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Effect of nitrogen levels and number of mites on some growth characteristics and the harvest of green fodder and grain yield for Barley (*Hordeum vulgaire* L.)

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Abstract

Barley *Hordeum vulgaire L* is an important grain crop, it ranks fourth after (wheat, rice and yellow corn) and is grown in large areas in most parts of the world and the Arab world. The aim of this research is to study the effect of different levels of nitrogen fertilizer on the yield and quality of green forage and grain yield for barley crop Iba 99 different levels of nitrogen fertilizer (0, 90, 180 and 270) kg N/H and the number of times of cutting (without cut and one and two cuttings) on the yield and quality of green forage and grain yield for barley crop Iba 99. The design of randomized complete segments was arranged in order of splitting-splitting plates with three replicates. Nitrogen levels were allocated to the main panels, nitrogen levels to the secondary panels and the number of pads in the sub-replicates plots. The study concluded that the addition of nitrogen fertilizer at the level (270 kg N/H) led to a significantly increases in the plant height, number of leaves / stem, number of tillers / m^2, area of flog leaf, number of spikes / m^2, number of grains/ spike, green forage yield, dry matter yield, grain yield, hay yield and percentage of crude protein in green forage.

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Introduction

Cereal crops respond to the addition of nitrogen fertilizer, especially in the poor soils because it helps to increase the speed of vegetative growth and improve the nutritional value of forage by increasing its protein content with increasing grain yield. It is advised that the addition of nitrogen fertilizers must be in low doses after each cutting to activate branching and regrowth (Farrokh 2012; Vieira-Megda *et al.,* 2015).

Nitrogen plays an important role in protein synthesis by contributing to the building of amino acids, which are the basic units in the proteins structure, and proteins have an effect in increasing the size of cells and increase the surface area of leaves, especially science paper because of its effectiveness in filling the grain, The roots of plants absorb nitrogen either in the form of ammonium ions NH_4^+ or nitrate ions NO_3^-, nitrogen ions when added to soil as fertilizer may be subjected to loss processes such as washing or volatilization to multiple factors, especially in Iraqi soils with a high content of carbonate minerals responsible primarily for its base (Li *et al.,* 2016; Biya, 2018).

The researchers pointed out the importance of adding an essential part of nitrogen fertilizer, adding ground to the soil and spraying the other part on the vegetative parts during selected stages of plant growth. Nitrogen fertilizer is usually sprayed on granules, including barley in critical vegetative and reproductive stages, which are more responsive than others, leading to reduced amounts of solid fertilizer and a lower risk of environmental pollution, and thus get better economic production with better quality (Belete *et al.,* 2018; Ameen *et al.,* 2019).

This study aimed to find out the effect of different levels of nitrogen fertilizer and the number of times of cutting on the yield and quality of green fodder and grain for barley Iba 99.

Materials and methods

The experiment was carried out according to the design of the complete randomized in the order of split-split plot design of three replicates. Nitrogen fertilizer levels were (0, 90, 180 and 270 kg/h) and were represented and symbolized (N_0, N_1, N_2 and N_3). The sub-sub treatments are represented by the number of times a cut or mash (without a cutting and one cutting and two cuttings), symbolized (C_0, C_1 and C_2).

Cutting was carried out for the experiment when the height of the plant (30 cm) and the level of cut (5-6 cm) from the soil surface.

The land was plowed once and then softened, leveled, and then divided into panels dimensions (2 × 1.5) m contains the board (10 lines), distance between lines 15 cm, the panel shoulders were separated with a width of about 1 m to prevent nitrogen compost leaks. Planting was done for the first season and for the second season and in the amount of seeds (100 kg /h). Phosphate fertilizer was added (46% P_2O_5) and based on (40 kg P/h) were added before planting.

Urea fertilizer (46% N) was used as a source of nitrogen in the fertilization experiment where it was added to the soil one level and for all experiment units (75 kg N/h). Ground nitrogen was added in the first tillers after two weeks of planting, the rest of the tillers are added after each bush to ensure the growth of the plant after the bush, the foliar nitrogen was added in three batches before and after each tampon (around 15 days), in order to allows the plant to form a good vegetative total and benefit from spraying.

