Evaluation of forage yield and grain yield of barley genotypes in the amount of nitrogen

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Abstract

The present research was aimed to study the effect of different levels of inorganic fertilizer N on the yield and yield components of barley varieties at Gorgan Research Station, Iran in 2013-2014 year. A split plot layout within randomized complete block design with 3 replications was used. Main plot were different level of nitrogen fertilizer (35, 70 and 105 kg ha-1) from urea source, and sub plot were different varieties (Line 3, Line 7 and Line 17). Condition represented the effect of nitrogen was significant on feed and grain yield, Protein yield, Plant height, HI. Maximum Plant height, HI and grain yield was recorded in sterling. The highest Feed yield, grain yield was observed in Line 5 variety. Nitrogen applied at the rate of 105 kg ha-1 resulted in maximum Plant height, Harvest Index, feed yield, grain yield, Protein yield.

Keywords: Barley, forage, grain yield.

INTRODUCTION

Barley (Hordeum vulgare L.) is the major cereal in many dry areas of the world and is vital for the livelihoods of many farmers. Barley is an annual cereal crop and grown in environments ranging from the desert of the Middle East to the high elevation of Himalayas (Hayes et al., 2003). It is the major food source in many North African countries. In Iran, it is mainly grown for grain and straw for small ruminants during winter, with green fodder sometimes used for winter grazing. Barley can replace wheat as the dominant crop due to its tolerance to drought and salinity. Barley assumes fourth position in total cereal production in the world after wheat, rice, and maize. Barley is more productive under adverse environments than other cereals. Barley serves as a major animal fodder, base malt for beer and certain other distilled beverages.

Excess nitrogen increased leaf area, tiller formation, leaf area index and leaf area duration and this increasing is led to much greater production of dry matter and grain yield (Ryan et al., 2009). Sylvester-Bradley et al. (1990b) reported that plant height of cereals increased significantly and linearly with increased nitrogen application. (Anbessa and Juskiw, 2012), in an experiment on the effects of nitrogen on barley cultivars concluded the biomass-related trait of leaf area was also increased by the application of N fertilizer. Also, percent increase in lodging incidence over the unfertilized treatment was assessed. The lodging data was so variable, and it was not statistically different between treatments. (Ahmad and Rashid, 2004), 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. (Ryan et al., 2009), in an experiment on barley stated as expected, the main factors N and variety.
Table 1. Analysis of variance (mean squares) for yield of barley genotypes 2012-2013, 2013-2014

<table>
<thead>
<tr>
<th>s.o.v</th>
<th>Df</th>
<th>Feed yield (kg/ha)</th>
<th>Grain yield (kg/ha)</th>
<th>Protein yield(kg/ha)</th>
<th>Plant height(cm)</th>
<th>Harvest Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error a</td>
<td>6</td>
<td>60786</td>
<td>28654</td>
<td>321.4</td>
<td>20.6</td>
<td>10.3</td>
</tr>
<tr>
<td>year</td>
<td>1</td>
<td>595234 n.s</td>
<td>2593987 n.s</td>
<td>2114 n.s</td>
<td>308.3 n.s</td>
<td>73.7 n.s</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>2</td>
<td>6008218 **</td>
<td>405431 **</td>
<td>41532 **</td>
<td>2054 **</td>
<td>80.2 **</td>
</tr>
<tr>
<td>Genotype</td>
<td>2</td>
<td>9591589**</td>
<td>21234 **</td>
<td>41672 **</td>
<td>5245 **</td>
<td>31.7 **</td>
</tr>
<tr>
<td>Interaction</td>
<td>4</td>
<td>397355 **</td>
<td>614354 **</td>
<td>4871 **</td>
<td>43.6 n.s</td>
<td>16.4 **</td>
</tr>
<tr>
<td>Error b</td>
<td>24</td>
<td>18791</td>
<td>50317</td>
<td>5224</td>
<td>16.6</td>
<td>5.45</td>
</tr>
<tr>
<td>CV</td>
<td>-</td>
<td>12.4</td>
<td>11.5</td>
<td>14.6</td>
<td>5.27</td>
<td>7.76</td>
</tr>
</tbody>
</table>

ns = Non-significant   * = Significant at 5% level of probability

Table 2. mean compare Nitrogen fertilizer for yield of barley genotypes 2013-2014

