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Effect of different herbicides on yield and NPK uptake by crop and removal by weeds

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Abstract
A field experiment was conducted to evaluate performance of different herbicides in wheat crop on heavy soil at Crop Research Centre, Chirodi form of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) during *Rabi* season 2016-17. The experiment was conducted in randomized block design with three replications comperising 12 treatments of weed management were Pendimethalin @ 750gai ha^{-1} *fb*1HW (T_1), Pendimethalin *fb* Sulfosulfuron @ 750+15g *ai* ha^{-1} (T_2), Sulfosulfuron @25gai ha^{-1} (T_3), Sulfosulfuron+Metsulfuron-methyl @ 20+2 g *ai* ha^{-1} (T_4), Clodinofoppropazil @ 60 g ai ha^{-1} (T_5), Clodinafop+Metsulfuron-methyl@ 60+4 g *ai* ha^{-1} (T_6), Pinoxaden+Metsulfuron-methyl @ 40+4 g *ai* ha^{-1} (T_7), Pinoxaden+Carfentarazone-ethyl @ 40+20 g *ai* ha^{-1} (T_8), Metsulfuron-methyl+Iodosulfuron @ 12+24 g *ai* ha^{-1} (T_9), Isoproturon+24-D @ 750+500 g *ai* ha^{-1} (T_{10}), Weed free (T_{11}) and Weedy check (T_{12}). The soil of experimental site was low in organic carbon and nitrogen and medium in available phosphorus and available potassium and alkaline in reaction. The findings of present study revealed that all weed control practices were proved effective to control weeds in wheat crop and produced significantly higher grain yield over all weedy check. Whereas these treatments were also produced significantly higher grain yield than other treatments. Thus the application of Clodinafop+Metsulfuron-methyl @ 60+4 g *a.i* ha^{-1} as post emergence is concluded the best for effective weed control, higher productivity and profitability of wheat crop.

Keywords: herbicide, NPK uptake, weeds and yields

1. Introduction
Wheat (*Triticum aestivum* L.) is a staple food of 40 percent human population across the globe. Wheat is the second most important cereal crop of India next to rice and accounts for 36.2% of total food grain basket of the country. There are a number of factors responsible for lower productivity of wheat crop as compared to certain developed countries. Biotic as well as the abiotic factors are also posing serious threats in realizing the full potential. Among the abiotic factors, the global warming consequently increase in the temperature at milking stage of crop is the major threat affecting the productivity adversely, however weed infestation is major biotic stress in Wheat crop is infested with a number of weeds namely Genhusa/Gullidanda /Gehunka mama *(Phalaris minor)*, Gazari *(Fumaria parviflora)*, Chatarimatari (*Lathyrus aphaca*), Motha (*Cyperus rotundus)*, Doob (*Cynodon dactylon)*, Bathua (*Chenopodium album*), Krishna neel (*Anagallis arvensis*), Wild oat (*Avena fatua*), Hiran Khuri (*Convolvulus arvensis*), Satyanashi (*Argemone maxicana*), Senji (*Melilotus alba/ Melilotus indica*) etc which can cause up to 33% reduction in wheat yield. *Phalaris minor* is one of the very serious problems in wheat. Significant reduction in wheat yield due to severe infestation of weeds ranging from 18-73% has been reported by Pandey and Verma (2004). However, some broad leaf weeds are also causing a threat but their control is comparatively easier and effective as compared to that of *Phalaris minor*, really serious challenge. The wild oat reduce grain yield of winter wheat by 17-62% depending upon cultivars. The several options like manual weeding and herbicide application are available for the efficient management of weeds applied before sowing and successive crop growth stages. Wheat productivity could be enhanced by minimizing research gap (potential yield and experimental yield) and management gap (actual experimental yield and farmers field yield). This has to come through improving efficiency of present agricultural system and stabilizing the productivity level with appropriate management practices.

