EFFECT OF CUTTING DATES AND DIFFERENT LEVELS OF NITROGEN ON THE YIELD OF GREEN FEED AND GRAIN YIELD FOR BARLEY CROP (HORDEUM VULGARE L.)

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Abstract
A field experiment was conducted during the winter season 2018-2019 in one of the fields belonging to the Hilla district / Babylon province. The split plot was used with randomized complete block design with three replication, the nitrogen levels (without fertilizer, 50, 100, 150, 200, 250) kg N.ha\(^{-1}\) were occupied. While the cutting dates (no-cutting, cutting after 45 days, cutting after 65 days, cutting after 85 days) were filled the subplots, the results conclude as follows: The third cutting dates (C3) (cutting after 85 days of sowing) was significantly higher than the average green fodder yield of 31.639 (tons.ha\(^{-1}\)), the treatment (C0) (without cutting) was significantly excelled which gave the highest average of grain yield, the number of spikes, Number of grains.Spike\(^{-1}\) and the 1000 grain weight, where amounted 5.728 (tons.ha\(^{-1}\)), 504.6 spike.m\(^{-2}\), 48.44 grain. spike\(^{-1}\), 42.532 g respectively. The level of fertilizer N5 (250 kg N.h\(^{-1}\)) gave the highest average for the green fodder yield, grain yield, number of spikes and Number of grains.Spike\(^{-1}\) where amounted 36.52 (tons.ha\(^{-1}\)), 6.196 (tons.ha\(^{-1}\)), 505.9 spike.m\(^{-2}\), 50.66 grain.spike\(^{-1}\), respectively. The results showed that there was a significant effect of the interaction values between the study factors. The treatment C3 N5 gave the highest mean of green fodder yield amounted 42.647 (tons .ha\(^{-1}\)) and the treatment C0N5 gave the highest average number of spikes and grain yield amounted 591 spike.m\(^{-2}\), 7.607 ton.ha\(^{-1}\) respectively.

It can conclude from the results of the study that there is a positive effect of the late cutting dates in increasing the yield of green fodder, it is also clear that the lack of cutting led to a positive increase in grain yield and most of its components, we conclude that high levels of nitrogen led to a positive increase in the yield of green fodder and grain yield.

Key words: green fodder, barely, number of spike, grain yield.

Introduction

Barley *Hordeum vulgare* L. is an important dual-purpose grain crop. It is grown for the purpose of obtaining green fodder and grains as well as entering various industries and is used in human feeding on a narrow scale. Barley is characterized by high nutritional value because it contains a high percentage of amino acids and protein and its ability to Tolerance to drought and salinity and rapid growth after cutting so most areas of Iraq are suitable for sowing as it is grown in the irrigated plains in the center and south, it’s used exploited fields for cutting or direct grazing (Al-Qaisi, 2001), cutting is one of the important field treatments of barley crop and has many benefits, including the elimination of the lodging experienced by local sowing and increase the number of tillers by reducing the Influence of apical meristem and provide a good amount of green fodder during the winter season, which is characterized by the scarcity of green fodder. This depends on the cultivar and its ability to regrow and the density of the total vegetative and the green fodder yield and protein ratio by different the cutting date (Al-Tikriti *et al*., 1981). Nitrogen is found in many vital compounds such as amino acids, protein and nucleic acids, so it is an important component of crop growth and productivity (Peltonen, 1995). There are many factors that affect the green fodder yield and grains in the barley crop, including the cutting date and nitrogen fertilizer levels. Khalil *et al*., (2011) reported that the dry matter yield was significantly affected by the cutting date as it increased with the cutting date delayed from 75 to 90 days after sowing. Tawfiq and Muhammed, (2014) was found after applying an experiment on three-grain crops, which included the use of four cutting dates (80, 90, 100 and 110) days after planting exceeded the date of mowing 110 days after sowing in the traits of green fodder yield
and dry matter yield of wheat, barley crops and Triticale. (Singh et al., 2014) indicated that the cutting date significantly affected the grain yield components. The cutting treatment after 60 days of sowing the highest mean yields, number panicles, number of grain in a panicle and 1000 grain Weight. While the cutting treatment after 90 days of sowing gave the lowest averages. (Alkarkhi, 2014) found that increasing the level of nitrogen fertilizer to 270 kg. E. 1-led to a significant increase in the traits of green fodder yield and dry matter yield. Alazmani, (2014a) indicated when using three levels of nitrogen fertilizer (75, 150 and 225 kg N.h⁻¹) Barley crop that increased nitrogen fertilizer led to a significant increase in grain yield and number of spikes. It also noted that increased nitrogen resulted in a significant decrease in 1000 grain Weight. This study was conducted to achieve the best combination between nitrogen and cutting date, which gives the highest yield of green fodder and grain.

