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Effect of Nitrogen and Herbicide on Growth and Yield of Wheat

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Abstract: A field investigation was carried out to study the impact of nitrogen levels and herbicide application on wheat growth and yield. Two levels of nitrogen i.e. 100 and 125 kg ha^{-1} (N_1, N_2) were randomized in main plots, whereas different doses of herbicide i.e. weedy control (D_0), Topik @ 200 and 300 g ha^{-1} (D_1, D_2) were superimposed on each nitrogen level as sub plot effect. The results revealed that maximum yield was obtained by the application of Topik @ 300 g ha^{-1} which was attributed to the more effective control of weeds that reduced the competitive effect of weeds on crop plants. It was concluded that the weed free plots resulted in profused tillering and increased number of spikelets per spike that contributed positively towards high yield.

Key words: Wheat, growth, yield, weeds, herbicide, nitrogen, fertilizer

INTRODUCTION

Nitrogen is major element of food for getting good yield of crop. A fertile soil stimulates the rapid growth of both crop plants and weeds. However, if weeds are controlled by some proper weed control approach at the time of seeding or immediately afterward, crop plants that have thereby been given an advantage can more easily maintain a lead if soil is well supplied with nutrients. An abundance of nitrogen encourages vegetative growth with resultant increase in the shade produced that tends to suppress weeds. Nitrogen has a key role in determining the fertility status of soil, so a different response of varying doses of herbicide is expected under different levels of nitrogen application.

Singh *et al.* (1985) studied the fertilizer economy through chemical weed control in wheat and stated that significant higher values for the number of effective tillers, grain yield and 1000-grain weight were obtained by applying 1.5 kg ha^{-1} Tribunil. The optimum nitrogen rates were found to be 83-93 kg ha^{-1} for Tribunil treated plots as against 120-129 kg ha^{-1} for unweeded control. Tayebi and Dudhane (1985) reported that application of 1.25 kg ha^{-1} isoproturon at pre-emergence stage in combination with 80 kg ha^{-1} nitrogen effectively controlled weeds in wheat and gave highest grain yield and net returns compared with other rates. Verma and Chaturuedi (1985) reported that weed control in wheat with application of isoproturon @1.0 kg ha^{-1} pre-emergence gave results equal to hand weeding at 2 NPK rates. Application of isoproturon increased the grain yield and yield components compared with hand weeding. Walia and Gill (1985) reported that 1.3 kg ha^{-1} methabenzthiazuron post-emergence resulted in higher uptake of nitrogen by wheat. Marks and Ladonin (1987) reported that 80 kg ha^{-1} nitrogen + Diamet- D (dicamba + MCPA) reduced the total number of weeds by 87% and reduced the infestation of cruciferous weeds, *Amaranthus retroflexus, Polyganum hepathifolium* and root species but not of annual grasses. Abbas (1988) studied that highest grain yield of wheat i.e. 35.24 q ha^{-1} was obtained by the post-emergence application of methabenzthiazuron @ 1.4 kg ha^{-1} and 100 kg ha^{-1} nitrogen application and was attributed to maximum number of spikelets per spike. Walia and Gill (1989) studied the effect of 0.9 kg ha^{-1} isoproturon as post-emergence, hand-weeding in the fourth week after sowing and no weeding at five levels of nitrogen viz. 30, 60, 90, 120 or 150 kg ha^{-1} in wheat. They stated that isoproturon gave complete control of *Phalaris minor* but hand weeding was not effective.