The first irrigation was immediately after planting and the rest were given as needed, both trials were manually weeded to remove the bush whenever needed, and harvested was done at full maturity.

Study qualities for both trials

Growth qualities

The stem height at harvest was measured from the soil surface to the end of the spike, on average; ten plants were randomly taken from each experimental unit (from guarded lines).

Number of leaves / stem: The number of leaves was calculated as an average of ten stems randomly taken from each experimental unit (from the guarded lines).
Number of tillers / m²:

The number of tillers was calculated for four guarded midlines from each experimental unit and then converted to square meters (and for all coefficients).

Percentage of dry matter in green fodder: Take (150 g) of green forager from each experimental unit of the guarded lines and then dried by electric oven at (65) C for 48 hours as an initial stage and then dried at 105 °C for (3 hours). The percentage of dry matter was calculated according to the following formula:

$$\%For\ dry\ matter = \frac{dry\ sample\ weight}{wet\ sample\ weight}\ X\ 100$$

Components of grain yield, Number of spikes / m²: The number of spikes after harvesting the plants was calculated in the four guarded intermediate lines from each experimental unit and then converted to square meters.

Qualitative qualities

Percentage of crude protein in green fodder

A sample of (0.2) gm was taken from a ground and dried feed form, the percentage of nitrogen was then digested in a laboratory of the Central Organization for Standardization and Quality Control in a way that Kjeldahl and with Micro Kjeldahl apparatus. Then the percentage of protein was calculated as follows:
% of protein in forage =% of nitrogen in feed × 6.25

Statistical analysis

Data analysis was done by using SPSS version 21.0 software and Microsoft Excel 2010. Categorical data formulated as count and percentage.

And Chi-square test was used to characterize the correlation of these data. A p-value of less than 0.05 was considered as statistical significance.

Results and discussion

Growth qualities

Plant height (cm)

The plant stem elongation is a prolongation of its phalanges and there is a range of stem length that can range from 30 to 150 cm depending on the variety and environment. Data in Table (1) indicate a significant effect of nitrogen fertilizer levels on plant height. N_3 gave the highest rate of (117.47cm), which helped increase growth, including plant height, which indicate that nitrogen fertilizer led to an increase in plant height for the crops they studied (Fageria, 2014).

Table 1. Effect of Nitrogen Fertilizer Levels, and Levels and Number of cuttings on Plant Height (cm).

Nitrogen fertilizer levels	N	Number of cuttings			Average N
		C_0	C_1	C_2	
N × C	N_0	98.94	97.55	83.94	93.48
	N_1	107.05	106.34	92.73	102.04
	N_2	112.60	108.90	100.69	107.40
	N_3	117.47	111.22	103.28	110.66
	Average C	109.02	106.00	95.16	
P 0.05		3.20			

Number of leaves / stem

The leaves are associated with photosynthesis and because they have a direct effect in the green (and dry) forage yield and in the future in the grain yield. Data of Tables (2) indicate a significant effect of nitrogen fertilizer levels on leaf / stem number. N_3 gave the highest rate (6.99) leaves / stem. The increase in the number of leaves may be due to the positive nitrogen fertilizer effect in most of the vital processes of the plant, including photosynthesis.

The increases in nitrogen fertilizer levels led to an increase in the number of leaves in the barley crop (Wissum *et al.*, 2009).

Table 2. Effect of Nitrogen Fertilizer Levels, and Number of cutting (Number of Leaves / Stem).

Nitrogen fertilizer levels	N	Number of harvest			Average N
		C_0	C_1	C_2	
N × C	N_0	5.95	5.81	5.25	5.67
	N_1	6.54	6.14	5.51	6.06
	N_2	7.20	6.67	5.91	6.59
	N_3	7.61	6.99	6.36	6.99
	Average C	6.83	6.40	5.76	
P 0.05			0.40		

Number of tillers / m²

The production of tillers is one of the important physiological activities during the vegetative growth stage and is a characteristic of small grain crops. The process of formation of tillers when they arise depends on the food obtained from the main branch and remains so until it consists of 3 leaves.

