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Effect of nitrogen and weed control on productivity of wheat

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ABSTRACT

A field experiment was conducted during winter season of 2005-06 and 2006-07 to evaluate the effect of nitrogen levels and weed control on weed growth, productivity and economics of wheat. The treatments comprised of 4 levels of nitrogen, *viz*. 0, 40, 80, and 120 kg/ha in main plots and 5 weed control methods, *viz.* weedy control, 2,4-D Na 0.75 kg/ha as post-emergence, isoproturon 1.0 kg/ha as post-emergence, isoproturon 1.0 kg/ha + 2,4-D Na 0.75 kg/ha as post-emergence and weeding by Dutch hoe at 15, 30 and 45 days after sowing. Maximum density and dry weight were recorded with 120 kg N/ha and minimum under N_0. Increasing levels of nitrogen from 0 to 40, 40 to 80 and 80 to 120 kg/ha increased weed density by 33.7, 39.9 and 47.3% and weed dry matter by 35.2, 24.9 and 13.5%, respectively while N up take by 68.8, 56.7 and 18.7% phosphorus 13.2, 4.6 and 4.4% and potassium 16.2, 7.0 and 8.7% over preceding lower levels. 120 kg N/ha recorded significantly higher grain (2.90 t/ha) and straw (4.6 t/ha) yield, net return (₹ 26,616/ha) and B:C ratio (1.52).

Key words: Economics Nutrient up take, Weed control efficiency, Weed dry matter, Weed population

Generally weeds are considered harmful plants and are one of the biggest threats to agriculture. They use the soil fertility, available nutrients and moisture and compete for space and sunlight with the crop plants. This not only results in yield reduction but also deteriorates the quality of the produce, hence reducing the market value of crops (Heyne 1987). It has been estimated that crop losses due to weed competition throughout the world as a whole are greater than those resulting from the combined effects of insect pests and diseases (Khan *et al*. 2005). Fertilization is an important agronomic strategy used extensively to increase crop yield. Nevertheless, although nutrients clearly promote crop growth, many studies have shown that in some cases, fertilizers benefit weeds more than crops (DiTomaso 1995). For example, Carlson and Hill (1986) found that addition of N fertilizer to wild oat-infested wheat increased the density of wild oat panicles without increasing crop yield. However, Satorre EH and RW Snaydon (1992) showed that N fertilizer reduced the severity of competition experienced by wild oat from six spring cereals. The increase in weed competition at higher N rates has been suggested to be related to an increase in the efficiency of nutrient accumulation and use by weeds. The weeds removed significantly higher quantity of nitrogen, phosphorus and potash from plots receiving 120 kg N/ha than from those receiving lower levels of nitrogen.

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MATERIALS AND METHODS

A field experiment was conducted during winter season of 2005-06 and 2006-07 to evaluate the effect of weed management and nitrogen levels on weed growth and productivity of wheat. The treatments comprised of 4 levels of nitrogen, *viz.* 0, 40, 80, and 120 kg/ha in main plots and 5 weed control methods, *viz.* weedy control, isoproturon 1.0 kg/ha as post-emergence, 2,4-D Na salt 0.75 kg/ha as post-emergence and weeding by Dutch hoe at 15, 30 and 45 days after sowing. Wheat variety '*K 9107*' with 120 kg/ha seed rate was sown on 6th November, 2005 and 10th November, 2006, receiving 60 kg P_2O_5 and 40 kg K_2O/ha. Nitrogen 40 kg/ha was applied in single dose basal, whereas 80 kg/ha was applied in 2 splits – half basal + half at tillering stage; and 120 kg N/ha was applied in 3 splits, one third each at basal, tillering and at flowering. All herbicides were applied at post-emergence stage at 30 days after sowing using spray volume of 500 l/ha. Weeds were collected at randomly placing 50 x 50 cm quadrant in each plot. Weeds were cut from ground level and then identified, counted and samples were kept in an oven at 65± 5^{0}C until they attained constant weight. The data on weeds were square root transformed ($\sqrt{x+0.5}$) for statistical analysis (Panse and Sukhatme 1967).

