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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 3 (6): 1002-1003, 2000

Nitrogen Uptake Efficiency in Wheat (*Triticum aestivum* L.) as Influenced by Nitrogen Level and Weed-crop Competition Duration

Mahboob Akhtar, Asjad Mehmood, Jalil Ahmad and Khalid Iqbal*
Department of Agronomy, University of Agriculture Faisalabad, Pakistan
*Department of Agri. Extension, Faisalabad, Pakistan

Abstract: Nitrogen uptake efficiency in wheat (*Tritcum aestivum* L.) as influenced by nitrogen level and weed-crop competition duration was determined at the Agronomic Research Area, University of Agriculture, Faisalabad during 1998-99. The data showed that yield, yield parameters of wheat, weed growth and nitrogen uptake by weeds increased with increased nitrogen application levels while weed population was not affected significantly. On the other hand yield and yield parameters in wheat decreased with an increase in the weed-crop competition durations while weed growth and nitrogen uptake by weeds increased by increasing the competition duration.

Key words: Wheat, nitrogen level, weed-crop competition, Pakistan

Introduction

Wheat occupies key position in Pakistan's economy but its yield is only 2.2 tones ha^{-1} which very low as compared to other developed countries like France (7 t ha^{-1}) and America (4.2 t ha^{-1}). Although the evolution of short statured, fertilizer responsive and disease resistant high yielding varieties have brought about a real breakthrough in wheat production yet there is a wide yield gap between actual and potential yields of existing wheat varieties. Weeds are usually more aggressive and strong competitors for growth resources than crop plants. The benefits of applied inputs are not fully realized unless weeds are timely controlled. Weed-crop competition is more severe when a particular growth factor is limited in quantity. Our soils are generally deficient in nitrogen, so for raising a good wheat crop, application of artificial nitrogen is essential as application of variable doses of nitrogen increase the growth and yield of wheat crop (Malik, 1981; Nazir *et al.*, 1988). The N, P and K fertilizers can not give the expected benefit in the presence of weed infestation.

Margin *et al*. (1983) noted that in low density stands, nitrogen application increased dry matter production and made weed control measures essential. Agarwal and Singh (1985) reported that wheat nitrogen needs can be reduced by 67% to obtain similar yield if weeds are controlled timely. They also observed that weeds could take away more than 50% of applied nitrogen. Farabakhsh and Murphy (1988) reported that with increase in nitrogen application in high weed density wheat crop the weeds were benefited more than the crop itself and weeds caused yield losses upto 32%. Bhagwati *et al.* (1989a) reported that dry weight of weeds and wheat crop increased with increasing the nitrogen rate. The increase in plant height and leaf area resulting from nitrogen was higher for wild oats than for wheat. Bhagwati *et al.* (1989b) studied that nitrogen uptake by broad-leaved weeds was less than the wild oats and at higher nitrogen levels, there was more uptake by wheat where broad-leaved weeds dominated the weed flora than where wild oats dominated. Anderson (1991) found that weed interference prevented the winter wheat from responding positively to nitrogen and thus caused yield losses upto 9%. Akhtar (1997) reported that magnitude of weed-crop competition was reduced with successive increase in nitrogen application. In order to check losses due to weeds, it is important that weed population in the cultivated crops should be controlled at appropriate stage.

Materials and Methods

An experiment to study the nitrogen uptake efficiency in wheat as influenced by nitrogen application levels and weed-crop competition duration was conducted at Agronomic Research Area, University of Agriculture, Faisalabad during 1998-99. A split plot design with three replications was used. Nitrogen levels and weed-crop competition durations were randomized in main and subplots, respectively. The treatments consisted of three nitrogen application levels (control, 100 and 150 kg ha^{-1}) and six weed-crop competition durations (No competition, competition for 4, 6, 8 and 10 weeks after sowing and for full season). Net plot size measured 1.25 m × 3.5 m.

