



Changes in yield and yield components of four cultivars of Barley under different Nitrogen Levels in Isfahan region

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ABSTRACT: In order to study the effect of different nitrogen levels on yield components and seed yield of three barley cultivars, an experiment was conducted in 2011-2012 in a research farm of farming building of Islamic Azad University Khorasgan (Isfahan) Branch located in Khatunabad village (latitude 32°/40' N and Longitude 51°/48' E). A split plot layout within randomized complete block design with 3 replications was used. Main plot were different level of nitrogen fertilizer (0, 75 and 150 kg ha⁻¹) from urea source, and sub plot were different cultivars (Reyhano3Nosrat, Valfajr and Yousef). Condition represented the effect of nitrogen was significant on number of spikes m⁻², seed yield, biological yield and harvest index. 50 kg N ha⁻¹ fertilizer treatment, resulted the maximum of all mentioned factors except biological yield. Effect of cultivar was significant on number of spikes m⁻² and biological yield. The maximum of all mentioned factors related to Valfajr cultivar. Interaction of nitrogen and cultivar was significant on number of spikes m⁻², seed yield and harvest index. On the basis of the results obtained, the fertilizer treatment 50 kg N ha⁻¹ and Valfajr cultivar might be suitable for barley productive under the condition similar to the present study.

Key words: Barley, Nitrogen, Cultivar, Seed yield.

INTRODUCTION

Barley (*Hordeum vulgare* L.) is a small grain cereal crop and used in varieties of ways, and is the fourth important cereal crop in the world and third important cereal in Iran, (FAO., 1993-2002). Nitrogen is a major nutrient element which provides lush green color to the plant due to increase in chlorophyll (Shah, et al., 2004). Despite the risk inherent in fertilization of barley in marginal areas, application of nitrogen and phosphorus is economical in most years (Mazid and Bailey, 1992; Jones and Wahbi, 1992). Emamet al (2000) Stated that farmers can use to improved management of nitrogen in the field, struggling to reduce branches mortality. Mi et al (2000) concluded, nitrogen deficiency decreased spike and number of grains per spike, but had no significant effect on grain yield. Lack of nitrogen during the spikes growing or after pollination, reduced number of seeds spike⁻¹ and spikes dry weight (Demotsminard., 2004). Ryan et al (2009), in an experiment on barley stated as expected, the main factors N and variety were significantly affected either on the yield parameters, but The interactions were less consistent. Alam et al (2007), in a similar experiment on seed yield of barley stated seed yield is a complex character depending upon a large number of environmental, morphological and physiological characters. Grain yields also depend upon other yield components. In this investigation, increased nitrogen dose increased grain yield as well. In Isfahan because of lack of knowledge about the best level of nitrogen and cultivars about barley, more research is needed for better adaptation of new cultivars for developing genotypes and management systems combinations leading to high productivity. The key

objectives of the present study were to determine the suitable level of nitrogen to optimize cultivation criteria for production of new barley's cultivars.

MATERIALS AND METHODS

An experiment was conducted on the basis of split plot layout with completely randomized block design with 3 replications. Main plot were different level of nitrogen fertilizer (0, 75 and 150 kg ha⁻¹) from urea source, and sub plot were different cultivars (Reyhan03Nosrat, Valfajr and Yousef). This research was conducted in 2011-2012, at research farm of farming building of Islamic Azad University Khorasgan (Isfahan) Branch located in Khatunabad village (latitude 32° /40' N and Longitude 51° /48' E). The soil preparation consisted of mouldboard ploughing (20-25 cm) followed by disking and smoothing with a land leveler. On the basis of soil analysis, 50 kg ha⁻¹ from triple superphosphate in planting time was used. Nitrogen as urea (46.6% N) was applied at the above mentioned levels. It was added into three equal portions, the first part was applied in planting time and the second part was applied in double ridge Stage, and third part in booting stage. Other normal agronomic practices for barley production were followed. The number of spikes m⁻², number of seeds spike⁻¹, 1000 seed weight (g), seed yield (kg ha⁻¹), biological yield (kg ha⁻¹), harvest index (%), was measured. Mstat-C software and mean comparison with Duncan's test in 5% probability was used.