**Materials and Methods**

A field experiment was conducted during the winter season 2018-2019 in one of the fields belonging to the Hilla district / Babylon province, in soil with silty loam, the Dumping process with water was conducted for the purpose of germinating thickets seeds and when the soil reached the appropriate moisture. The soil tillage by the Moldboard Plow and smoothing by Fixed harrows. After leveling, the land was divided according to the split-plot design (Randomized Complete Block Design). The main Plot included six treatments for nitrogen fertilization (without fertilizer 50, 100, 150, 200, 250) kg N.h⁻¹, which symbolized (N0, N1, N2, N3, N4, N5). Sub-Plot included four treatments for cutting dates (no-cutting, cutting after 45 days, cutting after 65 days, cutting after 85 days) after sowing, which symbolized (C0, C1, C2, C3) and three replicates, the area of the experimental unit was 6m² with dimensions (2 × 3m), the Space 2 m was left between the replicates and the experimental units 1m to prevent nitrogen fertilizer leakage between the experimental units, Barley crop of Behooth 244 cultivar was sowing on 20/10/2018 in a broadcast method when winds stopped to ensure the distribution of grains on a regular basis. The first irrigation was conducted to immediately after sowing and the rest of the irrigation was given according to the need of the plant. Phosphate fertilizer was added in the form of (P₂O₅, 46%) rate (40 kg P.h⁻¹), Latif et al., (1996) before plowing and used urea fertilizer (46% N) source of nitrogen where all levels were added in the form of batches after the first two weeks after sowing and the second after cutting to allow the plant to form a good total vegetative and the third when reaching the Booting Stage to ensure increased sedimentation of nutrients in the grain, the cutting process was conducted according to the dates studied and at the level (5-6) cm from the soil surface Latif et al., (1996) and harvested at the stage of full Maturity Stage.

**Studies traits :**

1. **Green fodder yield (ton.h⁻¹):** One square meter was cutting for all treatments at a height (5-6) cm and weighed in the field and then converted to tons.

2. **Number of spikes. m²:** The number of spikes from the square meters after harvesting from the middle of each experimental unit at the full maturity stage.

3. **Number of grains.Spike⁻¹:** Calculated as an average of ten spikes of the same square meter randomly selected for all experimental units.

4. **The 1000 grain Weight (g):** Calculated with a weight of 1000 grain taken randomly from the same square meter and weighed with a sensitive balance.

5. **Grain yield (ton.ha⁻¹):** The spikes collected from the same square meter and then Threshing for the extraction of grains and cleaned well and then the weight of grain yield and converted to tons.

Data were analyzed statistically by using the Genstat statistical program, the averages were compared according to the least significant difference (LSD), below 5% probability level (Alrawi and Khalaf Allah, 2000).

**Results and Discussion**

**The Green fodder yield (tons.ha⁻¹).**

The results in table 1, showed that there was a significant effect of cutting dates on the green fodder yield (tons.ha⁻¹). The treatment (C3) gave the highest average of 31.64 (tons.ha⁻¹), while treatment C1 gave the lowest average of amounted 17.81 (tons.ha⁻¹). The reason may be due to the late cutting dates gave sufficient time for the growth of plants and increase the green area and plant height (unpublished data), which reflected in the increase of photosynthesis and thus increase the green fodder yield. These results agree with Hussain et al. (2003), Tawfiq and Muhammed, (2014). The results in table 1, showed that nitrogen fertilizer levels significantly affected of green fodder yield. The treatment (N5) gave the highest average amounted of 36.52 (tons.ha⁻¹). While comparison treatment N0 gave the lowest average amounted of 12.39 (tons.ha⁻¹). The reason may be due to the positive role of nitrogen in increasing cell division and activity and increasing size, improving growth, increasing plant activity, plant height and number of leaves and areas, which is reflected in the increase of green fodder yield per unit area (Alkarkhi, 2014). These results

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Table 1: Effect of cutting dates, nitrogen fertilization and their interaction on the average yield of green feed (tons.ha⁻¹).

