Study of Yield and Yield Components of Durum Wheat, Affected by Nitrogen Fertilizer Levels and Plant Density


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ABSTRACT

A split plot experiment based on randomized complete block design with three replications was conducted at agricultural research station, Islamic Azad University, Ardabil branch, Iran in 2009-2010. Main plot included three densities (300, 350 and 400 seed m$^{-2}$) and sub plots contained four nitrogen levels (0, 70, 140 and 210 kg ha$^{-1}$ N). Results showed that with increasing nitrogen levels, biological yield was increased. Also, grain yield, number of spikes, 1000-grain weight and harvest index were obtained using 140 kg ha$^{-1}$ N and excess rates, decreased grain yield and other traits. With increasing plant density, all measured traits, other 1000-grain weight and harvest index, were increased. As results to increase grain yield, prevent of environmental pollution and decrease in fertilizer application as excess cost, application of 140 kg ha$^{-1}$ N in 400 plant m$^{-2}$ density (within conditions of this research), is recommended.

Key words: yield components, length of growth period, plant density, nitrogen and durum.

Introduction

Nitrogen plays an essential role in plant growth and shoot the other is the uncontrolled use of nitrogen fertilizer in different crops in addition to compromising the quality and reduces the consumption of healthy donors over time cause is environmental pollution. Therefore, determining the optimum level of nitrogen in which obtained the maximum performance and minimal environmental pollution is created is very important [6]. Nitrogen in cereal grain number is increased. Fixes nitrogen application caused increase restrictions for corn nitrogen and photosynthetic efficiency of plants and increase production and increase the number of grains per ear is. Wheat response to higher density of plants is weeding. The highest density in cereal crop due to excessive competition between plants for light, moisture or small amounts of seed are produced. Distribution of nitrogen fertilizers on the level and distribution of nitrogen in plants is effective. reduced the percentage of sterile plants with reduced nitrogen consumption and density reported. Rudha et al. [10] observed an increase in nitrogen consumption significantly decreased the time needed for the emergence of flowers. With density influences nutrient, moisture, solar radiation and crop growth stages on the leaves and may affect stems, perennial grasses of fine grain cereals and cold areas, if desired exposure Drshrayt every 6 to 10 days a Full sheets are produced, whereas in maize and tropical crops every four to six days a complete leaf is produced.

The aim of this study was study of yield and yield components of durum wheat varieties Seimareh affected by levels of nitrogen fertilizer and plant density.

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density.

Materials and Methods

1389-1388 crop year experiment in the field of agricultural research station of Azad University of Ardebil - Iran, a split plot randomized complete block design with three replications was conducted in Ardabil. Main plots included three levels of different densities (300, 350 and 400 seeds per square meter). And sub plots, including different levels of nitrogen fertilizer at four levels (0, 70, 140 and 210 kg N ha), respectively. The first irrigation after planting and subsequent irrigation depending on weather conditions and crop needs done. One third of nitrogen fertilizer when planting and the rest for roads in the spring and shoot on the stage was used (Kazemi Arbt, 1999). At the end of the growing plant and the plant fully arrived, for measuring the performance of durum wheat, about 1.5 square meter of each plot was harvested and yield was calculated. For data analysis and graphing software from SAS and Excel software and to compare the means was used of Duncan test at 5 percent probability level.

Grain yield per square meter:

ANOVA table showed that among different levels of nitrogen fertilizer and plant density interaction levels of nitrogen fertilizer on grain yield per unit area on a percentage level there are significant differences for main effect of density differences were not significant (Table 1). Although the statistically significant difference between levels of density were not observed, but the highest grain yield per plant density of 400 m and the lowest density of 300 plants per square meter was obtained. Increasing levels of nitrogen increased grain yield and highest yield in the use of 140 kg N ha respectively, while this was the next levels of nitrogen in one group were statistically increased nitrogen fertilizer caused more than 140 kg Grain yield was reduced. Increasing the level of nitrogen fertilizer to 140 kg and with increasing plant density per unit area, maximum yield was obtained (Table 2). Cuomo et al. [3] also reported results are quite similar. The interaction density for levels of nitrogen fertilizer, which was opened in combination treatments highest yield 140 kg of nitrogen fertilizer plant density of 400 m, was obtained (Figure 1). Cuomo et al. [3] reported that increasing plant density per hectare yield increases. N with increasing number of mature leaves causes respiration to photosynthesis ratio increased, assimilate materials production and yield increase, but if excess nitrogen is optimal shoot development was very high and therefore the number of leaves in the shade are increased photosynthesis to respiration ratio decreased to less grain assimilate materials will lead to more material consumption mature and immature leaves that were still in the shadow of consumers are reached [5].

