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Dinesh Kumar

Technical Assistant,
Department of Agriculture,
Sardar Vallabhbhai Palel
University of Agriculture &
Technology, Meerut, Uttar
Pradesh, India

Vivek

Professor Agronomy,
Sardar Vallabhbhai Palel
University of Agriculture &
Technology, Meerut, Uttar
Pradesh, India

Satendra Kumar

Professor Soil Science and
Agricultural Chemistry, Sardar
Vallabhbhai Palel University of
Agriculture & Technology,
Meerut, Uttar Pradesh, India

Corresponding Author:**Dinesh Kumar**

Technical Assistant,
Department of Agriculture,
Sardar Vallabhbhai Palel
University of Agriculture &
Technology, Meerut, Uttar
Pradesh, India

Effect of herbicides and nutrient management practices on weeds, nutrient depletion and yield of wheat (*Triticum aestivum* L.)

Dinesh Kumar, Vivek and Satendra Kumar

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Abstract

A field experiment was conducted at the Meerut during the winter (*rabi*) seasons of 2009-10 and 2010-11, to evaluate the effect of different herbicides and nutrient management practices on weeds and productivity of wheat (*Triticum aestivum* L.). The experiment was conducted in a factorial randomized block design, replicated thrice with 4 nutrient levels *viz.*; control (No NPK), 50% NPK + FYM 15 t/ha, 75 % NPK + FYM 10 t/ha and 100 % NPK and 5 weed control measures *viz.*; Pendimethalin 1.0 kg/ha, Fenoxaprop + metsulfuron-methyl (100 + 4 g/ha), Fenoxaprop + carfentrazone (100 +10 g/ha), two hand weeding (25 & 45 DAS) and weedy check. The results revealed that 75 % NPK + FYM 10 t/ha resulted in significantly reduced the density and biomass of weeds as compared to control treatment. The highest grain and straw yields were recorded with application of 75 % NPK + FYM 10 t/ha, which was at par with 100% NPK. Among the weed control treatments gave significantly higher wheat yield compared to weedy check, but application of Fenoxaprop + carfentrazone (100 +10 g/ha) comparable with two hand weeding was superior to all other weed control treatments. This treatment having better weed control, higher nutrient uptake resulted in higher yield, net returns and B:C ratio comparable with two hand weeding. Therefore, a combination of 75% NPK + FYM 10 t/ha and Fenoxaprop + carfentrazone (100 +10 g/ha) may be recommended for better weed control, higher yield, higher productivity and net returns.

Keywords: Weed-management, nutrient removal, wheat yield, weed-control efficiency

Introduction

Wheat is the most important food crop of world and is grown under different soil and agro-climatic conditions. In India, it is the second most important food crop after rice and occupied approximately 31.48 million hectare area with a production of 99.86 million tonnes during 2017-18 (DAC & FW, 2018-19). The improvement in its productivity has played a key role in making the country self-sufficient in food grain. However, in the past decade a general slowdown in increase in the productivity of wheat has been noticed (Nagarajan, 2005) ^[10].

By 2020, India will have a population of about 1.3 billion and there will be a substantial pressure on land to produce more food, specially wheat and rice. The introduction of high yielding dwarf varieties coupled with increased use of fertilizer and irrigation have increased weed problem which is one of the major constraints in achieving potential yield of wheat. Slow growth of wheat at early stages and application of more fertilizer as well as irrigation right from sowing, encourages the rapid growth of weeds and if not controlled, they cause loss in yields to the tune of 15 to 40% (Jat *et al.*, 2003) ^[6]. The losses caused by weeds vary depending on the weed species, their abundance, crop management options and environmental factors, under extreme cases, losses can be complete crop failure (Malik and Singh, 1993) ^[8]. The high cost and less efficacy of manual weeding in wheat made chemical weed control popular. Since the wheat crop is infested by number of weed species, it gets difficult to control them with single herbicide having just one kind of mode of action. It also contributes to a shift towards difficult to control weeds and rapid evolution of multiple herbicide resistance which is a threat to wheat production (Singh, 2007) ^[21]. Hence, there is a need to use mixture of herbicides in a way to lower their load on environment and improve weed-control efficiency without any adverse effect on crop.