RESULTS AND DISCUSSION

Effect on weed

Weed flora of the experimental field consisted mainly *Loilium temulentum* and *Avena fatua* among grasses and

Chenopodium album, Anagalis arvensis, Vicia sativa, Ageratum conzoides, Medicago polymorpha and *Oxalis corniculata* among broad-leaved weeds

Significant increase in weed density and dry matter accumulation at 90 days after sowing was observed with increase in each nitrogen level. Maximum density and dry weight were recorded with 120 kg N/ha and minimum under N_0. Increasing levels of N from 0 to 40, 40 to 80 and 80 to 120 kg/ha increased weed density by 33.7, 39.9 and 47.3% and weed dry matter by 35.2, 24.9 and 13.5%, respectively (Table 1). The significant increase in weed population and dry matter accumulation might be due to utilization of soil applied nitrogen in greater quantity by weeds, resulting in more growth and high dry matter accumulation. All weed control measures significantly reduced the weed density and dry weight of weeds at 90 days after sowing compared with weedy control. Weeding by Dutch hoe at 15, 30 and 45 days after sowing being similar to post-emergence application of isoproturon 1.0 kg/ha + 2,4-D Na 0.75 kg/ha proved most effective in arresting the population of weeds and dry matter accumulation. The highest weed control efficiency (86.1%) was recorded under weeding by Dutch hoe at 15, 30 and 45 days after sowing closely followed by isoproturon 1.0 kg/ha + 2,4-D Na 0.75 kg/ha post-emergence (84.1%). Similar results were also observed by Rajput *et al.* (1993).

Nutrient uptake by weeds and crop

The weeds removed significantly higher quantity of nitrogen, phosphorus and potassium from plots receiving 120 kg N/ha than from receiving lower levels of nitrogen. Increasing level of nitrogen from 0 to 40, 40 to 80 and 80 to 120 kg/ha increased nitrogen uptake by 68.8, 56.7 and 18.7% phosphorus 13.2, 4.6 and 4.4% and potassium 16.2, 7.0 and 8.7% over preceding lower levels (Table 1). It appeared that higher nitrogen application favored higher weed population and weed dry matter production resulting in higher nutrient uptake while under control treatment (0 kg N/ha) nutrient uptake was less owing to less availability of nitrogen resulting lower weed density and weed dry matter. Sankpal and Mahalle (1991) also reported similar finding.

All weed control treatments reduced the nitrogen, phosphorus and potash uptake by weeds significantly compared to weedy control. Weeding by Dutch hoe being comparable to isoproturon 1.0 kg/ha + 2, 4-D Na 0.75 kg/ha

Table 1. Effect of nitrogen level and weed control on weed growth, nutrient uptake, yield and economics of wheat

Treatment	Weed density/m^2 at 90 DAS	Dry weight of weeds at 90 DAS	Weed control efficiency (%)	Nutrient uptake (kg/ha)						Yield (t/ha)	Gross returns (x 10^3 ₹ /ha)	Net returns (x 10^3 ₹ /ha)	B:C ratio
				Weeds			Wheat						
				N	P	K	N	P	K				
N (kg/ha)													
N_0	5.34 (28.5)	5.12 (26.1)	74.8	9.3	3.8	3.7	14.5	3.5	1.5	0.09	1.44	-14.55	-0.91
N_{40}	6.17 (38.1)	5.95 (35.3)	66.0	15.7	4.3	4.3	29.6	6.1	18.2	1.11	16.23	-0.26	-0.02
N_{80}	7.30 (53.3)	6.80 (43.8)	57.8	24.6	4.5	4.6	69.6	18.2	42.5	2.82	41.17	24.14	1.42
N_{120}	8.89 (78.5)	7.65 (49.7)	52.1	29.2	4.7	5.0	73.7	21.6	48.6	2.90	44.17	26.61	1.52
LSD (P=0.05)	0.82	0.79	-	3.8	0.17	0.38	3.85	3.8	6.8	0.14	3.10	2.50	0.82
Weed control													
Isoproturon 1.0 kg/ha	6.82 (46.5)	5.58 (31.1)	70.0	17.2	4.5	3.2	46.4	12.5	29.6	1.93	28.44	12.56	0.79
2,4-D 1.0 kg/ha	6.43 (41.3)	5.28 (27.8	73.2	18.5	3.5	2.4	42.9	11.4	27.5	1.74	25.30	9.58	0.61
Isoproturon 1.0 kg/ha + 2,4-D 1.0 kg/ha	4.92 (24.2)	4.06 (16.5)	84.1	10.5	2.2	1.5	59.7	17.0	36.8	2.20	33.06	16.98	1.06
Weeding by Dutch hoe	4.78 (21.0)	3.80 (14.4)	86.1	9.9	2.5	1.2	60.7	18.6	40.2	2.37	35.32	14.49	0.69
Weedy control	10.72 (114.4)	10.19 (103.8)	-	42.5	9.5	13.5	24.5	2.3	4.6	0.43	6.64	-8.68	-6.64
LSD (P=0.05)	1.48	1.40	-	6.3	0.84	0.95	4.7	3.9	4.5	0.02	2.36	2.13	0.26