Total spike in one square:

ANOVA table showed that among different levels of nitrogen fertilizer, density and interaction density levels of nitrogen fertilizer per unit area for a number of spike on a percentage level there are significant differences (Table 1). Most spike plants in the density of 400 square meters and the lowest density of 300 plants per square meter was obtained. Increasing levels of nitrogen increased the number of symbols and most use of spike in the 140 kg N ha respectively. Meanwhile, the next levels of nitrogen in one group were statistically increased nitrogen fertilizer more than 140 kg will reduce the number of spike. Increasing the level of nitrogen fertilizer to 140 kg and whit increasing plant density per unit area, most were spike (Table 2). Hashemi Dezful et al. [7] also spike increased the number per unit area due to increased nitrogen fertilizer have reported pollen. The interaction density for levels of nitrogen fertilizer, which was also open most spike combined treatments on the density of 140 kg of nitrogen fertilizer plant in the 400 meters and the lowest value of this trait in combination treatments plant density of 300 m at the level of fertilizer to control respectively (Fig. 2).

1000-seed weight:

wheat grain weight studied away in this experiment affected the density and nitrogen levels and the interaction was a two (Table 1), the table showed that the variance between different levels of nitrogen fertilizer, density and interaction density levels of nitrogen fertilizer on a percentage level is significantly different. The highest density of 300 1000-seed weight in plants per square meter and the lowest density of 400 plants per square meter were obtained. Some researchers to reduce the effect of 1000-seed weight increased plant density have noted [4]. Increasing levels of nitrogen increased 1000-seed weight and 1000-seed weight in the highest use of 140 kg N ha respectively. In fact, with increasing levels of nitrogen fertilizer up to 140 kg and with increasing plant density per unit area, the highest seed weight was obtained (Table 2). Nitrogen at different growth stages of wheat by increasing the number of tillers per plant, ear number per unit area, number of grains per spike, grain weight and accumulate more dry matter yield is increased [5]. Hokmalipour, [8] also quite similar results with the results obtained in this experiment have been reported. The interaction density for levels of nitrogen fertilizer was also the highest grain weight
in combination treatments in the density of 140 kg of nitrogen fertilizer plant 300 m was obtained (Fig. 3). Increase in grain weight with increasing the nitrogen fertilizer such can be justified because increasing levels of nitrogen fertilizer, manure and photoassimilate uptake by seed and thus causing more accumulation of these substances in seeds and increased seed 1000-weight is, the density can be also noted that such a reduced current photosynthesis due to decreased leaf area duration after flowering, and high density, high breathing, tangible reduction in seed weight is high density [4].

**Biological yield per square meter:**

Biological yield of wheat in this experiment studied away under the influence of density and nitrogen levels, and these interactions were (Table 1), the table showed that the variance between different levels of nitrogen fertilizer, density and density of interaction levels of nitrogen fertilizer plants in the one percent level there is a significant difference. Most biological functions in the density of 400 plants per square meter and the lowest density of 300 plants per square meter were obtained. Increasing levels of nitrogen and the highest biological yield increased use of biological yield in 210 kg N ha obtained from the statistical level 140 kg N ha are located in a surface. Increasing levels of nitrogen fertilizer and plant density per unit area, the highest biological yield was obtained (Table 2). Density for the interaction of nitrogen fertilizer levels was observed in the composition of the highest biological yield 140 kg of nitrogen fertilizer treatments on plant density of 400 m and the lowest value of this trait in combination treatments plant density of 350 m at the level of fertilizer to control income (Figure 4). Nitrogen is the most important element of land cultivated with wheat are facing shortage of nitrogen at different growth stages of wheat by increasing the number of tillers per plant, ear number per unit area, number of grains per spike, grain weight and accumulation Dry matter yield can be increased [7,5].
The nitrogen fertilizer due to the significantly increased plant height and followed by increased levels of green plant organs and ultimately expands and increase air dry shoots are. This is due to the biological yield, nitrogen consumption increased higher levels [1]. With increasing plant density due to the number of stems and leaves per unit area due to increased number of plants per unit area, increases the value and seek dry matter per unit area will increase [2].