Pandey *et al.* (1998) found that grain yield was maximum at 100 kg N ha^{-1} and best weed control was observed by hand weeding followed by pendimethalin application. Saini and Angiras (1998) conducted field experiment to study the effect of top dressing with N on the efficacy of isoproturon for the control of weeds in wheat. Application of isoproturon at 1.5 or 1.0 kg a.i. ha^{-1} followed by a top dressing with N at 35 DAS resulted in lowest dry matter accumulation of weeds, highest number of effective tillers per meter length, spikelets spike^{-1}, straw and grain yield ha^{-1}.Shahdeva *et al.* (1998) applied 0, 40, 80 and 120 kg N ha^{-1} to wheat treated with 0.5 or 1.0 kg 2, 4-D ha^{-1}. They observed that weed density and dry weight of weeds were greater in fertilized plots that in unfertilized ones. Prishchepa (1999) conducted field trials to study the phytotoxicity of fertilizer-herbicide mixtures to dicot weeds in spring barley and winter wheat and reported that there is synergism between the herbicide and the fertilizers.

The present study was, therefore, carried out to investigate the effect of herbicide doses at different levels

of nitrogen on wheat growth and yield under agro-climatic conditions of Faisalabad.

MATERIALS AND METHODS

To evaluate the effect of different nitrogen levels and herbicide doses on wheat yield and weed control in wheat, the study was carried out at the Agronomic Research Area, University of Agriculture, Faisalabad during the year 2001-2002. A commercial wheat variety 'Chenab-2000' was used as test crop and was sown on 7th November, on a well prepared seed bed. The crop was sown with the help of single row cotton drill in 25 cm apart using a seed rate of 125 kg ha^{-1}. A basal dose of phosphoric fertilizer@ 100 kg ha^{-1} was applied at the time of sowing. The experiment was laid out in randomized complete block design (RCBD) with split plot arrangement, with four replications. The main plot treatments included the application of 100 kg ha^{-1} (N_1) and 125 kg N ha^{-1} (N_2) and sub plot treatments were weedy check (D_0), Topik (Clodinofop 15 WP) @ 200 g ha^{-1} (D_1) and Topik (Clodinofop 15 WP) @ 300 g ha^{-1} (D_2). The net plot size measured 2x5 m. All other treatments including irrigation were kept constant. The crop was harvested on 20th April. From each plot 1.0 m^2 unit area was taken at random to record observations on number of tillers per unit area (m^2), number of spikelets per spike, grain yield (t ha^{-1}), straw yield (t ha^{-1}), harvest index (%) and weed count at harvest by following standard procedure.

Data collected were analyzed statistically using Fisher's analysis of variance technique and treatment means were compared using least significance difference test (LSD) at 0.05 probability level (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

The maximum number of tillers per unit area (454.50 m^{-2}) were produced by the application of 125 kg N ha^{-1} (N_2) which were statistically higher than that of 100 kg ha^{-1} (N_1) (Table 1). Among herbicide doses maximum number of tillers per unit area (446.75 m^{-2}) were produced by application of Topik @ 300 g ha^{-1} (D_2); whereas minimum number of tillers per unit area (392 m^{-2}) were produced where weeds were not controlled (D_0). As regard the interaction of nitrogen and herbicide, maximum number of tillers per unit area (512.25 m^{-2}) were obtained by 125 kg N ha^{-1} + Topik @ 300 g ha^{-1} (N_2D_2) which were statistically higher from all treatments under study. Minimum number of tillers per unit area (388.25 m^{-2}) were obtained by the treatment combination of 100 kg N ha^{-1} + weedy check (N_1D_0) which were statistically similar with the application of treatment combination of 125 kg N ha^{-1} + weedy check (N_2D_0). These results are in agreement with those of Singh *et al.* (1985), Verma and Chaturuedi (1985) and Shahdeva *et al.* (1998).

As regards spikelets per spike, maximum number of spikelets per spike (27.67) was obtained by the application of N_2 which were statistically higher than that of N_1. Among herbicide doses, maximum number of spikelets $spike^{-1}$ (26.75) were produced by D_2 whereas minimum number of spikelets per spike (23.00) were produced where no weeds were controlled (D_0) which were statistically similar with D_1. The interaction between nitrogen and herbicide was insignificant. These results are similar with those of Verma and Chaturuedi (1985), Saini and Angiras (1998) and Shahdeva *et al.* (1998).

