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# 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 $32^{o}$ /40' N and Longitude $51^{o}$ /48' E). A split plot layout within randomized complete block design with 3 replications was used. Main plot were different level ofnitrogen fertilizer (0, 75and 150 kg $ha^{-1}$) from urea source, and sub plot were different cultivars (Reyhan03Nosrat, 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 andharvest 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 (*Hordeumvulgare*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 reducebranches 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 growingor after pollination, reduced number of seeds spike-1 and spikes dry weight (Demotsminard., 2004). Ryan et al(2009), in an experiment on barleystated 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

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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 ofnitrogen 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 $32^{o}$ /40' N and Longitude $51^{o}$ /48' E). The soil preparation consisted of mouldboardploughing (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. Thenumber 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 andin 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 $ha^{-1}$). Valfajrcultivar has highest No. of spikes $m^{-2}$, but had no significant differences withReyhan03. 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 1000seed weight was achieved in 50 kg N $ha^{-1}$treatment, but the lowest of 1000seed weight related to control. The highest of 1000seed weight was related to Valfajrcultivar and cultivars had no significant together(Table 2).

**Seed yield:**The highest of seed yield was achieved in 50 kgN $ha^{-1}$fertilizer and had significantly different from other treatments, but the lowest of this factor related to control.Itwas 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 $ha^{-1}$and 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/m2 | 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 $m^2$, No.ofseeds/spike, 1000-seed weight (g), seed yield (kg $ha^{-1}$), Biological yield (kg $ha^{-1}$), HI (%).

| Treatment | No. of spikes/m2 | 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.Itwas 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 100kg $ha^{-1}$, thesefactors was not increased.So, the results show that consumption of 50kgN $ha^{-1}$ 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 Valfajrcultivar. 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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