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Effect of fertility levels and herbicides combination on weed dynamics and productivity of wheat (*Triticum aestivum* L.)

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Abstract

The field experiment was conducted during the *rabi* season of 2014–15 and 2015–16 at the CRC, Chirodi, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram Meerut U.P. to study the “Effect of fertility levels and herbicides combination on weed dynamics and productivity of wheat (*Triticum aestivum* L.)”. The soil of experimental field was sandy loam in texture, low in organic carbon and available nitrogen, medium in available phosphorus and available potassium with near to neutral in reaction. There were two factor, 3 fertility levels (75, 100 and 125% recommended dose of NPK) and 6 weed control practices. The treatments were replicated three times in a split plot design. Among the herbicide sulfosulfuron + metsulfuron @ 25 + 4 g a. i ha⁻¹ was controlled the narrow and broad leaves weeds very effectively and recorded higher value of weed control efficiency and yield of wheat followed by Clodinofof + 2,4-D @ 60+500 g a.i. ha⁻¹. Thus, it may be concluded that application of 125% recommended dose of NPK ha⁻¹ with sulfosulfuron + metsulfuron @ 25 + 4 g a.i ha⁻¹ as proved most superior than other treatment with respect to higher yield, weed control efficiency and lower total density and dry matter accumulation of weed.

Keywords: Fertility levels, herbicides, weed control efficiency and wheat crop

Introduction

Wheat is an important prime cereal crop among the food-grain is grown in area 31.7 m. ha in India with the production 95.9 million t. and average productivity of 30.25 q ha⁻¹ with a share of our 32% UP has merged on top in terms of wheat production in India. Among the many factors adversely influencing wheat productivity, weed infestation is one of them (Singh *et al.* 2015). Weed infestation is one of the main causes of low wheat yield not only in India but all over the world as it reduces wheat yield by 37-50%. Weed compete with crop plants for nutrients, light, space, moisture and many other growth factor. The weeds in India are causing substantial losses to agriculture production. In agriculture weed causes more damage compared to insects, pests and diseases but due to hidden loss by weed in crop production, it has not draw much attention of agriculturists. Day by day, weed control through herbicides is increasing and popularizing among farmer. Because, weed control through manual methods is time consuming and tedious and become very costly due to unavailability of labour in peak period and labour charge are also high due to shifting of agricultural labours to industries for better and assured wages. Wheat is sown at very narrow row spacing. Therefore, cultural methods of weed control could not be performed and manual control becomes unaffordable. Hence, use of herbicides popularized particularly in irrigated wheat crop. Herbicides have shown to be beneficial and very effective means of controlling weeds in wheat because they are quite effective and efficient. Second causes of low productivity of wheat imbalance fertilizers uses.

Materials and Methods

A field experiment was conducted at the crop research center Chirodi, Sardar Vallabhbhai Patel university of agriculture a technology, Modipuram, Meerut (U.P.) located at a latitude of 29°4 North and longitude of 77°41' East with an elevation of 237 meters above mean sea level. The mean annual rainfall is 862 mm of which 80-90% is received from June to September. Maximum and minimum temperature gradually decreased from sowing to growth and after increase to harvest time of wheat crop during Rabi seasons of 2014-15 and 2015-16. The soil was sandy loam in texture with pH 7.8 organic carbon (0.41%) and available N, P and K were 237.1, 16.08 and 180.5 kg ha⁻¹ respectively.

The experiment was laid out in a SPD with three replications. There were two factor i.e. main factor three fertility levels viz 75% recommended dose of NPK, 100% RDF of NPK & 125% RDF of NPK and second factor six weed management practices viz Clodinofof @ (60 g ha⁻¹), sulfosulfuron @ (25g ha⁻¹), clodinofof + 2.4 - D @ (60 + 500 g ha⁻¹), sulfosulfuron + metesulfuron methyl @ (25 + 4 g ha⁻¹), two hand weeding at 20 & 40 DAS and weedy check, wheat variety PBW 550 was sown 20 cm apart using 100 kg seed ha⁻¹ on third week of November both the years fertilizer were applied as per treatment through Urea, Di ammonium phosphate and muriate of potash one third dose of nitrogen and full dose of phosphorus and potassium was applied as basal and remaining two thirds of nitrogen was applied through urea as top dressing after first irrigation and panicle initiations stages. First irrigation given at crown root initial stage after that crop was irrigated 20 – 25 days interval to avoid any kind of water stress. Herbicides were applied as post emergence i.e. 32 DAS with the help of hand operated knapsack sprayer, fitted with flat fan nozzle with 250 liter ha⁻¹ water. First hand weeding was done at 20 and second at 40 DAS. Weed density and dry weight was recorded at 60 and 90 DAS the data recorded on weed density and dry weight was subject square root transformation before statically analysis.