Wheat is generally grown in intensive cropping systems with higher use of inorganic plant nutrients, specially supplied through N: P: K fertilizers.

The continuous use of chemical fertilizers alone adversely affects the soil health and long-term crop productivity. Thus, it becomes necessary to supply the nutrients to crop through combined use of chemical fertilizers, organic sources and biofertilizers to sustain the soil health and crop productivity. The integrated use of organic manures and inorganic fertilizers in different proportions has proved its worth in maintaining higher productivity, providing greater stability to crop production (Patel *et al.*, 2014) ^[13] and sustaining the soil health (Weber *et al.*, 2007; Pullicino *et al.*, 2009) ^[23, 16]. Since very little information on the combined effect of herbicides and nutrient management practices on wheat is present. Hence, present investigation was undertaken to study the effect of herbicides and nutrient management practices and its time of application on weed-suppression and yield of wheat.

Materials and Methods

A field experiment was conducted during the winter (*rabi*) seasons of 2009-10 and 2010-11 at Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut (29° 05' 19" N and 77° 41' 50"E), Uttar Pradesh. The soil of the experimental field was sandy loam in reaction (pH 7.60), low in organic carbon (0.43%), available nitrogen (245 kg N/ha), and medium in available phosphorus (13.0 kg P/ha) and potassium (185 kg K/ha). Treatments were laid down in a factorial randomized block design, replicated thrice with 2 factors. First factor consisted of 5 weed control measures, viz. Pendimethalin 1.0 kg /ha, Fenoxaprop + metsulfuron-methyl (100 + 4 g/ha), Fenoxaprop + carfentrazone (100 +10 g/ha) and two hand weeding (25 & 45 DAS) and weedy check and the second factors 4 nutrient levels control (No NPK), 50% NPK + FYM 15 t /ha, 75 % NPK + FYM 10 t /ha and 100 % NPK. Wheat variety 'PBW 343' was sown on 28 November, 2010 and 29 November, 2011 with 100 kg seed/ha, keeping row-to-row distance of 20 cm during both the years of experimentation. Nitrogen was applied as per treatment, but full amount of P and K were applied at the time of sowing and FYM was applied as per treatments and incorporated into the soil before the sowing of the crop. As per treatments, all the post-emergence herbicides were dissolved in water and applied 35 days after sowing, whereas pendimethalin was applied as pre- emergence two day after sowing using knapsack sprayer fitted with flat-fan nozzle. Total weed density and biomass of weeds were recorded 60 days after sowing (DAS) and at harvesting using a quad rat of 0.5 m × 0.5 m randomly selected at 2 places in each plot. Furthermore, all weeds from quadrant were cut at the ground level, placed in a paper bag and dried for 48 hrs in an oven at 70°C and then were weighed to determine the weed dry biomass. Grain yield recorded in kg/plot was finally converted into grain yield in kg/ha. Weed data (density and biomass) were subjected to square-root transformation $\sqrt{x+1}$. Weed-control efficiency was computed on the basis of total weed density at harvesting. Net returns for each treatment combination were calculated by deducting the cost of cultivation from the respective gross returns. Benefit: cost ratio was calculated by dividing net returns (Rs/ha) with cost of cultivated (Rs/ha) pooled data two years are presented in tables.