Not all tillers carry a spike, and branches that reach the stage of the formation of the sanitary have a greater chance of forming the spikes.

Table 3. Effect of Nitrogen Fertilizer Levels and Number of cutting on Trait (Number of trills / m²).

Nitrogen fertilizer levels	N	Number of harvest			Average N
		C_0	C_1	C_2	
N × C	N_0	448.6	428.9	407.1	428.20
	N_1	496.8	517.9	462.6	492.43
	N_2	550.7	528.5	488.3	522.50
	N_3	625.6	588.3	533.7	582.53
	Average C	530.43	515.90	472.93	
P 0.05			24.80		

Table 4. Effect of Nitrogen Fertilizer Levels, and Number of Insects on the Percentage of Dry Material in Green Fodder.

Nitrogen fertilizer levels	N	Number of harvest		
		C_1	C_2	Average N
N × C	N_0	14.95	25.51	20.23
	N_1	14.77	23.96	19.37
	N_2	15.25	23.84	19.55
	N_3	14.55	23.59	19.07
	Average C	14.88	24.23	
P 0.05			N/A	

The data of Tables (3) indicate a significant effect of nitrogen fertilizer levels in the number of tillers / m². N_3 gave the highest rate of 582.5 and 576.8 tillers / stem. This may be due to the fact that nitrogen works to increase the activity of basal buds and the occurrence of frequent divisions in the life of the plant (For the role of nitrogen in the formation of cytokinesin that stimulates cells to divide and grow lateral buds that produce tillers) This leads to their growth and appearance of nitrogen fertilizer levels. The number of tillers is increasing with increasing nitrogen fertilizer levels (Wissum *et al.,* 2009).

Percentage of dry matter in green forage

This characteristic is influenced by the green fodder content of moisture and dry weight, which is evidence of the efficiency of photosynthesis (vitamins, minerals, sugars, starch and amino acids) (Barraclough *et al.,* 2014). Table (4) data showed that there was a significant effect of nitrogen fertilizer levels on the percentage of dry matter in the forage yield. Treatment with N_0 gave the highest rate (23.59), an increase over treatment N_3.

Table 5. Effect of Nitrogen Fertilizer Levels, and Number of cuttings in Trait (Number of Spikes / m²).

Nitrogen fertilizer levels	N	Number of cutting			
		C_0	C_1	C_2	Average N
N × C	N_0	396.8	377.2	350.2	374.73
	N_1	433.3	451.8	371.0	418.70
	N_2	498.5	460.1	414.5	457.70
	N_3	545.5	538.7	477.9	520.70
	Average C	468.5	456.95	403.40	
P 0.05			21.40		

Components of grain yield

Number of spikes / m²

The characteristic of the number of spikes per square meter is an important component of the crop for small grain crops, which is determined during the life of the crop for the period between the double crease phases. This trait is affected and its number is determined by the seeding rate per unit area, the number of germinating seeds and the number of plants that survive in different environmental conditions during that stage of plant life (Baloch *et al.,* 2014; Franzen and Goos 2019).

Table 6. Effect of Nitrogen Fertilizer Levels, Sulfur Levels and Number of cuttings on Raw Protein Percentage in Green Fodder

Nitrogen fertilizer levels	N	Number of harvest		
		C_1	C_2	Average C
N × C	N_0	14.78	14.27	14.53
	N_1	15.95	15.02	15.49
	N_2	16.06	16.18	16.12
	N_3	16.97	17.29	17.13
P 0.05			0.34	

The results of Table (5) indicate a significant effect of nitrogen fertilizer levels on the number of spikes / m². There was a significant effect of overlap between nitrogen fertilizer levels and the number of cuttings in the trait, the treatment Co x N3 gave the highest recipe rate (545.5) spike / m².

Qualitative qualities

Percentage of crude protein in green forage

It is an attribute that represents the quality of green fodder and its nutritional value for livestock (Simpson *et al.,* 2016). The results of Table (6) indicate a significant effect of nitrogen levels in the percentage of protein in forage. The treatment with N_3 gave 17.29 which represent an increasing in protein content with 17.5%

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