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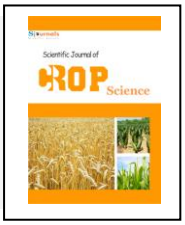

Original article

Effect of different levels of nitrogen fertilizer and plant density on yield and yield components of canola

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ABSTRACT

In order to assess the effect of different levels of nitrogen and plant density on Performance and yield components in winter rapeseed (figure Hyola401) experiment in 1388, form band split plot, a the mold a randomized complete block design with four replications, in the city of Sari, was performed. Treatments were included plant density at three levels including 80, 100 and 120 plants per square meter, and nitrogen in four levels, including zero, 5/34, 69, and 5/103 Kg per hectare ,as urea, respectively. Results showed that different levels of plant density had significant effect on number of pods per plant, grain weight, grain yield and harvest index, whereas the number of seeds per pod, biological yield and grain yield influenced by this treatment, were not. Different levels of nitrogen fertilizer, a significant effect on all characteristics, except harvest index found. In this experiment, it was observed that increasing nitrogen levels, effects on all characteristics found. The maximum grain yield, the density of 120 plants per square meter, and maximum application of nitrogen (5/103 kg per hectare), with an average of 4012 kg per hectare, respectively.

1. Introduction

Planting, oilseeds, always an important part of agriculture in many countries, including most countries in the Middle East, has been formed. (Nasser, 1996). Canola, among oilseeds, in the world's highest production, have in recent decades, and today, the third place, after soybean and palm oil, vegetable oil products, has established. (Berry and Spink, 2006). Canola plant at low densities, longer, for covering land, the higher the compaction needs. Longer duration of ground coverage by canopy, leading to reduced biomass, and the delay in reaching full coverage of the Earth's density, low barrier to effective use, solar radiation, and this, with reduced biomass, the relationship is (Dypn Brock, 2000). Leach, And Associates, (1999) by examining on the density of from 5/13 to 372 plants per square meter, over the last two years, showed that, with increasing density of 50 150 plants per square meter, the performance increases, but, with increased density over its performance will be reduced. Densities in excessive creating unfavorable microclimate, followed by risk of prevalence of the disease, and pests, grain yield, reduces (Imam and Niknejhad, 1994; Kymbr and McGregor, 1999; Mdham and Scott, 1975). The density, planting more desirable number of lateral stems, and number of pods on each plant decreased as a result, grain yield in each plant decreased (Taiwan Morgan and Scott 1979 Mdham 1975). Flexibility Canola in the replacement grain yield when the density of desirable lower, depending, availability of resources, such as water, light, and food there. Available reports indicate that the number of flowering stems, nitrogen application increased, and the flowering period also increased, causing an increase in total dry weight, and number and the dry weight of pod, are (Hejazi, 2000; Sadeghi Pour, 1996; Rahman and Olha, 1990). Natal and colleagues (1987) observed that consumption of 200 kg nitrogen per hectare performance and, protein Canola Grain , was significantly increased. In this study, the accumulation and redistribution of dry matter and minerals in canola pods, and the effects of of nitrogen fertilizer was observed that increasing nitrogen fertilizer from 90 to 150 kg per hectare the grain yield increased Rough (Hakyng et al. 2002). Kapn and colleagues (2000) Effect of nitrogen five levels of on yield and yield components of canola, as a result, found that, with increasing nitrogen, canola yield was increased, and the highest grain yield of 250 kg of nitrogen , Per hectare, was obtained.

2. Materials and methods

In order to assess the effect of different levels of nitrogen and plant density on performance and performance components in winter canola (figure Hyola401) experiment in 1388, as a split plot in a randomized complete block design with four replications in city of Sari, was performed. Plant density at three levels including 80, 100 and 120 plants per square meter, and four levels of nitrogen, zero, 5/34, 69, and 5/103 kg ha (urea nitrogen and 46% respectively). Before preparing the land, and the consumption of chemical fertilizers, soil from different locations at two depths, 30-0 and 60-30 cm samples, and to determine the physical and chemical properties of soil samples were sent. Results of analysis soil (Table 1) is shown. In the autumn, using the moldboard plow, the land was plowed and then, about 60 kg of phosphorus, pure source triple superphosphate fertilizer, land, fertilizer was given. For weed control, to amount of 5/2 liters per hectare, Trflan herbicide was used, which performs two-disc perpendicular style, Sam, was mixed with the soil. The total area of the experimental field, about 600 square meters. Subplots of each experiment, 5 5/1 square meter. In the main plot,, 4 sub-plots, there is a includes, 5-line slew, length 5 m, and the distance between rows and 30 cm. Required density with distance from the plant, the line was set up, which, respectively, from 7/2, 3/3 and 1/4 cm. Between repetitions, two meters, and between Main plots were, 1 m were considered. For the create a row of Foca, was used, and the seeds by hand, and on 22 October, were planted. To ensure the achievement of the desired plant population, at the time of planting, seeds, winnow, and determination viability, and the seed consumption rate was determined. Sure enough, most of the seed was used, and thinning operations, the 4 to 6 leaf stage of plant the density of the target was achieved. Fertilize, for all the plots, the same was done. Canola seed planting depth of about 4 cm was considered. Nitrogen fertilizer, after the measured and weighed, in four stages, respectively, after planting, rosette, stem elongation, and flower giving, to the soil was added. At the end of the growing season, when the plant maturity stage, close up, number 10 plants from each plot were randomly selected, and the number of pods per plant characteristics, number of seeds per pod, biological yield, harvest index, weight thousand grain, and grain yield were measured. Data resulted from experiments performed by statistical software, MSTAT-C, analysis of variance, and means, by Duncan's multiple range test at 5% DMRT, were compared.