Results and Discussion

Weed flora

The major weed species appeared in experimental field were

Phalaris minor and *Avena ludoviciana* among grasses weeds; and *Chenopodium album*, *Anagallis arvensis* and *Melilotus indica* among broad-leaf weeds was observed. The nutrient management treatments 75 % NPK + FYM 10 t /ha, significantly reduced the density and biomass of weeds as compared to control as per 2 years pooled data (Table 1). Her, it is necessary to mention that critical period of crop-weed competition in wheat is between 30 and 50 DAS (Chaudhary *et al.*, 2008) ^[2], which means those nutrient rates which provide competitive advantage to crop vis-a-vis suppressive effect on weeds up to 50 DAS would have positive influence on crop yield. Besides above facts, experimental findings also showed that during the critical period of crop weed competition, application of 75 % NPK + FYM 10 t /ha shifted the competitive advantage in favour of crop and also helped smothering the weeds. It appeared that vigorous crop stand and growth due to nutrient level asserted a strong smothering effect on growth and development of weeds (Patel *et al.*, 2012) ^[14]. Weed-control treatments significantly reduced the density and biomass of total weeds than the weedy check. In case of weed density and their biomass, the lowest values were recorded from two hand weeding (25 & 45 DAS) treatment. Fenoxaprop + carfentrazone (100 +10 g/ha) proved the most effective herbicidal combination against broad-leaf and grassy weeds and recorded significantly lower total density and biomass of weeds. This may be reason for excellent control of total weeds density owing to sequential two hand weeding (25 & 45 DAS) and differential selectivity towards broad-leaf and grassy weeds with the application of Fenoxaprop + carfentrazone (100 +10 g/ha). The results are in the agreement with the findings of Chopra *et al.* (2013) and Kaur *et al.* (2015). Fenoxaprop + carfentrazone (100 +10 g/ha) significantly reduced the biomass of total weeds over all other sole and tankmix application of different herbicides. With chemical and two hand weeding (25 & 45 DAS) treatments, the weed density was very much suppressed and hence the production of fresh weight and biomass weight were considerably lower. Our results confirm the findings of Jain *et al.* (2014) ^[5] and Khan *et al.* (2017) ^[7]. The highest weed-control efficiency was also recorded under Fenoxaprop + carfentrazone (100 +10 g/ha) than tankmix of Fenoxaprop + metsulfuron-methyl (100 + 4 g/ha), might be owing to lower weed density and biomass production of weed which resulted successful checking of weed growth under this treatment.

Nutrient depletion by Weeds

The maximum reduction in NPK depletion by the weeds was registered under application of 50 % NPK + FYM 15 t /ha than control treatment (Table 1) this was due to increased weed growth, resulting in higher dry biomass accumulation and consequently nutrient depletion.

Lower NPK depletion was registered under weed control treatments than under weedy check plot. Among the weed-control treatments, lowest depletion was recorded under Fenoxaprop + carfentrazone (100 +10 g/ha), which was on at par with two hand weeding (25 & 45 DAS), and both proved superior in minimizing the nutrient loss to the tank mix of Fenoxaprop + metsulfuron-methyl (100 + 4 g/ha). Reduction in dry biomass of weeds might be the reason for lower nutrient depletion under these treatments, indicating the extent of nutrient loss through weeds in wheat. Pandey *et al.* (2007) ^[12] also reported highest depletion of NPK in weedy check pot.

Table 1: Effect of herbicides and nutrient management practices on weed density, weed biomass, weed-control efficiency and nutrient removal by weeds (pooled data of 2 years)

Treatment	Total weeds density (No/m ²)	Total weed biomass (g) m ⁻²	Weed- control efficiency (%)	Nutrient removal by weeds (kg/ha)		
	60 DAS	60 DAS	60 DAS	N	P	K
Nutrient management						
Control	9.59 (99.33)	7.63 (62.08)	52.06	8.90	0.79	7.45
50% NPK+ FYM 15 t/ha	9.01 (88.62)	7.26 (57.05)	54.35	9.47	0.83	7.46
75% NPK + FYM 10 t/ha	7.68 (67.33)	6.21 (43.63)	58.49	7.54	0.80	5.97
100% NPK	8.42 (78.62)	6.82 (50.98)	55.54	8.62	0.84	6.78
SEm(±)	0.18	0.08	-	0.17	0.04	0.25
C.D. (P=0.05)	0.51	0.25	-	0.50	NS	0.74
Weed control practices						
Pendimethalin 1.0 kg/ha	9.05 (82.00)	7.28 (52.40)	55.95	8.45	0.79	6.77
Fenoxaprop + metsulfuron-methyl 100 + 4.0 g/ha	8.47 (71.99)	6.81 (46.00)	61.45	7.45	0.74	5.98
Fenoxaprop + carfentrazone 100 +10.0 g/ha	7.46 (56.33)	5.98 (35.56)	70.09	5.79	0.60	4.65
Two hand weeding (25&45 DAS)	4.48 (24)	3.94 (15.15)	87.47	2.47	0.27	1.98
Weedy check	13.14 (183.33)	10.89 (118.13)	0	19.00	1.68	15.19
SEm(±)	0.19	0.09	-	0.20	0.04	0.43
C.D. (P=0.05)	0.57	0.28	-	0.57	0.12	0.82