<table>
<thead>
<tr>
<th>Nitrogen levels.kg h⁻¹</th>
<th>Cutting dates.day</th>
<th>Interaction</th>
<th>Cutting dates</th>
<th>LSD 0.05</th>
<th>LSD 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>C3</td>
<td>C2</td>
<td>C1</td>
<td>C0</td>
<td></td>
</tr>
<tr>
<td>12.39</td>
<td>18.33</td>
<td>11.86</td>
<td>6.99</td>
<td>-</td>
<td>N0</td>
</tr>
<tr>
<td>19.15</td>
<td>24.68</td>
<td>18.42</td>
<td>14.34</td>
<td>-</td>
<td>N1</td>
</tr>
<tr>
<td>23.42</td>
<td>28.57</td>
<td>24.22</td>
<td>17.47</td>
<td>-</td>
<td>N2</td>
</tr>
<tr>
<td>28.63</td>
<td>35.17</td>
<td>31.43</td>
<td>19.30</td>
<td>-</td>
<td>N3</td>
</tr>
<tr>
<td>32.29</td>
<td>40.45</td>
<td>35.33</td>
<td>21.11</td>
<td>-</td>
<td>N4</td>
</tr>
<tr>
<td>36.52</td>
<td>42.65</td>
<td>39.24</td>
<td>27.68</td>
<td>-</td>
<td>N5</td>
</tr>
<tr>
<td></td>
<td>31.64</td>
<td>26.75</td>
<td>17.81</td>
<td>-</td>
<td>Average</td>
</tr>
</tbody>
</table>

The results in table 2, showed that cutting dates significantly affected the number of spikes. The treatment C0 gave the highest average amounted of 504.6 spikes, while treatment C3 gave the lowest average amounted of 301.2 spikes. The reason may be due to the non-cutting gave sufficient time for growth and formation of strong activities tiller of forming spikes, which increased the number of spikes per unit area. The non-

Table 2: Effect of cutting dates, nitrogen fertilization and their interaction on the average Number of spikes. M².

<table>
<thead>
<tr>
<th>Nitrogen levels.kg h⁻¹</th>
<th>Cutting dates.day</th>
<th>Interaction</th>
<th>Cutting dates</th>
<th>LSD 0.05</th>
<th>LSD 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>C3</td>
<td>C2</td>
<td>C1</td>
<td>C0</td>
<td></td>
</tr>
<tr>
<td>263.6</td>
<td>162.7</td>
<td>223.7</td>
<td>299.3</td>
<td>368.7</td>
<td>N0</td>
</tr>
<tr>
<td>327.4</td>
<td>199.0</td>
<td>302.3</td>
<td>384.7</td>
<td>423.7</td>
<td>N1</td>
</tr>
<tr>
<td>401.8</td>
<td>305.3</td>
<td>358.0</td>
<td>452.0</td>
<td>491.7</td>
<td>N2</td>
</tr>
<tr>
<td>463.8</td>
<td>346.0</td>
<td>408.0</td>
<td>535.0</td>
<td>566.0</td>
<td>N3</td>
</tr>
<tr>
<td>481.0</td>
<td>386.0</td>
<td>420.3</td>
<td>531.0</td>
<td>586.7</td>
<td>N4</td>
</tr>
<tr>
<td>505.9</td>
<td>408.0</td>
<td>439.0</td>
<td>585.7</td>
<td>591.0</td>
<td>N5</td>
</tr>
<tr>
<td></td>
<td>301.2</td>
<td>358.6</td>
<td>464.6</td>
<td>504.6</td>
<td>Average</td>
</tr>
</tbody>
</table>