3. Results and discussion

3.1. Number of pods per plant

The results of variance analysis showed that the adjective, number of pods per plant, under various levels of nitrogen, and the compression levels, a significant difference at the 1% level, respectively (Table 1). Comparisons of average showed that the highest number of pods per plant, nitrogen consumption 5/103 kg per hectare (240 pieces) and the lowest, the consumption of 0 kg nitrogen per hectare (153 pcs) and also the highest number of pods plant, related to density of 120 per square meter (4/215 digits) and lowest for concentrations of 80 and 100 plants per square meter, respectively (185 and 192 numbers), respectively (table 2). Reason, it can be justified that, having plants, from the nutrient nitrogen, increase the number of pods per plant, followed by, the performance is increased. In canola, number of pods per plant, which is very important characters, grain yield, it strongly depends because, after the flowering stage, with a reduction plant the leaf area, green pods, plays an important role in plant photosynthesis (Imam and Aylkayy, 2002). Therefore, given the important role of pod grain yield, any reduction in pod production, seed yield losses will be.

3.2. Grain number per Saddlebag

The results of analysis of variance, number of seeds per pod, showed that this trait, influenced by various levels of nitrogen, and 1% level, significant work has shown (Table 1). Comparison showed that the highest number of seeds per pod, with the nitrogen use 5/103 kg ha (28 digits) and the lowest, the use of nitrogen 0 kg per hectare (18), respectively (Table 2). Number of seeds of factors determine the size of the tank, or in other words, the number of grains increases, the larger the tank, for the digestive, metabolic, will be provided (Tommy and Evans, 1992).

3.3. Thousand grain weight

The results of variance analysis showed that this trait, influenced by various levels of nitrogen at the 1% level, and the impact of different levels of density at the 5% level, significant differences, are shown (Table 1). . Average comparison showed that the highest thousand grain weight with the consumption nitrogen-69 and 5/103 kg per hectare, respectively, (3/4 and 4/4 g) and the lowest, the consumption of nitrogen 0 and 5 / 34 kilograms per hectare (8/3 and 1/4 g), respectively (table 2). Significant difference showed. Thousand grain weight, including most important factors determining grain yield is. There is a large seed, which is well filled, they also raise the grain yield, also good seeds order to planting crops, provide (Jackson, 2000). By reducing the number of pods per plant, number of seeds per plant decreased, in contrast, the existing pod increases, and therefore plant can photosynthetic materials more into the granules, to allocate . Having more stem elongation, increase in plant photosynthesis, and thus increased grain weight, plant yield, is (Rabie et al 2004).

3.4. Biological function

The results of analysis of variance, Biological function shows that biological Biological function, of nitrogen at the 1% probability levels, a significant difference, as shown (Table 1). Tests Average comparison showed that, with the use of 5/103 kg per hectare of nitrogen, maximum biological function (19620 kg ha) and the lowest, related to use of nitrogen 0 kg per hectare (11,100 ha) was obtained (table 2). With increasing plant density, Biological function, increased because, at high densities, the number of higher plants, per unit area, is produced, and with that, the weight of the plant, in this case, is reduced but, the final dry weight, per unit area is increased (Agvlvy, 1984). Improve green cover crop for light, Fresh leaves for photosynthesis, increase desirable plant height and actively growing leaves represents a strong relationship between Consumption of nitrogen fertilizer, biological yield canola, is, therefore, to achievement, good Biological function, canola production requires a large amount Density on the nitrogen (Ismail et al, 2002).

Increased, Biological function, consumption, different levels of nitrogen, due to the effect of nitrogen on the increase, green surface, resulting in an increase of the matter is (Shariati, 1996). Parkl and Bradley (1991) showed that application of 220 kg nitrogen per hectare, The amount of on biological function due to increased dry weight of stem, number of lateral stems, and pods, per unit area increases. This represents a high-grade fertilizer, canola, and the ability to use nitrogen for biomass production, is.