Results and Discussion

The weed flora in the experimental field were collected, identified and classified at different stages of crop growth. Predominant weed species among broad leaf weeds *Chenopodium album* L., *Anagallis arvensis* L., *Melilotus alba*, *Fumaria parviflora* and *Vicia spp* whereas *Phalaris minor*, *Avena ludoviciana* and *Cynodon dactylon* among grasses. Moreover, among sedges only one species i.e. *Cyperus rotundus* was observed. Malik *et al.* (2012) [5] reported similar weed flora in wheat crop under normal sown condition.

Weed density (m⁻²) The density of *Phalaris minor*, *Anagallis arvensis*, *Avena ludoviciana*, *Chenopodium album*, *Melilotus alba*, other weeds and total weed recorded at 60 DAS stage indicates that significant response was observed maximum number weeds and then increase of crop age decline of the density of weed irrespective of the treatment. The highest weed density was found under application of 75% recommended dose of NPK when increasing of fertility levels then decline the weed density. Application of 125% recommended dose of NPK was found significantly lower weed density over rest fertility levels at 60 and 90 DAS during both years.

Among the weed management practices significantly lower total weed density was found with two hands weeding at 60 and 90 DAS (table 1) during 2014-15 and 2015-16. The maximum weed density was found under weedy check (control) at 60 and 90 DAS during both years. The weed control by herbicide, the minimum weed density was found significantly higher with sulfosulfuron + metsulfuron @ 25 + 4 g a.i. ha⁻¹ over rest treatment at 60 and 90 DAS during both year. The fact was that sulfosufuron + metsulfuron@ 25 + 4 g a.i ha⁻¹ controlled narrow and broad leaves weeds and clodinafof + 2,4-D @ 60+500 g a.i ha⁻¹ controlled narrow and broad leaves weed and Clodinofof @ 60 g a.i ha⁻¹ control the only narrow leaves weeds. These results were in close proximity with the finding of (Prasad *et al.* 2017) [5].

The highest weed dry matter accumulation was found with 75% recommended dose of NPK during 2014-15 and 2015-16. Application of 125% recommended dose of NPK was

found significantly lower total weed dry matter accumulation over rest treatment at 60and 90 DAS both years. All the weed management practices significantly lower total weed dry matter accumulation was found with two hands weeding at 60 DAS (Table 1) during 2014-15 and 2015-16. Total weed dry matter accumulation was found significantly lower with sulfosulfuron + metsulfuron @ 25 + 4 g a.i. ha⁻¹ over rest treatment at 60 DAS during 2014-15 and 2015-16. Reduction in weed biomass was due to lower weed population recorded under these treatments could be attributed to the effective weed control. The mean total weeds dry matter accumulation at 60 DAS was recorded significantly reduced all weed management practices over weedy check. Significantly the highest dry weight of weeds was observed under weedy check might be due to uncontrolled condition favoured luxurious weed growth leading to increased dry matter accumulation. The findings corroborate with those of (Yadav *et.al.* 2006) [9]. (Malekian *et.al.* 2013) [6] reported that application of metsulfuron- methyl + sulfosulfuron at 36 g ha⁻¹ reduced weed dry matter by 98.6 and 97.55% during first and second year, respectively and also recorded the lowest weed dry matter.

