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Agro-economic Traits of Dryland Barley as Influenced by NP Fertilizer Application

Aslam Khan, Munir Khan and Mir Azam
NWFP Agriculture University Peshawar, Pakistan

Abstract: This research was undertaken to determine the effect of NP fertilizer application on the agro-economic traits of barley (*Hordeum vulgar.* L. cv. Frontier 87) under dryland conditions. Fertilizer levels used were: 23-0, 46-0, 69-0, 2323, 46-23, 69-23, 23-46, 48-46, 69-46, 23-69, 46-69 and 69-69 N P_2O_5 kg ha^{-1}, respectively vs. control (0-0). The results of this study indicated that maximum plant height (104.8 cm), maximum number of spikes m^{-2} (414) and grains $spike^{-1}$ (45), heaviest 1000 grain wt (40.2 g), highest lodging index (3.0) were observed from 69-69 NP_2O_5 kg ha^{-1} of fertilizer applied. However, the highest biomass (12.65 t ha^{-1}) was given by 69-46 N P_2O_5 followed by 69-69 N P_2O_5 kg ha^{-1} of fertilizer, applied. The lowest plant height (63 cm) and spikes M^{-2} (169), grain $spike^{-1}$ (25), harvest index (16.3) percent, lodging index (0.4) and biomass yield (6.20 t ha^{-1}) produced by control treatment. Days to 50 percent flowering taken by control treatment (123 d), were more than those of N P_2O_5 fertilizer applied (120 d). It may be concluded that N P_2O_5 fertilizer application positively affected most of the traits studied. However, further research to optimize the levels of NP fertilizer application for barley crop under different agro climatic conditions of the NWFP is needed.

Key words: Spikes m^{-2}, grains $spike^{-1}$, grain wt., biomass yield

Introduction

Barley (*Hordeum vulgare* L.) is a drought tolerant early maturing winter season cereal crop grown mostly in the rainfed areas of Northwest Frontier Province (NWFP) of Pakistan. Barley grain usually fetches higher price than that of wheat in Pakistan. In Pakistan barley was planted on 162700 ha area with a total production of 174100 tones and a national average of 1070 kg ha^{-1} during the 1997-98. In the same period, in NWFP barley area was 54600 ha with total production of 59700 tones and an average yield of 1093 kg ha^{-1} (Anonymous, 1998). The barley production in Pakistan is very low as compared with that of other barley producing countries of the world. Fertilizer application has increased productivity in many crops. Barley is susceptible to lodging under high fertility and increased doses of fertilizers (Swati *et al.,* 1987). Rajput *et al*. (1989) reported that application of 100+80 kg NP ha^{-1} increased plant height, spike length, grains $spike^{-1}$and grain yield as compared with other lower doses of fertilizer used in their study on wheat in Quetta.

Khoso *et al*. (1989) also studied NP effect on barley production and found that the Increased level of NP fertilizer significantly increased plant height, tillers $plant^{-1}$, grain yield and yield components In barley. Swati *et al*. (1987) used different rates of NP fertilizer on wheat in Sindh and concluded that with increased rate of NP application grain yield, grains $spike^{-1}$ and grain wt., were increased correspondingly in all wheat genotypes studied. Zada and Karim (1982) reported that the grain weight and grain yield of barley was increased with increased rate of phosphorous application. Since limited published Information available on the NP application on effects agro-economics traits of barley in Pakistan. Therefore, tills study was conducted to determine the effects of NP application on agro-economic traits of barley under dryland conditions in Pakistan.

Materials and Methods

This field experiment was located at the Malaknadher Farm of Agricultural University, Peshawar with an objective to determine the effect of varying levels of NP fertilizer application on agro-economic traits of Barley. Barley cultivar Frontier-87 was sown at a seeding rate of 100 kg ha^{-1} on 13 Nov. 1991, in a randomized complete block design with four replication. Each treatment plot size was 6 rows 5 m long 30 cm apart. Fertilizer treatments were: FO (0-0), F1 (23-0), F2 (460), F3 (69-0), F4 (23-23), F5 (46-23), F6 (69-23), F7 (23-46), F8 (46-46), F9 (69-46), F10 (23-69), F11(48-69) and F12 (69-69). N P_2O_5 kg ha^{-1}. Fertilizer sources used were urea (46% N) and DAP (18-46-0). A basal dose of 50 K_2O kg ha^{-1} was also applied prior to planting in the form of K_2SO_4. Agra-economic traits studied were: number of plants m^{-2}, days to 50 percent heading and maturity, plant height, lodging index, productive tillers $plant^{-1}$, total tiller $plant^{-1}$, spikes m^{-2}, grains $spike^{-1}$, 1000-grain weight, biomass yield and harvest index. Data on grain yield are reported (Khan *et al*., 2000). Data on lodging index were recorded using the Belgium rating (Oplinger *et al.*, 1985) as follow:- Lodging index = $5 \times 1 \times 0.2$, where 5 = area of surface lodged (1 = none to 9 = total) Intensity of lodging (1 or upright to 5 = flats), thus giving a range from 0.2 to 9.0 i.e., 0.2 3 = No lodging and 9.0 = completely lodged. Statistical analysis was conducted and L.S.D was calculated where F values were found significant at 5 percent for treatments means.