3.5. Grain function

The results of analysis of variance showed that grain function, under the influence of various levels of nitrogen in the 1% probability level, and the level of congestion at the 5% level, significant differences showed (Table 1). Average comparison showed that the highest grain function, nitrogen consumption 5/103 kg per hectare (3817 kg per ha) and the least, related to consumption of 0 kg of nitrogen per hectare (2879 kg per ha) and also the highest performance grains, related to density of 120 per square meter (3621 kg per ha) and lowest for the density of 80 plants per square meter (3095 kg per hectare), respectively (table 2). Ndryd and colleagues (2002) reported that increasing light, in formation stage, beginning of seed in rows narrower than the main reason for the increase in grain function in narrower rows, knew. Increasing density, with the dry weight per plant, yield per plant decreased, but may increase the number of plants per unit area, compensation, performance decline resulted from decrease in number of pods per plant, will follow (Tommy and Evans, 1992). Christine and Drabl (1984) Increased yield, Canola Grain, in effect, the spacing decreased due to better distribution and more uniform plants, and less competition for available resources, know. Higher grain yield than in the 100 plants per square meter, lower densities (60 and 80 plants per square meter) because the number of pods, per unit area is. Also, the density of canola, creating more green cover, the unit area able, the more efficient the solar radiation in order to produce economic performance, utilization slow (Danesh, 2008). Increasing nitrogen application, way effect, yield components, cause affecting the grain function is. So that, by increasing nitrogen application, due to reduced flower abscission, and therefore increase the number of pods per unit area, and also effect on grain weight, grain yield increased, and the way the oil yield per unit area, is high (Fathi et al, 2001).

3.6. Harvest index

Results, data analysis, data from harvest index measurements showed that, among the various levels of aggregation, at the 5% level, significant differences, are shown (Table 1). Comparison shows that the highest harvest index, related to density of 120 per square meter (5/23%) and lowest for the density of 80 plants per square meter (4/22 percent), respectively (Table 2). This character is the most important attribute in the oil-producing plants is considered. Increased nitrogen application, with density due to an increase in biomass, decrease in canopy light distribution, reduced number of seed per pod, to have that, ultimately, is a reduction in harvest index (Fathi and Associates. 2002). Slight variations, harvest index, to the greater dependence of this character, to the genetic structure of the plant, relations have, it seems, self-regulation mechanisms, the balance between vegetative organs and reproductive reason for the slight variation in harvest index in densities is applied (Imam and Aylkayy, 2001).

Table 1
Average squares of analysis of variance of yield and some related traits.

Harvest index	Grain yield	Biological yield	Thousand grain weight	Grain number per silique	Number of pods per plant	Mean squares of Degrees of freedom	Source changes (S.O.V)
0/791	843/22526	931/7408597	836/2	337/89	022/2258	3	Repeat
n.s 153/0	**652/1962311	**048/164685875	**946/0	**147/231	**331/16557	3	nitrogen
450/1	522/72351	316/2176128	038/0	636/1	650/282	9	Error
*582/4	* 444/1105647	n.s 974/3923360	*482/0	n.s 609/1	**760/3907	2	Plant density
n.s 026/0	n.s 509/45305	n.s 869/192733	n.s 034/0	n.s 169/0	n.s 312/33	6	nitrogen × Plant density
.838/0	655/228266	478/5898301	118/0	693/2	094/718	24	The total error
98/3	20/14	91/15	18/8	06/7	54/13		The coefficient of variation (%)

ns non significant and significant at the 5% level and ** significant at 1%.

Table 2
Comparison of the average performance of simple effects and some related traits.

Harvest index	Grain yield	Biological yield	Thousand grain weight	Grain number per silique	Number of pods per plant	Amounts of nitrogen
23/1[a]	2879[d]	11100[d]	3/8[b]	18[d]	153[d]	N1
22/9[a]	3225[c]	13600[c]	4/1[b]	21[c]	185[c]	N2
23/1[a]	3539[b]	16730[b]	4/3[a]	24[b]	212[b]	N3
22/8[a]	3817[a]	19620[b]	4/4[a]	28[a]	240[a]	N4

Respectively, zero, 5/34, 69, and 5/103 kg nitrogen, per hectare N4 ,N3,N2,N1
Respectively, 80, 100 and 120 plants per square meter D3, D2, D 1.

4. Conclusions

Based on the results obtained, increasing the amount of nitrogen consumption, because of the increased number of pods per plant, seeds per pod, and seed weight increased the grain yield is, in a way that, consumption 5/103 kg ha pure nitrogen, the highest grain yield, was obtained. Plant density of 120 plants per square meter, the highest number of pods per plant (215), number of seeds per pod, (23), biological yield (15800 kg ha), grain yield (3621 kg per ha), and harvest index (5/23%) is found. Increasing the number of plants per unit area through increased use of seeds, increased grain yield, was such that the density of 120 per square meter, the highest grain yield was obtained.

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