Wheat variety Inqilab was sown in 25 cm apart single rows with the help of single row hand drill on a well-prepared seedbed. Seed rate of 100 kg ha^{-1} was used. Nitrogen, as urea, was applied in two splits, half at the time of sowing and remaining half with first irrigation. In addition a basal dose of 100 kg P_2O_5 and 100 kg K_2O was applied at the time of sowing. Weed control after prescribed periods was done by hoeing and after this period plots were kept free of weeds upto harvest. The data on weed density (m^{-2}), dry weed biomass (g), nitrogen uptake by weeds (g m^{-2}), number of fertile tillers (m^{-2}), number of grains per spike, 1000-grain weight (g), grain yield (t ha^{-1}) and nitrogen contents of wheat grains (%) was recorded by following the standard procedures. The data collected were analyzed statistically by using Fisher's analysis of variance technique and differences among the treatment's means were tested at 5% probability level, using LSD test (Steel and Torrie, 1984).

Results and Discussion

The data regarding weed density shows that it was not affected significantly by different nitrogen levels while different weed-crop competition durations had significant effect on the weed density. Maximum number of weed were found in the plots with full season weed-crop competition while minimum number of weeds was found in weed free plots. The data show that the interaction between nitrogen levels and weed-crop competition durations was non-significant. The data indicate that significantly higher weed biomass (53.218 g m^{-2}) was recorded in the treatment N_2 with nitrogen application level of 150 kg ha^{-1} and was followed by N_1 producing weed biomass of 48.093 g m^{-2} (Table 1). Weed biomass was also significantly affected by weed-crop competition durations and maximum was recorded in the treatment with full season weed-crop competition, which was significantly higher than rest of the treatments. The data in Table 2 shows that the interaction between nitrogen levels and weed-crop competition durations was significant and highest biomass was recorded in the treatment combination with nitrogen application level of 150 kg ha^{-1} and weed-crop competition for whole growing season. The data regarding nitrogen uptake by weeds in Table 1 indicate that nitrogen application levels significantly affected it and maximum nitrogen was taken up by weeds in N_2 with 150 kg ha^{-1} while minimum was removed from control. The effect of different weed-crop competition durations on nitrogen uptake by weeds was also found to be significant and maximum was removed from C_5 with full season weed-crop competition. Interaction between nitrogen levels and competition durations was also significant and maximum amount of nitrogen was removed by weeds from the treatment interaction N_2C_5 with nitrogen 150 kg ha^{-1} and weed-crop competition for full season

Table 1: Weed growth, wheat yield and yield parameters as influenced by nitrogen level (N) and weed-crop competition duration (C)

Treatments	No. of fertile tiller (m^{-2})	No. of grains $spike^{-1}$	1000-grain weight (g)	Grain yield (t ha^{-1})	N-contents of wheat grain (%)	Weed density	Weed biomass	N uptake by weeds (g m^{-2})
A) N-application level (kg ha^{-1}) (Main effects)								
N_0 (Control)	224.22b	47.00c	32.38b	5.23b	1.55c	69.5	3.542c	0.170c
N_1 = 100	272.72a	51.70b	33.77b	5.55b	1.74b	69.6	48.093b	0.263b
N_2 = 150	278.33a	55.60a	38.22a	6.33a	1.84a	71.9	53.218a	0.350a
LSD Value	17.273	0.78	2.021	0.339	5.069		4.421	5.853
B) Weed-Crop competition duration (C) [Sub Effects]								
No weed-crop competition	282.56a	57.00a	38.94a	6.41a	1.84a	0.000b	0.000f	0.000f
competition for 4 WAS	281.33a	53.30b	36.65b	6.07b	1.80b	22.436e	22.436e	0.123d
competition for 6 WAS	271.44b	51.70be	35.47b	5.84a	1.76c	32.609d	32.609d	0.166d
competition for 8 WAS	269.00b	51.00cd	35.27b	5.58d	1.71d	47.163c	47.163c	0.260c
competition for 10 WAS	247.56c	49.00d	32.68c	5.33e	1.63e	85.857b	65.857b	0.400b
Full season competition	198.67d	46.70e	29.72d	4.99f	1.53f	109.641a	109.641a	0.616a
LSD Value (P = 0.05)	9.544	2.129	1.669	0.193	3.0441	3.768	3.768	8.055

Table 2: Interaction between nitrogen level (N) and weed-crop competition duration (C)

