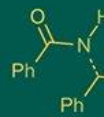


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Effect of weed control measures and fertility levels on growth, yield and economics of wheat (*Triticum aestivum* L.) and their residual effect on succeeding summer greengram

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Abstract

A field experiment was conducted at Research Farm, Agricultural Research Station, Kota during *rabi* 2023-24 and *rabi* 2024-25. The experiment was laid out in split plot design comprising eight weed control treatments in main plots and three fertility levels in sub-plots. Application of tank mix pyroxasulfone 85% WG @ 127.5 g a.i./ha + metsulfuron methyl 20% WP @ 4 g a.i./ha and pinoxaden 5.1% EC @ 45 g a.i./ha + metsulfuron methyl 20% WP @ 4 g a.i./ha were at par with each other in controlling weeds and reducing their dry matter and proved significantly superior over rest of the treatments. On pooled basis, two hand weeding at 30 and 45 DAS, pyroxasulfone 85% WG @ 127.5 g a.i./ha + metsulfuron methyl 20% WP @ 4 g a.i./ha and pinoxaden 5.1% EC @ 45 g a.i./ha + metsulfuron methyl 20% WP @ 4 g a.i./ha as post-emergence at 35 DAS resulted significantly higher grain yield (59.47, 56.19 and 55.57 q/ha, respectively) and straw yield (79.91, 76.86 and 72.63 q/ha, respectively). Fertility level of 125% and 150% NPK were at par and significantly resulted higher growth parameters and yields as compared to 100% NPK. No any phytotoxic effect on wheat and residual effect was observed on succeeding *summer* greengram.

Keywords: Weed control, fertility levels, phytotoxic, residual and succeeding summer greengram

Introduction

Wheat (*Triticum aestivum* L.) is the second most important cereal crop after rice worldwide. India is the second largest producer of wheat with area of 32.8 million ha and production of 1117.9 million ton (DA&FW, 2025). Rajasthan ranks fifth in wheat production after Uttar Pradesh, Madhya Pradesh, Punjab and Haryana, and is cultivated in 3.17 million ha area with the production of 112.7 million ton with hovering productivity of 3559 kg/ha (DA&FW, 2025). Weed infestation have become a serious threat and major production constraint in the wheat growing areas of the country. Wheat crop is infested with both grassy weeds *viz.* *Phalaris minor*, *Avena fatua*, *Cyperus rotundus*, *Cynodon dactylon* and broad leaved weeds *i.e.* *Chenopodium album*, *Chenopodium murale*, *Fumaria parviflora*, *Melilotus indica*, *Anagallis arvensis*, *Cirsium arvense*, *Lathyrus sativus*, *Convolvulus arvensis* and *Vicia hirsute* depending upon the adopted agronomic practices, soil types, weed control techniques and cropping system followed. Even a moderate weed infestation may bring down the wheat yield up to 33-66 percent or more (Bagri *et al.*, 2023 and Hazarika *et al.*, 2024) ^[1, 3]. Cultural weed control methods could not be performed well and becomes time consuming, tedious and very costly due to unavailability of labor in peak period. Herbicides are the potent tools to control the mixed weed flora in close growing crops like wheat. Apart from weed management, nutrient management also plays an important role in enhancing wheat productivity. The application of right amount of nutrients is an important part of achieving profitable yields of wheat (Ramnath and Verma, 2024) ^[5]. Also, the nutrient and weed management are intrinsically linked as both share the objective of improving resource use efficiency.

Materials and Methods

The field experiment was conducted in wheat during *rabi* 2023-24 & 2024-25 at Research Farm, Agricultural Research Station, Kota at Agriculture University, Kota. The soil of experimental site was clay loam. The experiment consisted of eight weed control treatments in main plots *viz.* W1: Weedy check, W2: Two hand weeding at 30 & 45 DAS, W3: 2,4-D (ester) @ 500 g *a.i./ha*, W4: Isoproturon @ 1.25 kg *a.i./ha*, W5: Clodinafop propargyl 15% + metsulfuron methyl 1% WP @ 52 g *a.i./ha*, W6: Mesosulfuron methyl 3% @ 12 g *a.i./ha* + iodosulfuron 0.6% WG 2.4 g *a.i./ha* @ 400 g/ha, W7: Pinoxaden 5.1% EC @ 45 g *a.i./ha* + metsulfuron methyl 20% WP @ 4 g *a.i./ha* and W8: Pyroxasulfone 85% WG @ 127.5 g *a.i./ha* + metsulfuron methyl 20% WP @ 4 g *a.i./ha* as post-emergence at 30-35 DAS and three fertility levels in sub-plots *viz.* F1: 100% RDF, F2: 125% RDF and F3: 150% RDF. The experiment was laid out in split plot design replicated thrice. The wheat crop variety Raj 4079 was sown with seed rate of 100 kg/ha and row spacing of 22.5 cm. All the herbicides were applied using the knapsack sprayer fitted with flat-fan nozzle with a spray volume of 500 l/ha water and the NPK was applied as Urea, SSP and MOP. Half urea and full SSP and MOP as basal dose and rest half urea was applied as top dressing at first irrigation.