Original values is parentheses and data subjected to square root ($\sqrt{x+1}$) transformation

Yield

The nutrient management significantly influenced the biological, grain and straw yields of wheat (Table 2). The highest grain and straw yields were recorded with application of 75 % NPK + FYM 10 t /ha, which was at par with 100% NPK than 50% NPK+ FYM 15 t/ha. It indicates that addition of FYM with 75% NPK proved beneficial in increasing the grain and straw yield of wheat over 100% NPK alone. Furthermore, addition of organic manures, viz. farm yard manure, with NPK was a better option for enhancing the grain yield of wheat. There was not much variation in straw yields under different treatments. Many nutrient management had very close straw yields. The highest biological yields was observed with 75 % NPK + FYM 10 t /ha, which was at par with 100% NPK. It indicates that the influence of combined application of 75 % NPK and FYM on biological yield of wheat was inconsistent. However, combined application of 75 % NPK and FYM was a better choice for enhancing the biological yield of wheat. Overall, combined application of NPK and organic manures (FYM) helped wheat crop better in enhancing the grain yield over sole application of chemical fertilizers. Shah and Ahmad (2006) ^[18] and Ram and Mir (2006) ^[17], and Singh *et al.* (2012) ^[20] also reported similar findings.

The weed-control treatments had significant influenced on biological, grain and straw yields. The highest grain and straw yields were obtained from two hand weeding (25 & 45 DAS) treatment, although this remained statistically at par with Fenoxaprop + carfentrazone (100 +10 g/ha) and both the treatments, resulted in an increase grain yield as compared to weedy check. It is all because of the fact that both the treatments showed its superiority in most of the yield attributes as well as these results might be because difference in weed dry weight obtained due to weed-control treatments, which resulted in reduced crop competition for space, solar radiation interceptions, moisture and nutrient uptake. The results conformity the findings of Bajya *et al.* (2015) ^[1] and Pal *et al.* (2016) ^[11]. The two hand weeding (25 & 45 DAS) treatment resulted in significantly superior biological yield fallowed by Fenoxaprop + carfentrazone (100 +10 g/ha) as compare to all the other herbicidal treatments. The application of Fenoxaprop + metsulfuron-methyl (100 + 4 g/ha) and Pendimethalin 1.0 kg/ha remained at par with each other. It is

obvious that dry matter is net saving of photosynthesis and essential for the building up of plant organs, which ultimately reflect on biomass production. Similar results were found by Meena and Singh (2013) ^[9] and Singh *et al.* (2015) ^[19].

Economics

The least cost of cultivation was recorded with control treatment as per 2 years pooled data (Table 2). It increased further when NPK was combined with organic manures, as the cost of organic manures is generally higher than chemical fertilizers. The cost of cultivation was still higher when FYM was combined with 75 % NPK over the FYM was used with 50 % NPK. Thus, the highest cost of cultivation was observed with 75 % NPK + FYM 10 t /ha, followed by 100 % NPK and 50 % NPK + FYM 15 t /ha. Grass return was also highest with 75 % NPK + FYM 10 t /ha followed by 100 % NPK and 50 % NPK + FYM 15 t /ha. However, the highest net returns and benefit: cost ratio were obtain with 75 % NPK + FYM 10 t /ha followed by 100 % NPK and 50 % NPK + FYM 15 t /ha. Even application of organic manures (FYM) with 75 % NPK proved much better over 100 % NPK alone, particularly with respect to the grass returns, net returns and benefit: cost ratio. Verma *et al.* (2014) ^[22], also reported similar results.