Treatments	No. of fertile tiller (m^{-2})	No. of grains $spike^{-1}$	1000-grain weight (g)	Grain yield (t ha^{-1})	N-contents of wheat grain (%)	Weed density	Weed biomass	N uptake by weeds (g m^{-2})
N_0C_0	256.00 d	53.7	36.29	5.93	1.63 g	0.00	0.000 j	0.000 k
N_0C_1	258.00 d	49.0	34.29	5.54	1.60 gh	77.7	2.0083 i	0.139 hijk
N_0C_2	227.67 e	46.7	33.25	5.39	1.59 gh	83.0	21.637 i	0.092 ijk
N_0C_3	228.33 e	46.0	33.64	5.20	1.55 hi	82.7	32.790 gh	0.170 ghik
N_0C_4	196.00 g	44.3	30.46	4.94	1.49 ij	85.0	53.663 e	0.304 defg
N_0C_5	179.33 h	42.3	26.14	4.39	1.46 j	88.7	97.007 c	0.313 def
N_1C_0	292.67 ab	56.7	38.64	6.31	1.89 bcd	0.00	0.000 j	0.000 k
N_1C_1	291.00 ab	53.7	34.90	5.84	1.85 d	81.3	20.660 i	0.089 jk
N_1C_2	294.00 ab	52.7	33.74	5.60	1.79 e	81.7	35.723 fg	0.174 fghij
N_1C_3	287.00 ab	51.7	33.34	5.41	1.73 f	83.7	52.607 e	0.258 defgh
N_1C_4	268.33 cd	49.3	32.58	5.19	1.64g	81.3	69.350 d	0.395 cd
N_1C_5	203.33 fg	46.3	29.39	4.93	1.52 i	89.3	110.217 b	0.661 b
N_2C_0	299.00 a	60.7	41.88	6.98	1.99 a	0.00	0.000 j	0.000 k
N_2C_1	295.00 a	55.7	40.76	6.82	1.94 ab	84.0	26.563 hi	0.142 hij
N_2C_2	292.67 ab	55.0	39.24	6.53	1.91 bc	87.7	40.467 f	0.229 efghi
N_2C_3	291.67 ab	55.0	38.83	6.13	1.86 cd	82.3	56.093 e	0.353 de
N_2C_4	278.33 bc	53.03	34.99	5.86	1.76 ef	84.3	74.557 d	0.502 c
N_2C_5	217.33 ef	51.3	33.62	5.64	1.59 gh	93.3	212.630 a	0.875 a
LSD (P=0.05)	16.530	-	-	-	5.273	-	6.528	0.1395

while minimum was removed from control. Table 1 indicates that different nitrogen application levels affected the number of fertile tillers and significantly higher number of fertile tillers were recorded in the treatment N_2 with 150 kg ha^{-1}. Significant effect of different weed-crop competition durations was also noted and greater number of fertile tillers were recorded in plot where weeds were controlled throughout the season while minimum in the treatment C_5. The interaction between nitrogen levels and competition durations was found to be significant and highest fertile tillers were found in N_2C_0 while minimum in N_0C_5. Table 1 shows that significantly greater number of grains per spike was recorded in N_2 with 150 kg N ha^{-1} while minimum in control. Significant effect of different weed-crop competition durations was also observed and significantly greater number of grains was recorded in the treatment with no competition while minimum were recorded in the treatment with full season weed-crop competition. Table 1 also indicates that 1000-grain weight was significantly affected by nitrogen levels and significantly higher weight was recorded in N_2 with nitrogen rate 150 kg ha^{-1} while significantly greater 1000-grain weight (38.94 g) was recorded in the treatment with no weed-crop competition and minimum in the treatment with full season competition. The interaction of the treatments was found to be non-significant. Maximum grain yield was recorded in N_2 nitrogen rate (150 kg ha^{-1}) and minimum in control (Table 1). Significantly greater grain yield (6.41 t ha^{-1}) was recorded in C_0 with no weed-crop competition and minimum was found in C_5 with full season competition. The interaction between nitrogen levels and weed-crop competition durations was found to be non-significant. Further the data in Table 1 indicate that significantly higher nitrogen contents were recorded in N_2 while minimum in control. Significantly greater nitrogen contents in wheat grain were recorded in the treatment with no weed-crops competition while minimum in C_5 with full season weed-crop competition. The interaction between nitrogen levels and weed-crop competition durations was found to be significant.

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