International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 6 Issue 3, March-April 2022 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Effects of Herbicides on Growth and Yield of Wheat Crop (*Triticum Astivum L.*)

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ABSTRACT

One year field experiment was conducted during rabi season of 2019-20 at the agricultural research farm (Pilikothi) **Tilak Dhari Post Graduate College Jaunpur U.P.** The experiment comprised of nine treatments *viz.* weedy check, weed free(two hand weeding 30 & 45 DAS), Sulfosulfuron at 0.025 kg ha^{-1}, Metribuzin at 0.2 kg ha^{-1}, Carfentrazone-ethyle at 0.02 kg ha^{-1}Carfentrazone-ethyle at 0.025 kg ha^{-1}, Metsulfuron-methyle at 0.004 kg ha^{-1}, Sulfosulfuron +Metsulfuron-methyle 0.030+0.004 kg ha^{-1} and 2, 4-D at 0.500 kg ha^{-1}, replicated four times in Randomized Block Design. Wheat variety HD-2967 was used as attest crop. Application of Sulfosulfuron+Metsulfuron-methyle 0.030+0.004 kg ha^{-1} significantly increased the plant height and dry matter accumulation at different growth stages over weedy check resulted into higher yield attributes viz. effective plant population in per m^2 (920.25) at harvesting time, grain ear^{-1} (49.25) and 1000 grain weight (40.00 g). Consequently, highest grain (4546.00 kg ha^{-1}), Straw (6214 kg ha^{-1}) and biological yield (10761.50 kg ha^{-1}) were through controlling weeds by Sulfosulfuron +Metsulfuron-methyle after two hand weeding which was at per Carfentrazone- ethyle at @ 0.025kg ha^{-1} (3908.25,5811.50 and 9719.75 kg ha^{-1}) followed by Carfentrazone-ethyle at @ 0.020 kg ha^{-1} and proved significantly superior over rest of other treatments.

KEYWORDS: *Herbicide, Weed flora, Wheat, Yield*

How to cite this paper: Abhijeet Kumar Patel | Dr. Shrish Kumar Singh | Rakesh Bind | Subhash | Aravind Kumar Patel "Effects of Herbicides on Growth and Yield of Wheat Crop (Triticum Astivum L.)" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-6 | Issue-3, April 2022, pp.919-924, URL: www.ijtsrd.com/papers/ijtsrd49647.pdf

IJTSRD49647

INTRODUCTION

Wheat is most important staple food crop in India, serves as backbone of food security in the country. In India, it is the second most important cereal after rice contributing substantially to the national food security by providing more than 50 per cent of the calories to the people. In India, wheat contributed an annual production of 107.59 mt and area of 31.45mha with a productivity of 3.421 t ha-^{1} during 2019- 20 **(Annual Report-DACFW, 2019-20).** The five major wheat growing States of Uttar Pradesh, Madhya Pradesh, Punjab, Haryana and Rajasthan contributed nearly 86.03 percent to the total production in the country.

The wheat (*Triticum aestivum)* is cultivated in almost every state under varying agro-ecological production conditions. The country is broadly divided in six wheat growing zones. Three fourth of total *Triticum aestivum* produce is harvested in two zones *viz.* North western plain and North- eastern plain zone which cover major wheat growing states of country.

Weeds cause economic losses by competing with crop plants for nutrients, water and space resulting in significant reduction in crop yield. The losses caused by weeds (33 per cent) are more than losses caused by either diseases (20 per cent) or insect pests) in India weed not only reduce the quality of crop produce it also decrease quality of whole farm produce, increase cost of cultivation and serve as alternate hosts for pest and disease.

Wheat crop field are infested with grassy, non- grassy and sedges weeds. The major grassy weeds are *Phalaris minor*, *Avena sp., Polypogon monspeliensis and Cynodon dactylon*. Non- grassy weeds include *Chenopodium sp., Lathyrus spp Parthenium hysterophorus, Anagalli sarvensis, Chenopodium*

album, Cynodon dactylon, Caronopus didymus etc. of the sedges *Cyperus rotundus* is most prevalent.

Conventional method of weed removal i.e. hand weeding is prevalent in different part of the country. However due to unavailability of adequate labour, weeding operation is often delayed and high wages of labour, secondary hand weeding has been proved ineffective because of morphological similarity of little seed canary grass, wild oat and wheat plant, particularly in initial stages of growth. In this view, herbicidal application for controlling weeds in wheat crop has been found effective and economical.