The two hand weeding (25 & 45 DAS) and all the herbicides sole or in tank mix application recorded higher monetary returns than weedy check. Among the weed-control treatments, the highest net returns were obtained from two hand weeding (25 & 45 DAS) treatment, followed by Fenoxaprop + carfentrazone (100 +10 g/ha) and Fenoxaprop + metsulfuron-methyl (100 + 4 g/ha). Alone application of herbicides also accured higher net returns/ha than weedy check. The maximum benefit: cost ratio was recorded with Fenoxaprop + carfentrazone (100 +10 g/ha) against benefit: cost ratio of two hands weeding (25 & 45 DAS). The profitability was lower under weedy check due to disproportionate decrease in yield on account of higher crop-weed competition. The results confirm the findings of Jain *et al.* (2014) ^[5] and Chopra *et al.* (2015) ^[3].

Hence, it may be concluded that post-emergence application of Fenoxaprop + carfentrazone (100 +10 g/ha) along with 75 % NPK + FYM 10 t /ha could be a best option for achieving higher yield, net returns, benefit: cost ratio as well as significant weed suppression in wheat.

Table 2: Effect of herbicides and nutrient management practices on grain yield, straw yield, biological yield (q/ha) and economics in wheat (pooled data of 2 years)

Treatment	Grain yield (t/ha)	Straw yield (t/ha)	Biological yield (t/ha)	Economics			
				Cost of cultivation (Rs×10 ³ / ha)	Grass returns (Rs×10 ³ /ha)	Net returns (Rs×10 ³ /ha)	Benefit: cost ratio
Nutrient management							
Control	2.75	4.23	6.98	19.49	40.22	20.73	1.07
50% NPK+ FYM 15 t/ha	4.49	6.87	11.36	25.34	65.55	40.21	1.57
75% NPK + FYM 10 t/ha	4.75	7.16	11.91	26.17	68.99	42.82	1.63
100% NPK	4.65	7.08	11.73	25.80	67.63	41.83	1.61
SEm(±)	0.05	0.06	0.05	-	-	-	-
C.D. (P=0.05)	0.15	0.16	0.15	-	-	-	-
Weed control practices							
Pendimethalin 1.0 kg/ha	4.20	6.45	10.65	23.29	61.33	38.04	1.59
Fenoxaprop + metsulfuron-methyl 100 + 4.0 g/ha	4.37	6.64	11.01	23.80	63.56	39.76	1.63
Fenoxaprop + carfentrazone 100 +10.0 g/ha	4.53	6.85	11.38	24.06	65.81	41.75	1.70
Two hand weeding (25&45 DAS)	4.64	6.98	11.62	27.97	67.29	39.32	1.38
Weedy check	3.07	4.75	7.82	21.89	44.98	23.09	1.06
SEm(±)	0.05	0.06	0.05	-	-	-	-
C.D. (P=0.05)	0.16	0.18	0.17	-	-	-	-