2. Materials and Methods

The experiment was conducted at Crop Research Centre at Chirodi of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) in *Rabi* season of 2016-17. Meerut is located on the Delhi-Dehradun highway. Geographically it is located at 29^0 04, N latitude and 77^0 42 'E longitude at an altitude of 237 meters above the mean sea level. The area lies in the heart of the Western Uttar Pradesh has sub-tropical climate. The soil of experimental site was low in organic carbon and nitrogen and medium in available phosphorus and available potassium and alkaline in reaction. The experiment was conducted in randomized block design with three replications comperising 12 treatments of weed management were Pendimethalin @ 750g *ai* ha^{-1} *fb*1HW (T_1), Pendimethalin *fb* Sulfosulfuron @ 750+15g *ai* ha^{-1} (T_2), Sulfosulfuron @25g *ai* ha^{-1} (T_3), Sulfosulfuron+Metsulfuron-methyl @ 20+2g*ai* ha^{-1} (T_4), Clodinofoppropazil @ 60 g *ai* ha^{-1} (T_5), Clodinafop+Metsulfuron-methyl @ 60+4g *ai* ha^{-1} (T_6), Pinoxaden+Metsulfuron-methyl @ 40+4g *ai* ha^{-1} (T_7), Pinoxaden+Carfentarazone-ethyl @ 40+20gai ha^{-1} (T_8), Metsulfuron-methyl+Iodosulfuron @ 12+24g *ai* ha^{-1} (T_9), Isoproturon+24-D @ 750+500g *ai* ha^{-1} (T_{10}) Weed free (T_{11}), and Weedy check (T_{12}).

3. Results and Discussions

The data regarding the effect of different treatments on grain yield are shown in Table 1. Grain yield was affected significantly by various treatments involving weed management practices. The highest grain yield 45.53 q ha^{-1} was recorded in weed free plot which was statically at par with T_1, T_2, T_3, T_4, T_5 and T_6 treatments and significantly higher than remaining treatments. Whereas the lowest yield was recorded in weedy check which was significantly lower than the all other treatments. The application of T_6 treatment gave 43.88 q ha^{-1} grain yields which was at par with T_1, T_2, T_3, T_4, T_5 and significantly higher than rest of the herbicidal treatments. The application of T_6 gave 45.55% and 24.13% more grain yield compared to T_{12} and T_{10}, respectively. Whereas the recommended practices of T_{10} produced only 13.23% higher grain yield over weedy check. The data regarding the effect of different treatments on nitrogen uptake by wheat grain straw and total are presented in Table 1. Nitrogen uptake was affected significantly by various treatments involving weed management practices**.** The most effective treatment was weed free with maximum nitrogen uptake by wheat crop grain, straw and total which was remained statistically at par to T_2, T_3, T_4, T_5 and T_6 and significantly higher than remaining treatments. The weedy plot recorded minimum nitrogen uptake by wheat crop (grain, straw and total) which was significantly lower than all other treatments. Such effects of weed management treatments on yield have also been reported by Punia *et al,* (2008) [4], Lathwal and Ahlawat (2011) [3] and Kumari *et al,* (2013) [2], and Chhokar *et al.* (2006) [1].

Table 1: Yield and NPK uptake of wheat crop and weeds as influenced by various weed management treatments

Treatment	Gran yield (q ha^{-1})	Nutrient removed by crop									Nutrient removed by weeds (kg ha^{-1})		
		Nitrogen uptake (kg ha^{-1})			Phosphorus uptake (kg ha^{-1})			Potassium uptake (kg ha^{-1})					
		Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total	N	P	K
T_1	41.66	55.82	45.61	101.43	17.08	11.87	28.95	16.66	98.10	114.76	1.59(1.55)	1.13(0.29)	1.56(1.45)
T_2	42.90	57.05	47.08	104.13	16.67	10.29	26.96	16.73	98.35	115.08	1.62(1.65)	1.14(0.32)	1.59(1.55)
T_3	43.09	56.87	46.66	104.42	16.80	10.86	27.66	16.37	99.07	115.44	1.71(1.95)	1.17(0.39)	1.66(1.77)
T_4	43.39	58.57	47.39	105.95	17.78	11.84	29.62	15.79	98.45	114.24	1.72(1.97)	1.18(0.40)	1.67(1.79)
T_5	43.64	58.91	44.92	103.83	17.45	11.39	28.84	15.27	86.18	111.45	1.74(2.04)	1.17(0.37)	1.68(1.83)
T_6	43.88	57.48	45.05	103.53	18.08	11.29	29.46	16.04	101.36	117.4	1.75(2.07)	1.20(0.45)	1.70(1.89)
T_7	38.95	49.46	37.38	86.84	14.41	8.76	23.17	13.24	88.21	101.45	1.94(2.77)	1.22(0.50)	1.90(2.62)
T_8	36.09	46.55	36.43	82.98	12.99	8.28	21.27	11.90	82.08	94.07	1.95(2.82)	1.20(0.46)	1.87(2.50)
T_9	37.29	47.73	34.77	85.50	13.05	7.60	20.65	11.93	80.93	92.86	1.92(2.69)	1.20(0.45)	1.88(2.56)
T_{10}	35.35	44.54	33.54	79.84	12.01	7.03	19.04	10.60	80.08	90.68	1.96(2.85)	1.20(0.45)	1.92(2.72)
T_{11}	45.53	64.19	53.26	112.05	21.30	15.02	36.32	19.57	109.9	128.87	1.00 (00)	1.00 (00)	1.00 (00)
T_{12}	31.22	36.83	19.45	56.28	9.05	9.08	18.13	8.74	56.64	65.38	4.64(20.59)	2.26(4.14)	4.44(18.74)
S Em ±	1.38	1.81	1.38	3.20	0.52	0.36	0.88	0.48	3.08	3.60	0.08	0.049	0.08
CD (P= 0.05)	4.07	5.35	4.15	9.45	1.54	1.07	2.60	1.41	9.10	10.63	0.25	0.14	0.24