RESULTS AND DISCUSSION

N fertilizer had significant influence on number of spikes m⁻², seed yield, biological yield and harvest index (Table 1). Alamet al (2007), in a similar experiment on yield and yield components of Barley cultivars in relation to nitrogen fertilizer [0 kg/ha (N0), 30kg/ha (N1), 60 kg/ha (N2), 90 kg/ha (N3) and 120 kg/ha (N4)], stated yield and yield components were significantly affected by nitrogen level and in this investigation, increased nitrogen dose increased grain yield as well. Cultivar had significant influence on number of spikes m⁻² and biological yield (Table 1). Ryan et al (2009), in an experiment on barley stated as expected, the main factors N and variety were significantly affected either on the yield parameters, but the interactions were less consistent.

No. of spikes m⁻²: The highest No. of spikes m⁻² was related to 50 kg N ha⁻¹ fertilizer treatment, but had no significant differences with 100 kg N ha⁻¹. The lowest No. of spikes m⁻² related to control (0 kg N ha⁻¹). Valfajr cultivar has highest No. of spikes m⁻², but had no significant differences with Reyhan03. The lowest No. of spikes m⁻² related to Nosrat cultivar and had no significant differences with Yousef (Table 2).

No. of seeds spike⁻¹: The highest No. of seeds spike⁻¹ was related to control treatment and had no significant differences with other treatments. Mi et al (2000) concluded, nitrogen deficiency decreased spike and number of grains per spike, but had no significant effect on No. of seeds spike⁻¹. Also, Nosrat cultivar has highest No. of seeds spike⁻¹ (Table 2).

1000 seed weight: N fertilizer had no significant influence on 1000 seed weight nevertheless; the highest of 1000 seed weight was achieved in 50 kg N ha⁻¹ treatment, but the lowest of 1000 seed weight related to control. The highest of 1000 seed weight was related to Valfajr cultivar and cultivars had no significant together (Table 2).

Seed yield: The highest of seed yield was achieved in 50 kg N ha⁻¹ fertilizer and had significantly different from other treatments, but the lowest of this factor related to control. It was maybe because of highest of No. of spikes m⁻² and 1000 seed weight in 50 kg N ha⁻¹. The highest of seed yield was achieved in Valfajr cultivar and other cultivar had not significant differences together (Table 2).

Biological yield: The highest of biological yield was achieved in 100kgN ha⁻¹ fertilizer treatments, but had no significantly different with 50 kg N ha⁻¹, and the lowest of these factors related to control. The highest of biological yield was achieved in Valfajrcultivar but had no significant differences with Reyhan03 and Yousef. Sothe lowest biological yield related to Nosrat cultivar (Table 2).

Harvest index:The highest of harvest index was achieved in 50 kg N ha⁻¹and hassignificant differences with control and 100kg N ha⁻¹ treatments. The lowest of harvest index related to controlbut has no significant differences with 100 kg N ha⁻¹.The highest of harvest index was achieved in Valfajr, and other cultivars had no significant differences together(Table 2).

Table 1- Analysis of variance for experimental characteristics.

S.O.V.	d.f	No. of spikes/m ²	No.of seeds/spike	1000seed weight	Seed yield	Biological yield	HI
Replication	2	18021.0	0.50	1.34	1948102.6	1330477.7	110.07
Nitrogen	2	111076.0*	29.61	433.27	24343891.4*	22165769.4*	1441.61*
Error (a)	4	6911.5	40.69	95.66	866014.3	2766561.1	49.10
Cultivar	3	54988.8*	2.09	3.38	3311495.6	9990262.9*	248.42
Nitrogen×Cultivar	6	46404.8*	10.12	42.93	6961110.9*	2491510.1	958.34*
Error (b)	18	8943.1	7.58	26.76	1364389.8	163011.1	105.27

* and ** Significant at P=0.05 and P=0.01 level, respectively in F-test.

