
2013-14	39.20	1400	54880	61.64	240	14793	69673
Mean	39.75	1375	54656	62.31	227	14144	68800

Table 3 : Comparative economics of different weed control methods

Year	Treatments of Demonstration	Demonstration				Farmers practice (Sulfosulfuron 75 WG @33.3 g/ha)				Net Returns increase (%)	Increase in gross return by increase in cost (Rs./ha)
		Gross Cost (Rs./ha)	Gross Return (Rs./ha)	Net Return (Rs./ha)	B:C Ratio	Gross Cost (Rs./ha)	Gross Return (Rs./ha)	Net Return (Rs./ha)	B:C Ratio		
2012-13	Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS	36800	77882	41082	2.12	34200	67945	33745	1.99	21.74	3.82
2013-14	Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS	37800	82872	45072	2.19	35500	69673	34173	1.96	31.89	5.7
	Mean	37300	80355	43055	2.15	34850	68800	33950	1.97	26.79	4.7

control treatment plot as compare to farmers practice treatment plot, which produced higher grain and straw yield from given area. However, the minimum gross returns, net returns and B:C ratio obtained with farmers practice (Sulfosulfuron 75 WG @33.3 g/ha) during both the years, because of reduction in overall yield of grains as well as straw due to weed-crop competition and unavailability of healthy surrounding for normal growth or their potential crop production. The results are in line with the results of Nanher *et al.* (2015) who reported the significantly higher gross, net returns and B:C ratio in Sulfo. + Metri.25+105 g a.i ha^{-1} than Sulfosulfuron 25 g a.i ha^{-1}. It was also interesting that the cost of cultivation of both the technologies demonstrated was also higher as compared to the farmers practice, but added cost of weedicide and one weeding was less as compared to the yield enhancement in both the demonstrated technologies. Marginal profit analysis showed that increase in net returns due to treatment of Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS + one hand weeding at 45 DAS was reported 31.89 per cent while it was 21.74 per cent due to treatment of Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS. Also every additional rupee invested on Sulfosulfuron 75 WG + one hand weeding and Sulfosulfuron 75 WG + Metsulfuron 5 WG gave return of Rs. 5.7 and Rs. 3.82, respectively. This might be attributed to drastic increase in wheat grain and straw yield by investing small amount on weed control technologies.

Conclusion:

On the basis of the results obtained in this study, it is concluded that post-emergence application of Sulfosulfuron 75 WG @ 25g a.i/ha at 30 DAS followed by one hand weeding at 45 DAS or Sulfosulfuron 75 WG + Metsulfuron 5 WG @ 30 g a.i./ha at 35 DAS may be adopted for efficient weed management in wheat under Hathras (U.P.) conditions of northern India.

Acknowledgement:

The author is thankful to Director of Extension, C. S. A. University of Agriculture and Technology Kanpur, Uttar Pradesh and Director ICAR-ATARI, Kanpur for giving me opportunity to conduct the On Farm trials and providing fund during the course of investigation.

REFERENCES

Anonymous (2019). *Agricultural statistics, Government of India.* Ministry of Agriculture and Farmers Welfare Department of Agriculture Co-operation and Farmers Welfare Directorate of Economics and Statistics New Delhi, India.

Chaudhari, D.D., Patel, V.J., Patel, H.K., Aakask Mishra, Patel, B.D. and Patel, R.B. (2017). Assessment of pre-mix broad spectrum herbicides for weed management in wheat. *Indian J. Weed Sci.,* **49**(1): 33–35.

Joshi, N.C. (2002). *Manual of weed control*. Research Publication 7615-B, East Azad Nagar, Delhi, India.

Kulshrestha, G., Singh, S.B. and Gautam, R.C. (2003). Bio-efficacy and persistence of a herbicide mixture in wheat. *Annals of Plant Protection Sciences,* **11**(2): 364-368.

Kumar, S., Tyagi, R.C. and Malik, R.K. (2001). Differential response to sulfosulfuron under different irrigation frequencies to control weeds in wheat (*Triticum aestivum*). *Indian J. Agron.,* **46** (3) : 480–484.

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

Pandey, A.K., Gopinath, K.A. and Gupta, H.S. (2006). Evaluation of sulfosulfuron and metribuzin for weed control in irrigated wheat (*Triticum aestivum*). *Indian J. Agron.,* **51** (2) : 135-138.

Pandey, J., Gopinath, K.A. and Verma, A.K. (2002). Investigation on low doses of atrazine, metribuzin and pendimethalin on weeds and yield of wheat. *Acta Agronomica Hungarica,* **50** (4) : 441–445.

Yadav, D.B., Yadav, A., Punia, S.S. and Chauhan, B.S. (2016). Management of herbicide-resistant phalarisminor in wheat by sequential or tank-mix applications of pre and post-emergence herbicides in north-western Indo-Gangetic Plains. *Crop Protection,* **89**: 239–247.

Yadav, H.L., Gupta, A. K., Choudhary, R. R. and Kumawat, Sanju (2019). To study response different herbicides and herbicide mixtures on performance of wheat and their residual effect of succeeding crops. *Internat. J. Chem. Stud.,* **7**(3): 1410-1413.