The results in table 3, showed that there was a significant increase of vegetative growth of plants at different stages of growth, which is reflected by the increase of dry matter accumulated in the stages of plant growth and that the increase of vegetative growth increased the efficiency of the exploitation of solar radiation effective in photosynthesis (P.A.R) Especially at the beginning of plant life, which increased the amount of materials that support the formation of primers tiller and the success of their growth and continuity, which was reflected in the increase in the number of spikes per unit area. Table 2, shows a significant interaction between cutting dates and nitrogen fertilizer levels. The treatment N5C0 gave the highest mean of 591.0 spikes. It did not significantly differ from the combinations N4C0, N5C1 and N3C0, while The treatment N0C3 gave the lowest average of 263.6 spikes. This may be due to the role of high levels of nitrogen in increasing vegetative growth of plants at different stages of growth, which is reflected by the increase of dry matter accumulated in the stages of plant growth and that the increase of vegetative growth increased the efficiency of the exploitation of solar radiation effective in photosynthesis (P.A.R) Especially at the beginning of plant life, which increased the amount of materials that support the formation of primers tiller and the success of their growth and continuity, which was reflected in the increase in the number of spikes per unit area. Table 2, shows a significant interaction between cutting dates and nitrogen fertilizer levels. The treatment N5C0 gave the highest mean of 591.0 spikes. It did not significantly differ from the combinations N4C0, N5C1 and N3C0, while The treatment N0C3 gave the lowest average of 263.6 spikes.

Number of grains.Spike⁻¹

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significant effect of cutting dates on the average number of grains in the spike. Spike-1. The treatment C0 gave the highest average amounted of 48.44 grains. Spike-1 it did not differ significantly from treatment C1 while treatment C3 gave the lowest average of 41.89 grains. Spike-1. This may be due to that the treatments were not exposed to the cutting have evolved normally and benefited from the food stored in their parts in the growth of spike primers and evolution, which increased the number of grain in the spike. While the treatments prone to the cutting exploited the food storage to compensate the vegetative part, the growth rate after the cutting is slow, which led to the reduction of the development period of the spikes due to lack of sufficient time, which was reflected in the decrease in the number of florets in the spike and thus the decrease in the number of grains (Dunphy, 1982). These results agree with Hadi et al., (2012); Singh et al., (2014), which indicate that no cutting or early cutting leads to an increase in the number of grains in the spike compared to late cutting. The results in table 3, showed that nitrogen fertilizer levels significantly affected this trait, where the treatment (N5) gave the highest average amounted of 50.66 grains. Spike-1, it did not significantly differ from treatment N4, while the control treatment N0 which gave the lowest average of 37.59g. This may be due to the positive role of high nitrogen levels, which improve the fertility status of most florets in the spikes, which makes their ability to grain formation compared to low levels (Langer and Hanif, 1973). The role of nitrogen in prolonging the evolution and development of spikes, which is a factor in increasing the number of grain structures and increasing the fertility of the lateral, basal and late florets (Langer and Liew, 1973). These results agree with Fayad et al., (2005); Ahmad et al., (2007) and Alawi, (2011) indicated that the increase in nitrogen fertilizer level leads to a significant increase in the number of grains in the spike. The results in table 3, showed a significant interaction between cutting dates and nitrogen fertilizer levels. The treatment N4C1 gave the highest average amounted of 53.20 grain. Spike-1 did not significantly differ from the interaction treatments N5C1, N3C1, N4C0, N3C0 and N5C0, while treatment N0C3 gave the lowest average of 33.57 grains. Spike-1.

The 1000 grain Weight. (g)

The results in table 4, showed that cutting dates significantly affected on the 1000 grain Weight (g). The treatment C0 gave the highest average amounted of 42.53g. it did not differ significantly from treatment C1 while treatment C3 gave the lowest average of 35.90 g. The reason may be due to the availability of sufficient time for treatments that were not exposed to the cutting, increasing the accumulation of dry matter in the grain, the cutting caused the depletion of nutrients in the plants that were exposed to the cutting, As a result, there was reduce the accumulation of dry matter in it (Al-Saadi, 2005). These results agree with Eric et al., (2010), Singh et al., (2014); Alazmani (2014b). They found that not exposing the plant to the cutting leads to the increase the weight of grain. The results in table 4, showed that nitrogen fertilizer levels significantly affected in this trait, where the treatment (N5) gave the highest average amounted of 42.21g, it did not differ significantly from treatment N3, while the control treatment N0 which gave the lowest average amounted of 37.59g. This may be due to the increase in the number of spikes and the number of grains in the treatments with high fertilization rates, which led to a decrease in the share of the single grain of photosynthesis (accumulated dry matter) on the contrast to the low-fertilization treatments in which the number of spikes and the number of grains in the spike decreased, pushing the plant to the principle of compensation (Table 3 and 4), an increase in one component of the yield may also lead to a decrease in the other components due to the state of compensation (Jamal et al., 1996). These results agree with Munir, (2002) and Alazmani, (2014a).
**Table 5:** Effect of cutting dates, nitrogen fertilization and their interaction on the average grain yield (tons.ha⁻¹).