In the light of these facts and situation, it becomes imperative to assess weed control, Sulfosulfuron at 0.025 kg ha^{-1}, Metribuzin at 0.2 kg ha^{-1},Carfentrazone-ethyle at 0.02 kg ha^{-1} Carfentrazone-ethyle at 0.025 kg ha^{-1}, Metsulfuron-methyle at 0.004 kg ha^{-1}, Sulfosulfuron +Metsulfuron-methyle 0.030+0.004 kg ha^{-1} and 2,4-D at 0.500 kg ha^{-1}, are herbicides and their effects on weeds and productivity of wheat crop to provide a wider base for commercial recommendation of herbicide for the farmers.

MATERIALS AND METHOD

The experiment was carried out during rabi season of 2019 at the instructional Farm, Department of Agronomy Tilak Dhari Post Graduate College Jaunpur U.P. The experiment comprised of nine treatments *viz.* Sulfosulfuron at 0.025 kg ha^{-1}, Metribuzin at 0.2 kg ha^{-1},Carfentrazone-ethyle at 0.02 kg ha^{-1} Carfentrazone- ethyle at 0.025 kg ha^{-1}, Metsulfuron-methyle at 0.004 kg ha^{-1}, Sulfosulfuron +Metsulfuron-methyle 0.030+0.004 kg ha^{-1} and 2,4-D at 0.500 kg ha^{-1}, two hand weeding at 30 & 45 DAS and weedy check. All the treatments were replicated four times indiscriminately in Randomize Block Design. Wheat variety HD-2967 was used as a test crop. The soil of the experimental were sandy loam in texture, non-saline and slightly alkaline in reaction. They were low in available nitrogen, medium in organic carbon and phosphorus and high in available potassium. The crop was sown on 4 week of December during rabi seasons with a seed rate of 120 kg ha^{-1}. All crop management practices were performed as per recommendation. The crop was fertilized with 150 kg N and 60 kg P2O5 ha^{-1} through Urea and DAP and 40kg ha^{-1}. Half dose of nitrogen and full dose of phosphorus were applied as basal at the time of sowing while remaining half dose of nitrogen was top dressed in two equal splits at the time of first and second irrigation. Application of herbicide was sprayed by knapsack sprayer fitted with flat fan nozzle using a spray volume of 500 l/ha. Weedy check plots remained infested with native population of weeds till harvest. The observations were taken on different growthand yield attributes at various growth stages. All the data were subjected to analysis of variance (ANOVA) for RBD using SAS 9.3 software packages.

Fig.1 Experimental crop HD-2967

EXPERIMENTAL FINDINGSS

Table 1: Effect of weed control treatments on plant population, plant height and crop dry matter accumulation of wheat at 60 DAS

Treatment	Rate of application kg ae or a.i/ha	Plant population/m^2	Plant height (cm)	Dry matter accumulation (g/m^2)
Weedy check		845.75	76.275	272.00
Weed free	(two hand weeding)	853.50	79.525	274.00
Sulfosulfuron	0.030	847.75	76.85	270.50
Metribuzin	0.2	845.25	77.25	273.50
Carfentrazone	0.020	847.75	75.825	270.50
Carfentrazone	0.025	848.50	74.25	269.50
Metsulfuron-Methyl	0.004	843.50	75.975	270.50
Sulfosulfuron+ Metsulfuron-methyl	0.034	852.25	77.7	275.50
2,4-D	0.500	841.50	76.85	270.50
C.D.at 5%		2.168	1.588	2.225
SEm		0.738	0.541	0.758

Table 2: Effect of weed control treatments on yield attributes of wheat at harvest

Treatment	Rate of application kg ae or a.i/ha	No. of of spike/m2	No. of of grain/spike	Test weight
Weedy check		875.50	43.00	36.00
Weed free	(two hand weeding)	910.00	50.00	40.00
Sulfosulfuron	0.030	895.00	44.75	37.50
Metribuzin	0.2	893.50	44.50	36.25
Carfentrazone	0.020	892.25	44.25	36.25
Carfentrazone	0.025	896.50	47.00	39.25
Metsulfuron- Methyl	0.004	892.25	44.50	36.25
Sulfosulfuron + Metsulfuron-methyl	0.034	909.75	49.25	39.25
2,4-D	0.500	891.50	45.00	36.25
C.D.at 5%		2..709	0.808	0.636
SEm		0.923	0.275	0.217

Table 3: Effect of weed control treatments on yield and harvest index of wheat at harvest

Treatment	Rate of application kg ae or a.i/ha	Grain yield kg/ha	Straw yield kg/ha	Biological yield kg/ ha	Harvest index
Weedy check		3608.25	6211.50	9819.75	0.36
Weed free	(two hand weeding)	4546.00	6215.50	10761.50	0.42
Sulfosulfuron	0.030	3616.75	6214.25	9831.00	0.36
Metribuzin	0.2	3613.00	6212.00	9825.00	0.36
Carfentrazone	0.020	3908.00	6011.50	9919.50	0.39
Carfentrazone	0.025	3908.25	5811.50	9719.75	0.40
Metsulfuron-Methyl	0.004	3612.00	6212.00	9824.00	0.36
Sulfosulfuron +Metsulfuron-methyl	0.034	4546.00	6214.50	10749.75	0.42
2,4-D	0.500	3609	6111.50	9720.50	0.37
C.D.at 5%		11.574	1.879	13.453	0.012
SEm		3.942	0.640	4.582	0.004

Table- 4: Percent composition of major weed species at 30, 60, 90 and120 days after sowing in weedy check.