Weed control efficiency (%)

Among weed management practices the highest weed control efficiency 95.30 and 95.10 percent were registered under tow hand weeding and closely followed by sulfosufuron + metsulfuron 25 + 4 g a.i ha⁻¹ 93.50 and 93.10 percent at 60 DAS at 2014-15 and 2015-16. The minimum weed control efficiency 77.13, 76.80 percent at 60 DAS was found with clodinofof @ 60 g a.i. ha⁻¹. This is due to lower weed population and lower dry matter production of weeds. During application of this herbicide control of weeds and provide weed free and congenial environment to the crop.

Yield attributes and Yield of wheat (q ha⁻¹)

The Yield attributes and grain yield was significantly influenced due to fertility levels (Table 2). Application of 125% recommended dose of NPK was found significantly higher Yield attributes and grain yield 42.3 and 41.8 q ha⁻¹ over 75% recommended dose of NPK and at par with 100 % recommended dose of NPK during 2014-15 and 2015-16, respectively. The mean increase in grain yield 16.41 percent with 125% recommended dose of NPK and 10.90 percent with 100 % recommended dose of NPK over 75 % recommended dose of NPK. The grain and straw yield increased with increase with level of fertility. Application of the 125% recommended dose of NPK recorded significantly higher, grain and straw yield of crop. Increasing rate of fertility levels shift the competitive advantage in favours of crop and reduce the crop weed competition for nutrient which is significantly enhanced yield. These results were in close proximity with the finding of (Prasad *et.al.* 2017) [5].

Among the weed management practices significantly increase Yield attributes plant height, effective tiller m⁻², no. Of grains per panicle and test wt. and grain yield 47.60 q ha⁻¹ and 47.20 q ha⁻¹ was found with two hands weeding during 2014-15 and 2015-16 respectively. Weed control by herbicide the grain yield 45.40 q ha⁻¹ and 44.70 q ha⁻¹ was recorded significantly higher under sulfosulfuron + metsulfuron @ 25 + 4 g a.i. ha⁻¹ during both years. The grain yield and straw yield was recorded significantly higher with sulfosulfuron + metsulfuron @ 25 + 4 g ha⁻¹ due to reduced crop weed competition, effectively suppressed predominant throughout crop growth period. The application of hand weeding and

herbicidal weed control treatments gave significantly higher grain and straw yields than weedy check (Prasad *et al.* 2017) [7], Istadev *et al.* 2016 [1]. Herbicide mixtures are

reported to have complementary effect and cause greater effect on complex weed flora than individual application.

Table 1: Effect of fertility levels and weed management practices on weed density, dry weight and weed control efficiency.

Treatment	Total weed density M ⁻² at 60 DAS		Total weed density M ⁻² at 90 DAS		Total Dry matter accumulation(g) M ⁻² at 60 DAS		Total Dry matter accumulation(g) m ⁻² at 90 DAS		Weed control efficiency at 60 DAS	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Fertility levels										
75% NPK	7.70 (58.35)	7.90 (61.45)	7.38 (53.60)	7.52 (55.65)	5.96 (34.56)	5.96 (34.58)	6.56 (42.12)	6.65 (43.25)	-	-
100% NPK	7.24 (51.56)	7.39 (53.70)	6.86 (46.12)	7.01 (48.24)	5.58 (30.15)	5.69 (31.46)	6.23 (37.84)	6.27 (38.35)	-	-
125% NPK	6.56 (42.12)	6.74 (44.50)	6.22 (37.76)	6.22 (37.77)	5.18 (25.85)	5.26 (26.74)	5.75 (32.15)	5.78 (32.49)	-	-
SEm ±	0.07	0.07	0.05	0.06	0.04	0.04	0.05	0.06		
C.D. (P=0.05)	0.28	0.28	0.20	0.24	0.16	0.16	0.20	0.24		
Weed management practices										
Clodinafop 60 g a i/ha	8.31 (68.15)	8.42 (70.80)	7.95 (62.25)	8.02 (63.46)	5.14 (25.45)	5.21 (26.24)	5.75 (32.15)	5.72 (32.75)	77.13	76.80
Sulfosulfuron 25 g a i/ha	7.88 (61.12)	8.02 (63.45)	7.51 (55.47)	7.59 (56.70)	4.86 (22.69)	4.91 (23.18)	5.46 (28.90)	5.57 (30.10)	79.61	79.50
Clodinafop + 2, 4-D (60+500 g a i/ha)	4.44 (18.78)	4.59 (20.14)	3.76 (13.20)	3.90 (14.24)	3.59 (12.80)	3.78 (13.3)	3.90 (14.25)	3.97 (14.83)	88.5	88.20
Sulfosulfuron + metsulfuron methyl (25+ 4 g a i/ha)	3.18 (9.12)	3.40 (10.56)	2.90 (7.45)	2.98 (7.90)	2.86 (7.20)	2.88 (7.80)	3.95 (15.64)	3.97 (15.80)	93.5	93.10
Two hand weeding (20 & 40 DAS)	2.49 (6.21)	3.09 (8.6)	2.64 (6.00)	2.50 (6.25)	2.48 (5.20)	2.54 (5.50)	3.31 (11.0)	3.52 (11.40)	95.3	95.10
Weedy Check	11.88 (140.36)	12.02 (143.70)	11.62 (134.48)	11.66 (135.12)	10.59 (111.32)	10.70 (113.5)	11.10 (122.30)	11.10 (123.4)	-	-
SEm ±	0.10	0.10	0.07	0.06	0.07	0.07	0.08	0.07	-	-
C.D. (P=0.05)	0.30	0.30	0.21	0.18	0.21	0.21	0.24	0.21	-	-