<table>
<thead>
<tr>
<th>Average</th>
<th>Cutting dates.day</th>
<th>Nitrogen levels.kg h⁻¹</th>
<th>Interaction = 0.499; Cutting dates = 0.144; Nitrogen levels = 0.421</th>
<th>LSD 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C3</td>
<td>C2</td>
<td>C1</td>
<td>C0</td>
</tr>
<tr>
<td>1.85</td>
<td>0.96</td>
<td>1.36</td>
<td>2.23</td>
<td>2.85</td>
</tr>
<tr>
<td>2.68</td>
<td>1.38</td>
<td>2.45</td>
<td>3.17</td>
<td>3.73</td>
</tr>
<tr>
<td>3.87</td>
<td>2.35</td>
<td>2.58</td>
<td>4.72</td>
<td>5.84</td>
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<td>5.41</td>
<td>3.45</td>
<td>4.84</td>
<td>6.34</td>
<td>6.99</td>
</tr>
<tr>
<td>5.93</td>
<td>3.93</td>
<td>5.62</td>
<td>6.83</td>
<td>7.36</td>
</tr>
<tr>
<td>6.20</td>
<td>4.09</td>
<td>5.67</td>
<td>7.41</td>
<td>7.61</td>
</tr>
<tr>
<td>2.69</td>
<td>3.75</td>
<td>5.12</td>
<td>5.73</td>
<td>Average</td>
</tr>
</tbody>
</table>

They found that the increase in nitrogen fertilizer level resulted in an increase in the number of spikes and the number of grains in the spike with a significant decrease in the average the 1000 grain Weight. Table 4, shows a significant interaction between cutting dates and nitrogen fertilizer levels. The treatment N3C0 gave the highest mean of 43.93g, while, the treatments N4C0, N4C1, N3C1, N2C0 and N3C1 were not significantly different, while treatment N0C3 gave the lowest average of 32.05g. This may be due to an increase in the yield components of the number of spikes and the number of grains in the spike (Table 2 and 3), which was reflected in the decrease in grain weight.

**Grain yield (tons.ha⁻¹)**

The results in table 5, showed that there was a significant effect on cutting dates on grain yield. The treatment C0 gave the highest average of 5.73 (tons.ha⁻¹), while treatment C3 gave the lowest average of 2.69 (tons.ha⁻¹). This may be due to that the cutting led to a shorter growth period for new growths, insufficient time for the production of Tillers and the formation of spikes. These results agree with Munsif et al., (2013); Alazmani, (2014a) and Singh et al., (2014) that the delayed cutting dates lead to a significant decrease in grain yield and its components compared with no cutting or early cutting. The results in table 5 indicate that nitrogen fertilizer levels significantly affected in this trait, the treatment N5 gave the highest average of 6.20 (tons.ha⁻¹) it did not significantly differ from treatment N4 while the control treatment N0 gave the lowest average of 1.85 (tons.ha⁻¹). This may be due to the significant effect of high nitrogen levels on both the number of spikes and the number of grains in the spike (Table 2 and 3). High nitrogen levels were considered to be important factors in increasing the number of spikes and the number of grains in the spike and then the grain yield (Oweis and Pala, 1998). These results agree with those of Alam et al., (2007); Malecka Blecharczyk, (2008); Iqbal et al., (2012); Alkarkhi, (2014) and Alazmani, (2014a). Table 5, shows a significant interaction between cutting dates and nitrogen fertilizer levels. The treatment N5C0 gave the highest average of 7.61 (tons.ha⁻¹), it did not significantly differ from the treatment N5C1 and N4C0 while the treatment N0C3 gave the lowest average of 0.96 (tons.ha⁻¹).

**References**


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