Results

Effect on growth

Plant height, dry matter accumulation at 45 and 75 DAS was significantly affected due different weed control treatments and fertility levels both the years. Two hand weeding, pyroxasulfone 85% WG @ 127.5 g *a.i./ha* + metsulfuron methyl 20% WP @ 4 g *a.i./ha* and pinoxaden 5.1% EC @ 45 g *a.i./ha* + metsulfuron methyl 20% WP @ 4 g *a.i./ha* resulted significantly higher plant height and dry matter as compared to other treatments and weedy check at 45 and 75 DAS (Table 1).

Effect on yield attributes and yield

Different weed control treatments significantly affected the yield attributing characters *viz.* effective tillers, grains/ear and yields (Table1). Two hand weeding, pyroxasulfone 85% WG @ 127.5 g *a.i./ha* + metsulfuron methyl 20% WP @ 4 g *a.i./ha* and pinoxaden 5.1% EC @ 45 g *a.i./ha* + metsulfuron methyl 20% WP @ 4 g *a.i./ha* showed significantly higher yield attributes as compared to other treatments and weedy check. Similarly, two hand weeding at 30 and 45 DAS gave maximum grain and straw yield on pooled basis (59.47 and 79.91 q/ha, respectively), followed by pyroxasulfone 85% WG @ 127.5 g *a.i./ha* + metsulfuron methyl 20% WP @ 4 g *a.i./ha* and pinoxaden 5.1% EC @ 45 g *a.i./ha* + metsulfuron methyl 20% WP @ 4 g *a.i./ha* which were statistically at par. It can be seen that mixture herbicides resulted in better yield attributes and yield as compared to sole herbicides as they have broad spectrum weed control (Table 2). Similar findings are reported by Kaur *et al.* (2014) [4]. Among the fertility levels 125% and 150% NPK were superior in improving wheat yield attributes and yield as compared to control. On pooled basis maximum grain (53.07 q/ha) and straw yield (69.70 q/ha) was observed with 150% NPK which was at par to 125% NPK (50.49 and 65.66 q/ha, respectively). These observations are in close agreement with the findings of Saquib *et al.* (2012) [6], Sarita *et al.* (2022) [7].

Effect on quality

Table 1 indicates that weed control treatments did not have any significant effect on crude protein content in wheat and it ranged from 11.25 to 11.41%. Among the different fertility levels, maximum crude protein content was recorded under 150% NPK (11.48%), closely followed by 125% NPK (11.41%) and were at par and significantly higher than 100% NPK (11.19%).

Table 1: Effect of weed control and fertility levels on growth, yield attributes, yield and protein content of wheat on pooled basis

Treatments	Plant height (cm)		Dry matter accumulation (g/mrl)		Effective tillers (No./mrl)	Grains/ear (No.)	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index	Crude protein content (%)
	45 DAS	75 DAS	45 DAS	75 DAS						
Weed control										
W1	38.46	75.79	69.49	109.71	106.3	33.9	31.67	44.37	41.82	11.25
W2	49.73	90.74	87.42	163.53	140.5	46.0	59.47	79.91	42.89	11.41
W3	43.10	81.62	75.46	132.61	115.4	37.4	46.18	57.63	44.71	11.36
W4	42.96	81.42	74.54	129.89	115.2	36.9	45.99	57.41	44.53	11.35
W5	43.73	82.41	77.48	137.61	123.5	40.1	50.93	65.21	44.02	11.36
W6	44.89	86.63	78.62	140.93	124.7	40.2	51.23	65.54	44.08	11.38
W7	48.61	88.17	81.18	151.58	132.1	42.7	55.57	72.63	43.66	11.38
W8	49.15	88.98	81.39	151.92	133.3	43.0	56.19	76.86	42.37	11.40
SEm	0.68	0.97	1.23	2.05	1.27	0.43	0.62	1.26	0.62	0.10
CD	1.97	2.81	3.56	5.93	3.68	1.25	1.79	3.65	NS	NS
Fertility levels										
F1	43.70	81.48	74.04	130.58	118.8	38.6	45.39	59.48	43.47	11.19
F2	45.23	85.00	79.08	142.53	124.9	40.4	50.49	65.66	43.58	11.41
F3	46.30	86.93	81.47	146.05	128.0	41.1	53.07	69.70	43.48	11.48
SEm	0.44	0.73	0.93	1.26	1.25	0.35	0.85	2.02	0.83	0.04
CD	1.23	2.05	2.63	3.56	3.53	0.98	2.40	5.71	NS	0.11