Harvest index:

Analysis of variance related to harvest index showed that plant density, nitrogen levels and the interaction density levels of nitrogen level is a significant percentage (Table 14). Density for the interaction of nitrogen fertilizer levels were determined in the combined treatments in 140 kg nitrogen per hectare in the density of 300 plants m\(^2\) highest harvest index was obtained (Fig. 5). With

![Fig. 4: Biological yield per square meter as affected by N and plant density.](image1)

![Fig. 5: Harvest index as affected by N and plant density.](image2)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>Grain yield per square meter</th>
<th>Total spike in one square meter</th>
<th>1000-seed weight (g)</th>
<th>Biological yield per square meter</th>
<th>Harvest index (%)</th>
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<tbody>
<tr>
<td>Replication</td>
<td>2</td>
<td>41147.35**</td>
<td>10821.75*</td>
<td>375.86**</td>
<td>95160.35**</td>
<td>18.60**</td>
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<tr>
<td>Density (D)</td>
<td>2</td>
<td>702.56es</td>
<td>12391.35**</td>
<td>30.52**</td>
<td>275472.13**</td>
<td>37.11**</td>
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<tr>
<td>Error</td>
<td>4</td>
<td>3292.25</td>
<td>1798.29</td>
<td>6.94</td>
<td>5607.65</td>
<td>2.48</td>
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<tr>
<td>Nitrogen (N)</td>
<td>3</td>
<td>45702.94**</td>
<td>14226.41**</td>
<td>30.32</td>
<td>2372145.25**</td>
<td>47.50**</td>
</tr>
<tr>
<td>D × N</td>
<td>6</td>
<td>94605.02**</td>
<td>34411.58**</td>
<td>48.71**</td>
<td>228824.76**</td>
<td>186.47**</td>
</tr>
<tr>
<td>Error</td>
<td>18</td>
<td>4239.26</td>
<td>2047.58</td>
<td>4.47</td>
<td>10575.56</td>
<td>2.50</td>
</tr>
<tr>
<td>CV %</td>
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<td>7.40</td>
<td>9.67</td>
<td>3.96</td>
<td>3.99</td>
<td>4.59</td>
</tr>
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*Numbers with the same words in each column, have no significant differences to each other.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Grain yield per square meter</th>
<th>Total spike in one square meter</th>
<th>1000-seed weight (g)</th>
<th>Biological yield per square meter</th>
<th>Harvest index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant density (plant m(^{-2}))</td>
<td>300</td>
<td>873.21a</td>
<td>433.70b</td>
<td>55.08a</td>
<td>2402.46b</td>
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<td></td>
<td>350</td>
<td>878.03a</td>
<td>471.74ab</td>
<td>53.16ab</td>
<td>2634.32a</td>
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<tr>
<td></td>
<td>400</td>
<td>888.20a</td>
<td>497.58a</td>
<td>51.91b</td>
<td>2668.35a</td>
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<tr>
<td>Nitrogen levels (kg ha(^{-1}))</td>
<td>70</td>
<td>835.04b</td>
<td>436.36b</td>
<td>51.30c</td>
<td>2411.66b</td>
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<td></td>
<td>140</td>
<td>845.28b</td>
<td>445.45b</td>
<td>53.52b</td>
<td>2387.09b</td>
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<td></td>
<td>210</td>
<td>852.79b</td>
<td>474.16b</td>
<td>55.75a</td>
<td>2769.65a</td>
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</table>

*Numbers with the same words in each column, have no significant differences to each other.
increasing plant density, harvest index was significantly decreased. So, the highest harvest index, plant density at 300 m was obtained (Table 2). Reddy et al. [9] reported that increasing plant density in corn, harvest index decreased. Cox and Cherny [2] were observed with increasing density, harvest index decreased. While some scholars have expressed the harvest index were affected by plant density is not [2]. Pooryosef et al. (2000), the effect of planting pattern and plant density on yield and yield components of two varieties of hybrid corn were investigated and concluded that the density dose not affect by harvest index. It is also reported that high plant density, dry matter yield increases, but may increase competition within the plant, harvest index therefore decreased. The observed increase in nitrogen harvest index is increased and thus the maximum level of 140 kg of fertilizer per hectare, respectively. Was that although statistically, the level control 210 kg nitrogen level, the lowest allocated (Table 2). Nitrogen fertilizer improves plant growth is that the production is more photoassimilate to the stage of seed development, seed production and therefore allocated on the biological yield of grain than to grow.

References