Values are square root $\sqrt{(X + 1)}$ transformed and the actual are given in parenthesis

The data regarding the effect of different treatments on phosphorus uptake by wheat grain straw and total are presented in Table 1. Phosphorus uptake was affected significantly by various treatments involving weed management practices. The most effective treatment was weed free which has recorded the maximum phosphorus uptake by wheat crop grain, straw and total and significantly higher than all other treatments. Among the herbicidal treatment were T_4 with maximum phosphorus uptake by wheat crop (grain, straw and total) followed by T_1, T_3, T_5, and T_6 and significantly higher than reaming treatment except weed free. The lowest phosphorus uptake by wheat crop (grain, straw and total) was recorded in weedy check which was significantly lower than all other treatments. The data regarding the effect of different treatments on potassium uptake by wheat grain, straw and total are presented in Table 1. Potassium uptake was affected significantly by various treatments involving weed management practices. The most effective treatment was weed free with maximum potassium uptake by wheat crop (grain, straw and total) which was significantly higher than all other treatments. Among herbicidal treatment T_6 recorded maximum potassium uptake by wheat crop (grain, straw and total) fallowed by T_1, T_2, T_3, T_4, and T_5which was significantly higher than reaming treatment except weed free. The weedy plot recorded lowest value of potassium uptake from wheat crop (grain, straw and total) which was significantly lower than all other treatments. The data regarding the effect of different treatments on nitrogen removed by weeds is presented in Table 1.The least nitrogen was removed by weeds with application of T_1 which was found at par with T_2, T_3, T_4, T_5, and T_6, treatments. The weedy plot maximum nitrogen was removed by weeds in weedy plot. The data regarding the effect of different treatments on phosphorus removed by weeds is presented in

Table 1. Among the weed management treatments, the maximum phosphorus removed by weeds was observed in weedy treatment. The lowest value of phosphorus removed by weeds was observed with the application of T_1 which was remained statistically at par with all other treatments except weedy check. The data regarding the effect of different treatments on potassium removed by weeds is presented in Table 1. The maximum potassium removal by weeds was observed in weedy treatment. Among the weed management treatments the higher potassium removed by weeds in the application of T_{10} was found at par with T_5, T_6, T_7, T_8 and T_9 treatments. While the minimum potassium removed by application of T_1 which was statistically at par with T_2, T_3, T_4, T_5 andT_6 treatments. Similar findings were also reported Tuti and Das (2011) [7], Pisal *et al.* (2013) [5], and Tomar and Tomar (2014) [6].

4. Conclusions

On the basis of field experiment conducted during Rabi 2016-2017, following conclusion could be drawn in farmer point of view: All weed control practices were proved effective to control weeds in wheat crop and produced significantly higher grain over all weedy check. Thus the application of Clodinafop+Metsulfuron-methyl @ 60+4 g a.i ha^{-1} as post emergence is concluded the best for, higher productivity of wheat crop**.**

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