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Feed yield (kg/ha)</th>
<th>Grain yield (kg/ha)</th>
<th>Protein yield(kg/ha)</th>
<th>Plant height(cm)</th>
<th>Harvest Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td>2452 c</td>
<td>4012 c</td>
<td>82.5 c</td>
<td>80.2 c</td>
<td>38.3 a</td>
</tr>
<tr>
<td>N2</td>
<td>2655 b</td>
<td>4206 b</td>
<td>90.9 b</td>
<td>82.6 b</td>
<td>38.8 a</td>
</tr>
<tr>
<td>N3</td>
<td>2793 a</td>
<td>4438 a</td>
<td>97.3 a</td>
<td>84.2 a</td>
<td>37.5 b</td>
</tr>
<tr>
<td>G1</td>
<td>2375 c</td>
<td>3641 c</td>
<td>85.2 c</td>
<td>80.5 c</td>
<td>38.8 b</td>
</tr>
<tr>
<td>G2</td>
<td>2445 b</td>
<td>3843 b</td>
<td>90.2 b</td>
<td>84.0 a</td>
<td>39.7 a</td>
</tr>
<tr>
<td>G3</td>
<td>2567 a</td>
<td>4523 a</td>
<td>99.5 a</td>
<td>87.5 b</td>
<td>39.4 a</td>
</tr>
</tbody>
</table>

Means followed by different letter(s) in a row are significant at 5% level of probability

were significantly affected either on the yield parameters, but the interactions were less consistent.

The amount of nitrogen that a barley crop needs to maximize yield and quality will depend on the seasonal conditions, soil type, and rotational history of the soil as well as the potential yield of the crop. Nitrogen is needed for early tiller development of barley to set up the crop for a high yield potential. Cantero et al. (1995) reported that split N application had little effect on yield, but decreased lodging and spike population with increased grain weight. (Singh and Uttam, 2000) recorded increased grain yield with increase in nitrogen level. However, increasing N fertility beyond a certain limit induced lodging and ultimately decreased grain yield and its components. The aim of this study is to determining yield on cultivars of barley in different levels of nitrogen.

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 35,70 and 105 kg ha-1) from urea source, and sub plot were different Genotypes (Line 3 (G2), Line 7(G3) and Line 17(G1). This research was conducted in 2013-2014 year, at research farm of farming building of Gorgan Research Station, Iran. A plot size of 2.5 m x 2 m having 6 rows, 30 cm apart was used. Phosphorus at the rate of 30 kg ha-1 was applied as basal dose. All other input and agronomic practices was carried out uniformly. 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, feed and grain yield, Protein yield, Plant height, Harvest Index was measured. All data are presented as mean values of three replicates. Data were analyzed statistically for analysis of variance (ANOVA) following the method described by Gomez and Gomez, (1994). SAS computer software was used to carry out statistical analysis. The significance of differences among means was compared by using Least Significant Difference (LSD) test.

RESULTS AND DISCUSSION

N fertilizer had significant influence on feed and grain yield, Protein yield, Plant height, Harvest Index (Table 1). Our results are in line with Le Gouis et al., (1999); Moselhy and Zahran, (2002) who reported that nitrogen application had little or no effects on days to emergence. (Anbessa and Juskiw, 2012), in an experiment on the effects of nitrogen on barley cultivars concluded the biomass-related trait of leaf area was also increased by the application of N fertilizer. Cultivar had significant influence on feed and grain yield, Protein content (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.

The highest of feed and grain yield, Protein yield, Plant height was achieved in 105 kgN ha-1 fertilizer treatment. The lowest of them related to control (Table 2). Demotes-Mainard and Jeuffroy, (2001), reported that wheat varieties with spikes are larger and longer than the...
smaller and shorter grains, have greater power-sharing for photosynthetic material. (Zeidan, 2007), showed that the highest levels in flag leaves of barley plants, the use of 35 kgN ha-1 respectively. The highest of feed and grain yield, Plant height, HI achieved in Line7 cultivar but the highest of Protein yield, related to Line 17 cultivar (Table 2). N fertilizer and cultivar interaction had significant influence on ear length (Table 1). The maximum of feed and grain yield, Protein yield, Plant height achieved in 105 kg N ha-1 and Line7 cultivar (Table 2).

More feed yield (2793 kg/ha), grain yield (4238 kg/ha) Plant height (84.2 cm), HI (37.5 %), Protein yield (97.3 kg/ha) was produced by the application of 105 kg N ha-1. Cantero et al. (1995) who observed that nitrogen application significantly affected productive tillers m-2. haudhary and Mehmood (1998); Oweis et al. (1999) observed similar results for grain spike-1 in barley. Weight and number of grains spike-1 was significantly increased with increasing N fertilization as reported by Moselhy and Zahran (2002). They further revealed that application of nitrogen fertilizer significantly increased spike length, number of grains spike-1, 1000 grain weight, grain yield and N uptake by the crop (Le Gouis et al., 1999; Ahmad and Rashid, 2004; Pervez et al., 2009).

CONCLUSION

The results showed that, with increasing in nitrogen fertilizer, the feed and grain yield, Protein yield, Plant height was increased and led to increased production of seed yield too. So, the results show that consumption of 105 kgN ha-1, is sufficient for the plant needs and produce maximum yield Ryan et al. (2009) also reported similar results for barley and stated Excess nitrogen increased leaf area, tiller formation, leaf area index and leaf area duration and this increasing is led to much greater production of dry matter and grain yield. Also, the maximum of seed yield, related to Line7. Then on the basis of the results obtained, the fertilizer treatment 105 kg N ha-1.

REFERENCE