Table 2-Mean comparison for No.of spikes m², No.ofseeds/spike, 1000-seed weight (g), seed yield (kg ha⁻¹), Biological yield (kg ha⁻¹), HI (%).

Treatment	No. of spikes/m ²	No.of seeds/spike	1000-seed weight	Seed yield	Biological yield	HI
Nitrogen (kg ha⁻¹) (N)						
0 (N1)	480.0b	24.71a	30.08b	3600.5c	9409.2b	38.20b
50 (N2)	663.0a	22.95a	42.05a	6422.7a	11465.8a	57.58a
100 (N3)	623.0a	21.58a	35.10ab	4676.2b	11976.7a	39.02b
Cultivar (C)						
Reyhan03 (C1)	662.6ab	22.90a	35.87a	4979.7ab	11490.0a	44.58ab
Nosrat (C2)	505.1c	23.66a	35.13a	4412.4b	9372.2b	46.86ab
Valfajr (C3)	685.7a	22.53a	36.54a	5726.8a	11534.4a	50.37a
Yousef (C4)	541.1bc	23.23a	35.43a	4480.2b	11405.6a	37.91b
Nitrogen×Cultivar (N×C)						
N1C1	591.3ab	26.63a	32.00cd	4997.0bc	9433.4c	54.13bc
N1C2	292.7c	24.87ab	25.67d	1865.0e	8740.7c	20.80f
N1C3	706.0ab	23.70ab	31.67cd	5314.0bc	9480.4c	55.77bc
N1C4	330.0c	23.67ab	31.00cd	2226.0de	9983.9bc	22.10ef
N2C1	574.0b	19.70b	42.97ab	4861.0c	11530.1ab	42.30cd
N2C2	668.7ab	24.37ab	43.97a	7142.0ab	9047.0c	79.20a
N2C3	763.3a	23.40ab	44.63a	7963.0a	12600.2a	64.17ab
N2C4	646.0ab	24.33ab	36.63abc	5724.0bc	12690.2a	44.67cd
N3C1	702.7ab	22.37ab	32.67cd	5082.0bc	13510.3a	37.3cdef
N3C2	554.0b	21.77ab	35.77abc	4230.0cd	10330.0bc	40.60cde
N3C3	588.0ab	20.50b	33.33bcd	3902cde	12520.2a	31.20def
N3C4	647.3ab	21.70ab	38.67abc	5491.0bc	11540.1ab	46.97bcd

Common letters within each column do not differ significantly.

Interaction of nitrogen and cultivar:N fertilizer and cultivar interaction had significant influence on number of spikes m⁻², seed yield and harvest index (Table 1). Interaction between the fertilizer

treatment 50 kg N ha⁻¹ and Valfajr cultivar has highest level of all experimental characteristics. It was maybe because of highest of No. of spikes m⁻² and 1000 seed weight in 50 kg N ha⁻¹ and Valfajr cultivar (Table 2).

CONCLUSION

The results showed that, with increasing in nitrogen fertilizer, the No. of spikes m⁻² and 1000 seed weight was increased and led to increased production of seed yield and biological yield too. But increasing the nitrogen level of 50 to 100 kg ha⁻¹, these factors were not increased. So, the results show that consumption of 50 kg N ha⁻¹ is sufficient for the plant needs and produce maximum yield. Ryan et al (2009) also reported similar results for barley. Also, the maximum of all mentioned factors except No. of seeds spike⁻¹, related to Valfajr cultivar. Then, on the basis of the results obtained, the fertilizer treatment 50 kg N ha⁻¹ and Valfajr cultivar might be suitable for barley productive under the condition similar to the present study.

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