Effect on economics

However, maximum yield was obtained with two hand weeding at 30 and 45 DAS but maximum net return and B:C ratio (Rs/ha 120069 and 3.03, respectively) was obtained with pyroxasulfone 85% WG @ 127.5 g *a.i./ha* +

metsulfuron methyl 20% WP @ 4 g *a.i./ha* followed by pinoxaden 5.1% EC @ 45 g *a.i./ha* + metsulfuron methyl 20% WP @ 4 g *a.i./ha* (Rs/ha 116425 and 2.95, respectively), which were at par to each other and significant to other treatments and weedy check (Table 2).

This may be due to the high labour cost required for two hand weeding. Similar results were found by Choudhari *et al.* (2017) and Sarita *et al.* (2022) ^[2, 7].

Residual effect

There was no any residual effect found on growth, yield attributes, yield and quality of succeeding *summer*

greengram due to the application of different herbicide treatments in preceding wheat crop. Similarly, there was no significant residual effect of fertility levels on succeeding greengram as applied in wheat. Although during initial crop growth stage, plant height and plant dry matter at 30 DAS sowed significant results due residual effect of fertility levels on succeeding crop.

Table 2: Effect of weed control and fertility levels on residual effect on succeeding *summer* greengram on pooled basis

Treatments	Plant height (cm)	Dry matter accumulation (g/plant)	Nodules/plant	Pods/plant	Seeds/pod	Seed yield (q/ha)	Protein content (%)
	30 DAS	30 DAS					
Weed control							
W1	17.02	5.19	27.9	22.8	11.2	8.34	21.19
W2	17.79	5.33	29.3	23.9	11.4	9.13	21.84
W3	17.24	5.25	28.2	23.1	11.3	8.60	21.44
W4	17.19	5.23	28.0	23.0	11.3	8.45	21.36
W5	17.39	5.28	28.3	23.3	11.3	8.63	21.46
W6	17.41	5.29	28.3	23.4	11.4	8.67	21.61
W7	17.41	5.30	28.5	23.5	11.4	8.74	21.66
W8	17.50	5.33	28.7	23.6	11.4	8.82	21.82
SEm±	0.35	0.03	0.4	0.29	0.07	0.19	0.20
CD(P = 0.05)	NS	NS	NS	NS	NS	NS	NS
Fertility levels							
F1	16.44	5.22	28.10	23.2	11.3	8.54	21.43
F2	17.63	5.27	28.58	23.3	11.3	8.64	21.58
F3	18.04	5.34	28.58	23.5	11.4	8.84	21.63
SEm±	0.23	0.03	0.43	0.22	0.09	0.14	0.08
CD (P = 0.05)	0.66	0.08	NS	NS	NS	NS	NS

Conclusion

From two-year field experimentation it can be concluded that weed control treatments and fertility levels significantly affected growth, yield attributes and yield of wheat crop. Two hand weeding at 30 and 45 DAS gave highest yield followed by pyroxasulfone 85% WG @ 127.5 g a.i./ha + metsulfuron methyl 20% WP @ 4 g a.i./ha and pinoxaden 5.1% EC @ 45 g a.i./ha + metsulfuron methyl 20% WP @ 4 g a.i./ha which were statistically comparable. Among fertility levels, 125% and 150% NPK were at par in increasing growth, yield attributes and yield of wheat than compared to 100% NPK. Highest net return and B:C ratio (Rs/ha 120069 and 3.03, respectively) was obtained with pyroxasulfone 85% WG @ 127.5 g a.i./ha + metsulfuron methyl 20% WP @ 4 g a.i./ha which was at par to pinoxaden 5.1% EC @ 45 g a.i./ha + metsulfuron methyl 20% WP @ 4 g a.i./ha (Rs/ha 116425 and 2.95, respectively). None of the herbicides showed any phytotoxic residual effect on succeeding *summer* greengram.

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