Data in parentheses denote original values; Price of wheat: grain ₹ 12/kg, straw - ₹ 2/kg

Table 2. Interaction effect of nitrogen and weed control treatments on grain yield of wheat (t/ha)

Treatment	Nitrogen (kg/ha)			
	N_0	N_{40}	N_{80}	N_{120}
Isoproturon 1.0 kg/ha	1.05	1.05	3.27	3.32
2,4-D 1.0 kg/ha	0.075	0.94	2.84	3.12
Isoproturon 1.0 kg/ha + 2,4-D 1.0 kg/ha	0.090	1.54	3.63	3.53
Weeding by Dutch hoe	1.22	1.77	3.75	3.84
Weedy control	0.080	0.28	0.64	0.72
LSD (P=0.05)	398			

post-emergence resulted in 76.7, 91.1 and 59.6% lower nitrogen, phosphorus and potash uptake by weeds compared to weedy control.

Nitrogen, phosphorus and potassium uptake by wheat was maximum at 120 kg/ha and was at par with 80 kg/ha. Increasing nitrogen level from 0 to 40, 40 to 80, 80 to 120 kg/ha increased nitrogen uptake by 104, 135 and 5.89; phosphorus uptake by 69.8, 200.0 and 18.7 and potassium uptake by 1100, 133 and 14.3% over preceding lower levels of nitrogen. Among weed control methods, weeding by dutch hoe being at par with application of isoproturon 1.0 kg/ha+ 2,4-D 1.0 kg/ha recorded significantly higher nitrogen, phosphorus and potassium up take by wheat crop

Grain yield

An increase in N level significantly increased grain yield of wheat only up to 80 kg/ha (2.84 t/ha). However, maximum grain yield of wheat (2.90 t/ha) was obtained in plots receiving 120 kg N/ha. All weed control treatments recorded significantly high grain yield compared to weed control. The grain yield with isoproturon 1.0 kg/ha + 2,4-D Na 0.75 kg/ha post-emergence (2.19 t/ha) was comparable with that of 3 weeding by Dutch hoe at 15, 30 and 45 days after sowing. The interaction effect of nitrogen levels and weed control treatments (Table 2) produced significant variation in grain yield. All weed control treatments responded only up to 80 kg N/ha in increasing the grain yield of wheat. Application of isoproturon 1.0 kg/ha + 2,4-D 1.0 kg/ha or weeding by Dutch hoe at 15, 30 and 45 DAS along with 80 or 120 kg N/ha performed similarly in producing higher wheat grain yield as compared to other weed control and nitrogen combinations.

Economics

Application of 120 kg N/ha being at par with application of 80 kg N/ha recorded significantly higher net return(₹ 26,616) and benefit cost ratio (1.52) as compared to 0 and 40 kg N/ha. Among weed control methods, application of isoproturon 1.0 kg/ha + 2,4-D 1.0 kg/ha registered significantly higher net return (₹ 16,980) and benefit cost ratio (1.06) as compared to isoproturon 1.0 kg/ha, 2,4-D 1.0 kg/ha and weeding by Dutch hoe at 15, 30 and 45 DAS.

REFERENCES

Carlson HL and Hill JE. 1986. Wild oat (*Avena fatua*) competition with spring wheat: effects of nitrogen fertilization. *Weed Science* **34**: 29-33.

DiTomaso JM. 1995. Approaches for improving crop competitiveness through the manipulation of fertilization strategies. *Weed Science* **43**: 491-497.

Heyne EG. 1987. *Wheat and Wheat Improvement*, 2nd edition. Madison, Wisconsin, USA.

Khan Bahadur Marwat, Muhammad Saeed, Zahid Hussain and Bakhtiar Gul. 2005. Chemical weed managent in rainfed areas. *Pakistan Journal of Weed Science Research* **11** (1-2): 31-36

Rajput MJ, Alam SM and Rajput MS. 1993. Effect of weed control and N application on the growth of wheat. *Pakistan Journal of Agricultural Research* **14** (2&3): 131-135.

Sankpal AM and Mahalle SS. 1991. Studies on interaction between herbicide and levels of nitrogen in sunflower. *Journal Maharashtra Agricultural Universities* **16**: 323-324.

Satorre EH and Snaydon RW. 1992. A comparison of root and shoot competition between spring cereals and *Avena fatua* L. *Weed Research* **32**: 45-55.