Results and Discussion

As is evident from the data on agro-economic traits (Table 1) plant emergence was not significantly affected by N fertilizer levels applied. Uniform germination under various levels of NP fertilizers were also reported by Khan (1985). However, days to 50 percent heading were significantly affected by N fertilizer applied. The control treatment took 123 days to 50 percent heading as compared to NP fertilizer applied treatments. All fertilizer treatment generally hasten 50 percent heading and this effect was more pronounced in 23-69 N P_2O_5 kg ha^{-1} applied treatment which took 117 days to 50 percent heading. Plant height was significantly affected by NP fertilizers application. Maximum plant height measured in treatment 6969 N P_2O_5 kg ha^{-1} fertilizer applied and lowest plant height of 63 cm was measured in control plot. All fertilizer application significantly increased plant height. A progressive increase in plant height was noted with an increase N application. Similar increased in plant height by NP application was also reported by Khan (1985). Lodging index was also affected by NP fertilizer application. Maximum lodging index of 3.0 was observed with highest does of NP fertilizer. Productive tillers

Table 1: Agra-economic Traits of Barley at varying level of NP fertilizer application

Treatment N P_2O_5 (kg ha^{-1})		Plants m^{-2} no.	Plant height (cm.)	Logding index (02.9.0)	Days to 50% heading	Days to maturity	Product-ive tillers $plant^{-1}$	Total tillers $plant^{-1}$	Spike m^{-2} no.	Grain $spike^{-1}$ no.	1000 grain Wt. (g)	Harvest index WO	Biomass yield kg ha^{-1}
0	0	168	63	0.4	123.3	162.8	1.0	3.0	170	25	35	16.3	3.2
23	0	172	67	0.42	120.0	157.8	2.0	3.3	275	32	34	17.2	6.5
46	0	171	80	1.38	119.0	159.8	3.3	4.8	309	33	34	20.0	8.2
69	0	173	94	2.15	120.3	163.8	3.3	5.8	298	39	34	20.0	9.5
23	23	170	78	0.72	120.3	156.0	2.3	3.5	238	32	35	19.0	7.47
46	23	169	92	1.03	119.5	156.3	3.3	5.0	389	39	35	21.0	9.72
69	23	171	92	0.53	119.8	159.8	3.8	5.8	356	42	35	21.0	11.45
23	46	168	85	0.57	118.5	157.3	2.8	3.5	276	37	35	21.0	8.48
46	46	170	91	2.14	118.0	157.3	3.5	5.0	354	40	36	20.0	10.41
69	46	170	99	2.16	118.8	157.0	4.3	6.0	376	43	38	22_2	12.65
23	69	171	86	0.77	117.3	149.8	3.5	4.0	291	38	35	23.2	9.22
46	69	169	99	2.73	118.3	155.3	3.8	4.5	352	42	37	21.2	11.43
69	69	173	104	3.0	119.8	155,8	4.3	6.5	414	45	40	22.3	11.59
L. S. D. (5%)NS		1.74	2.5	2.5	2,1	0.7	1.0	2.4	2.4	0.9	NS	2.05	

$plant^{-1}$ were affected significantly by NP fertilizer application. The maximum number of 4.25 productive tillers was recorded in 69-69 N P_2O_5 kg ha^{-1} fertilizer applied and the lowest number of the productive tillers was given by control treatment. Similar results were reported by Khoso *et al.* (1989) from their research on barley.

Spikes m^{-2} is an important yield component, which was significantly affected by NP fertilizer applied. Maximum number of spikes 414 m^{-2} was observed in plot treated with 69-69 N P_2O_6 kg ha^{-1} and the lowest number of spikes 170 m^{-2} was recorded from control plot. Similarly, number of grains $spike^{-1}$ was affected by NP fertilizer application and maximum number of grains $spike^{-1}$ was obtained from the highest dose of N P_2O_5 kg ha^{-1} fertilizer application and the lowest number of grains $spike^{-1}$ was obtained from control plot. These results are in agreement with those of Rajput *et al*. (1989), Khoso *et al.* (1989) who reported increased in number of grains $spike^{-1}$ with fertilizer application. A significant difference was also noted in 1000-grain wt. by application of NP fertilizer. Heaviest 1000 grain weight of 40 gram was given by treatment 69-69 N P_2O_6 kg ha^{-1} of fertilizer applied and the lowest grain weight was obtained by fertilizer treatments, where N was applied alone. Balanced application of NP fertilizer played an important role an increasing grain weight. Other researcher also reported similar results in their study (Jalil and Ghani, 1982; Zada and Karim, 1982; Swati *et al*., 1987). Biomass yield is an important trait, indicating efficiency of using solar energy. The data indicated a significantly increased in biomass by NP fertilizer application as compared to control plots. Maximum biomass yield was observed from application of 69-69 N P_2O_5 kg ha^{-1} of fertilizer and the lowest 3.2 t ha^{-1} was produced by the control treatment. Harvest index was not signficantly different among the treatments.

It may be concluded from this study that most of the traits were affected by NP fertilizer application and that a balance use of NP fertilizer is important for increasing barley production in the province. However further research is needed to optimize NP level for farmers growing barley in various agroclimatic conditions of the NWFP.

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