Weed species	Days after sowing			
	30	60	90	120
Cyperus rotundus	35.19	39.95	30.67	25.33
Parthenium hysterophorus	18.38	16.16	20.08	30.99
Anagallis arvensis	15.45	12.59	13.45	20.26
Chenopodiam album	11.87	10.98	12.80	5.36
Cynodon dactylon	7.01	8.16	8.10	6.85
Carnopus didymus	5.15	3.77	4.14	6.74
Other weed spices	6.95	8.39	10.76	4.47

RESULT AND DISCUSSION

Effect of herbicide and their combination on Growth attributes

All herbicidal treatments whether applied singly or as mixture or in sequence and two hand weeding tended to significant enhancement in growth attributes *viz.* plant height, dry matter accumulation etc. during the year of experimentation except weed free control. The degree of pooled increase varied for plant height and dry matter accumulation from (Table 1). The minimum values of these parameters were obtained when crop was subjected to complete weed stress (weedy check) (76.225 cm & 272.00 g m^{-2}row length). The tallest plant and highest pooled dry matter accumulation was recorded under metsulfuron + sulfosulfuron (77.70 cm and 275.50 g m^{-2} row length) among herbicidal treatments after two hand weeding but variations were at par with metribuzin, sulfosulfuron, 2,4-D and carfentrazone and accounted for 41.4, 40.9, 40d.1 and 39.0 per cent increase in pooled plant height and 61.9, 59.0, 57.0 and 55.9 per cent increase in pooled dry matter accumulation, respectively over the weedy check which recorded least plant height and dry biomass. The solitary application of herbicide accounted for less increase in plant height and dry biomass, hence lagged behind mixtures and sequential application of herbicides. This may be attributed to that the treatments reduced the density and dry weight more effectively, provided more favorable micro-environment to enhance the crop growth and ultimately having more crop dry weight in the respective treatments. Similar findings were also obtained by Meena*et al*. (2017), Chaudhari*et al*., (2017) and Kaur*et al*., (2017).

Fig.2 Experimental crop HD-2967

Yield attributes

Data reveals that different weed control treatments significantly increased the yield attributes *viz.* effective tillers m^{-1} row length, grains ear^{-1}1000 grain weight etc. over weedy check (Table 2). Two hand weeding recorded the highest pooled effective tillers (853.50), grains ear^{-1} (50.00) and 1000 grain weight (40.00 g). Among the herbicides, mixed application of sulfosulfuron + metsulfuron recorded maximum yield attributes (852.25, 49.25 and 39.25) which was closely followed bycarfentrzone -ethyl, sulfosulfuron, metsulfuron-methyl and 2,4-D. However, the variations among these treatments were at par and proved their superiority over other sequential and alone application of single herbicide. Independent

usage of single herbicide registered for lower value of these parameters. Weedy check recorded least yield attributes among all weed control options. Similar findings were also reported by Singh *et al*., (2017) [13], Chaudhari*et al*., (2017) [1] and Punia*et al*., (2017) [10].

Yield and Harvest index

Different weed management options brought about marked increase in the grain, straw and biological yield of wheat over weedy check. Two hand weeding recorded highest pooled grain, straw and biological yield (4546, 6215 & 10761.50 kg ha^{-1}) whereas weedy check accounted for minimum value (3608.25, 6211.50 & 9819.75 kg ha^{-1}) followed by 2,4-D alone (Table 2). Further insight of data explicate that collective application of herbicides either as premix, tank mix or sequentially resulted in significantly higher yield of wheat over singly applied herbicides. Amongst herbicidal treatments, highest pooled grain, straw and biological yield was obtained by controlling weeds through sulfosulfuron + metsulfuron followed by carfentrazone-ethyl.

The solitary application of single herbicide resulted in lesser grain yield. The weed control treatments did not register any significant variation in the harvest index of wheat. A relatively reduced weed infestation through different treatments might have helped the crop plants to accumulate greater dry matter through greater nutrient uptake which might have provided greater quantity of photosynthates to developing sink in crop plants that were able to produce more yields. Various authors have also reported improved yield attributes with reduced weed density and dry matter (Singh *et al*., 2017; Lekh Chand and Puniya, 2017; Punia*et al*., 2017 and Chouhan*et al*., 2017).

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