References

- Bajja DR, Parveen T, Lakharam MC, Raja SK. Efficacy of new formulations of trisulfuron on weeds in wheat and their residual effects on succeeding maize. *Indian Journal of Agronomy*. 2015; 60(1):57-60.
- Chaudhary S, Muzzammil H, Ali MA, Iqbal J. Effect of weed competition period on yield and yield components of wheat. *Journal of Agriculture and Research, Lahore*. 2008; 46(1):47-53.
- Chopra NK, Chopra N, Choudhary D. Bioefficacy of sole and tankmix of pinoxaden and clodinafop with carfentrazone and metsulfuron for control of complex weed flora in wheat. *Indian Journal of Agronomy*. 2015; 60(1):104-108.
- DAC FW. Annual Report 2016-17. Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture, Government of India, Krishi Bhawan, New Delhi, 2016-17.
- Jain V, Jain N, Kewat ML. Effect of application of post-emergence herbicides at different levels of available soil moisture content in irrigated wheat. *Indian Journal of Agronomy*. 2014; 59(1):91-95.
- Jat RS, Nepalia V, Chaudhary PD. Influence of herbicides and methods of sowing on weed dynamics in wheat (*Triticum aestivum* L.). *Indian Journal of Weed Science*. 2003; 35(1):18-20.
- Khan N, Chaudhry S, Siddiqui MZ, Yadav RA, Husain K. Effect of weed management options and nitrogen scheduling on weed dynamics and yield of wheat (*Triticum aestivum* L.) under central plain zone of Uttar Pradesh. *Indian Journal of Agronomy*. 2017; 62(4):464-469.
- Malik RK, Singh S. Evolving strategies for herbicide use in wheat: Resistance and integrated weed management, (In) Proceedings of International Symposium on Integrated Weed Management for Sustainable Agriculture, organized by the Indian Society of Weed Science during 18-20 November 1993 at Hisar, Haryana, India, 1993, 225-238.
- Meena BL, Singh RK. Response of wheat to rice and weed management practices. *Indian Journal of Agronomy*. 2013; 58(4):521-524.
- Nagarajan S. Can India produce enough wheat even by 2020 *Current Science*. 2005; 89(1):467-1, 471.
- Pal S, Sharma R, Sharma HB, Singh R. Influence of different herbicides on weed control, nutrient removal and yield of wheat (*Triticum aestivum* L.). *Indian Journal of Agronomy*. 2016; 61(1):59-63.
- Pandey IB, Dwivedi DK, Pandey RK. Efficacy of herbicides and fertilizer management on weed dynamics in wheat (*Triticum aestivum* L.). *Indian journal of Agronomy*. 2007; 52(1):49-52.
- Patel HK, Sadhu AC, Lakum YC, Suthar JV. Response of integrated nutrient management on wheat (*Triticum aestivum* L.) and its residual effect on succeeding crop. *International Journal of Agricultural Sciences and Veterinary Medicine*. 2014; 2(4):48-52.
- Patel SM, Patel JC, Chaudhary PP, Patel DM, Patel GN, Patel BM. Effects of nitrogen levels and weed management on production potential of weed (*Triticum aestivum* L.). *Research on Crops*. 2012; 13(2):456-462.
- Prasad R. Fertilizers and manures. *Current Science*. 2012; 102(6):894-898.
- Pullicino DS, Massaccesi L, Dixon L, Bolb R, Gigliottia G. Organic matter dynamics in a compostamended anthropogenic landfill capping-soil. *European Journal of Soil Science*. 2009; 61:35-47.
- Ram T, Mir MS. Effect of integrated nutrient management on yield and yield-attributing characters of wheat. *Indian Journal of Agronomy*. 2006; 51(3):189-192.
- Shah Z, Ahmad MI. Effect of integrated use of farm yard manure and urea on yield and nitrogen uptake of wheat. *Journal of Agricultural and Biological Science*. 2006; 1(10):60-65.
- Singh AP, Pandagare T, Abraham S, Chandrakar D, Chowdhury T. Evaluation of metribuzin in combination with clodinafop, sulfosulfuron and Pinoxaden for weed control in wheat. *International Journal of Life Science*. 2015; 10(1):271-274.
- Singh JP, Kaur J, Mehta DS, Narwal RP. Long-term effect of nutrient management on soil health and crop productivity under rice-wheat cropping system. *Indian Journal of Fertilisers*. 2012; 8(8):28-48.

21. Singh S. Role of management practices on control of isoproturon-resistant littleseed canarygrass (*Phalaris minor*) in India. Weed Technology. 2007; 21(2):339-346.
22. Verma VK, Chaudhry S, Singh V, Gupta SK, Harvansh K. Effect of integrated soil fertility management practices on production and productivity of wheat in alluvial soils of Central Plain Zone of U.P. International Journal of Agricultural Science. 2014; 10(2):735-738.
23. Weber J, Karczewska A, Drozd J, Licmar M, Licznar S, Jarnroz E. Agricultural and ecological aspects of a sandy soil as affected by the application of municipal solid waste composts. Soil Biology and Biochemistry. 2007; 39:1294-1302.