Different levels of nitrogen affected the grain yield significantly. Maximum grain yield (5.74 t ha^{-1}) was obtained by N_2 which was statistically higher than that of N_1. The differences among grain yield were affected statistically by the different doses of herbicide where D_2 produced maximum grain yield (6.09 t ha^{-1}) while minimum grain yield (5.10 t ha^{-1}) was produced where no weed control treatment was applied (D_0). The interaction between nitrogen and herbicide was non significant. These results are in confirmation with those of Walia and Gill (1985), Mark and Ladonin (1987), Abbas (1988) and Pandey *et al.* (1998).

Different levels of nitrogen had non significant effect on straw yield. However, the differences among straw yields were affected significantly by different doses of herbicide where D_2 produced maximum straw yield (7.21 t ha^{-1}) which was statistically similar with that of D_1. Minimum straw yield (6.14 t ha^{-1}) was produced where no weed control treatment was applied (D_0). The interaction between nitrogen and herbicide had non significant effect on the differences among straw yield. These results are in confirmation with those of Abbas (1988), Saini and Angiras (1998) and Shahdeva *et al.* (1998).

Neither nitrogen and herbicide dose individually nor their effect showed significant effect on harvest index. These results are in line with those of Abbas (1988).

It was concluded that different levels of nitrogen had non significant effect on weed count at harvest which means that nitrogen did not show any favorable or adverse effect on weed population. However, different doses of herbicide showed significant effect on weed count at harvest. Application of Topik @ 300 g ha^{-1} (D_2)

Table 1: Effect of nitrogen and herbicide on growth and yield of wheat

Tillers per unit area (m^2)	Number of spikelets spike^{-1}	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)	Weed count at harvest	Nitrogen (N) means
N_1(100 Kg ha^{-1})	408.25b	22.33b	5.47b	6.62	45.28	7.92
N_2(125 Kg ha^{-1})	454.50a	27.67a	5.74a	6.91	45.38	8.17
LSD (0.05)	4.57	3.77	0.14	NS	NS	NS
Herbicide (H)						
D_0(Weedy check)	392.00c	23.00b	5.10c	6.14b	45.43	10.50a
D_1(Topik @ 200 g ha^{-1})	434.37b	25.25ab	5.62b	6.93a	44.81	8.50a
D_2(Topik @ 300 g ha^{-1})	467.75a	26.75a	6.09a	7.21a	45.74	5.12b
LSD (0.05)	7.12	2.34	0.41	0.42	NS	3.08
Interaction (NxH)						
N_1D_0	388.25d	20.00	5.03	5.82	46.37	10.25
N_1D_1	413.25c	22.50	5.52	6.92	44.30	8.25
N_1D_2	423.25c	24.50	5.87	7.12	45.15	5.25
N_2D_0	395.75d	26.00	5.17	6.47	44.49	10.75
N_2D_1	455.50b	28.00	5.72	6.94	45.31	8.75
N_2D_2	512.25a	26.75	6.32	7.31	46.33	5.00
LSD (0.05)	10.06	NS	NS	NS	NS	NS

resulted in minimum weed count (5.12) which means that maximum weed control was achieved by this treatment. Maximum weed count at harvest (10.50) was obtained where no weed control treatment was applied (D_0) which was statistically similar with the application of Topik @ 200 g ha^{-1}. The interaction between nitrogen and herbicide had no effect on weed count at harvest. These results are in confirmation with those of Tayebi and Dudhane (1985), Verma and Chaturuedi (1985), Abbas (1988), Shahdeva *et al.* (1998) and Prishchepa (1999).

The study under report was carried out at agro-ecological conditions prevailing at Faisalabad. The soil and environmental conditions vary from place to place and the response of tested inputs may differ accordingly. Our study has revealed that application of Topik @ 300 g ha^{-1} was quite effective in controlling the weed flora present at the given soil and environmental conditions.

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