Table 2: Effect of fertility levels and weed management practices on yield attribute and yield of wheat.

Treatment	Plant height at harvest (cm.)		Effective tiller m ⁻²		no. of grains panicle ⁻¹		Test weight (g)		Grain yield (q h ⁻¹)		Straw yield (q h ⁻¹)	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Fertility levels												
75% NPK	79.6	79.8	280	284	37.3	37.6	37.5	37.4	35.5	34.8	42.2	42.7
100% NPK	81.2	81.7	310	320	40.2	39.7	38.7	38.9	39.8	39.1	48.6	47.5
125% NPK	83.5	83.6	325	328	42.8	41.9	40.1	41.0	42.3	41.8	51.6	50.2
SEm ±	0.80	0.82	5.0	4.5	0.35	0.32	0.33	.32	0.58	0.56	0.64	0.65
C.D. (P=0.05)	2.45	2.49	14.8	13.2	1.02	0.95	0.98	0.95	1.74	1.68	1.92	1.95
Weed management practices												
Clodinafop 60 g a i/ha	80.1	80.4	304	307	37.9	36.8	38.2	38.3	37.3	36.5	46.2	44.1
Sulfosulfuron 25 g a i/ha	81.6	81.7	312	316	39.2	38.2	38.6	38.5	38.2	37.3	48.4	47.8
Clodinafop + 2, 4-D (60+500 g a i/ha)	82.8	82.7	316	321	41.4	41.2	39.7	39.6	41.5	40.8	48.3	47.8
Sulfosulfuron + metsulfuron methyl (25+ 4 g a i/ha)	84.0	84.2	322	326	42.5	42.1	40.8	40.4	45.4	44.7	50.9	49.5
Two hand weeding (20 & 40 DAS)	85.7	85.8	328	330	52.4	51.8	41.3	41.5	47.6	47.4	58.3	57.4
Weedy Check	74.4	74.7	256	262	28.6	29.7	36.2	36.3	25.4	24.8	32.6	31.5
SEm ±	0.56	0.67	4.2	4.3	0.31	0.32	0.28	0.29	0.36	0.39	0.39	0.35
C.D. (P=0.05)	1.64	1.95	12.4	12.8	0.85	0.87	0.81	0.83	1.12	1.15	1.15	1.10

Conclusion

Among the herbicide sulfosulfuron + metsulfuron @ 25 + 4 g a.i ha⁻¹ was controlled the narrow and broad leaves weeds very effectively and recorded higher value of weed control efficiency and yield of wheat. Thus, it may be concluded that application of 125% recommended dose of NPK ha⁻¹ with sulfosulfuron +metsulfuron @ 25 + 4 g a.i ha⁻¹ as proved most superior than other treatment with respect to higher weed control efficiency and yield of wheat.

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