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The Effects of Varying Nitrogen Doses Some Yield Components of *Nigella Sativa* L.

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ABSRACT

This study was carried out to determine the effects of different Nitrogen doses (0, 40, 80 and 120 kg/da) on yield and some yield components of black cumin (*Nigella sativa* L.) in Cumra/Konya ecological conditions in 2010 and 2011. Field trials were designed by Completely Randomized Block Design with four replications at the experimental fields of Cumra Vocational High School of Selcuk University. In the study, plant height (cm), the number of branch (branch/plant), the number of capsule (capsule/plant), the number of seeds in the capsule (seed/capsule), thousand-seed weight (g) and seed yield (kg/ha) were determined. According to statistical analysis, significant differences were determined among the nitrogen doses applications for the number of branch and thousand seed weight. The seed yield increased by increasing nitrogen doses then it decreased. According to the results, the highest seed yield (740 kg/ha) and thousand-seed weight (3.54 g) were obtained from 80 kg N/ha fertilizer application. The highest mean values for the number of capsule (8,58 capsule/plant) resulted in 80 kg N/ha application.

1. Introduction

Various medical plants have been used for years in daily life to treat disease all over the world. Turkey is an important floristic center internationally because of its geographic location, climate and the presence of nearly 10,000 natural plant species. Black cumin (*Nigella sativa* L.) is a small annual herb. The height of black cumin plant ranges from 30 to 80 cm and its seed is black color (Baytop 1999, Telci 1995). Eastern Mediterranean, Southern Europe and West Asian origin of the black cumin *Nigella sativa* L. has been spread to other countries in the world. Although the genus *Nigella* is an annual herbaceous plant (*Ranunculaceae*) includes about 20 species (e.g. *N. sativa* L., *N. damascena* L. and *N. arvensis* L.) distributed from the Mediterranean regions to West Asia (Kokdil *et al.,* 2006 Cheikh-Rouhou et al., 2006, Atta, 2003), *N. sativa* a spicy plant is most important species cultivated in various parts of the world (Kokdil *et al.,* 2006, Kokdil *et al.,* 2005, Ali and Blunden 2003). The seeds of *N. sativa* have been also known as black cumin or black caraway in English name and corek otu in Turkish name and used as spice and culinary purposes such as pityriasis, leucoderma, antimicrobial, ringworm, eczema, chest congestion, migraine, paralysis, rheumatism and diuretic for the century (Arici et al. 2005, Kokdil et al. 2006, Kokdil et al. 2005, Ali and Blunden 2003).

2. Material and Methods

Black cumin seed material used in field trials was obtained from West Anatolia Region local Variety, Usak, Turkey. Field studies were conducted in experimental fields of Selcuk University, Cumra Vocational High School and Medicinal Aromatical Plant Program in 2010 and 2011. Soil characteristics of the experimental fields were clay loam, high in clay (37.23 %), and slightly alkaline (pH 7.46). Experimental field soil had low concentrations of organic material (1.01 %). Available phosphorus content of the soil was sufficient (68.30 kg/ha) and useful potassium content was high (4598 kg/ha).

Climatic values for experimental area in the research years were 391.9 – 368.2 mm rainfall respectively. Seed sowings, in the ratio of 15 kg/ha, by hand were realized in both experimental years. Field trials were designed according to Completely Randomized Block Design

with four replications. As factorial, four different Nitrogen doses (Control 0 kg/ha, 40 kg/ha, 80 kg/ha and 120 kg/ha in Ammonium nitrate 33 % N form) were applied to plots. Seeds were sown by hand in April 30, 2010 and 2011 in the experimental years. Each plot sizes were 5 x 1.2 = 6 m ^{2} and row spacing was 20 cm in 6 rows. Area harvested was 2.4 m^2 and plants were harvested by hand when seeds were ripened. All the necessary cultural practices were applied the plots during vegetation period. In the study, some agricultural traits such as plant height (cm), the number of branch (branch/plant), the number of capsule (capsule/plant), the number of seeds in the capsule (seed/capsule), thousand-seed weight (g) and seed yield (kg/ha) were investigated. The data obtained from agricultural traits were subjected to variance analyses and the average values were compared by Duncan Multiple Range Test.

Table 1

Precipitation, maximum and minimum temperature data obtained from meteorology data of 2010-2011 and long year average

	Precipitation			Max Temp. ^{o}C			Min. Temp ^{o}C		
	L.Y	2010	2011	L.Y.	2010	2011	L.Y.	2010	2011
January	35.6	43.6	52.9	18.0	18.0	8.0	-22.5	-12.8	-6.3
February	28.1	33.3	40.1	20.8	20.8	15.1	-19.0	-12.7	-9.9
March	31.9	12.1	44.2	28.2	26.9	22.9	-14.6	-6.0	-8.7
April	40.0	67.4	48.0	31.5	24.9	24.0	-9.7	0.4	-2.1
May	32.2	12.4	52.5	33.8	32.1	25.8	0.8	4.8	2.0
June	21.2	47.9	39.5	35.2	33.5	32.2	3.9	9.7	9.5
July	6.0	0.0	0.0	39.9	36.4	36.7	7.6	13.0	11.4
August	4.6	0.0	1.0	39.2	39.2	36.4	8.6	12.5	11.2
September	13.2	1.6	3.8	36.1	36.1	31.1	1.4	9.5	6.3
October	27.3	62.6	32.1	31.8	30.5	27.0	5.0	-1.0	-2.3
November	33.8	4.2	29.2	24.0	24.0	15.8	-18.2	-1.3	-10.5
December	46.1	106.8	24.9	22.9	22.9	15.4	-21.8	-4.6	-9.1
TOTAL	320	391.9	368.2						

3. Results and Discussion

Plant height values of black cumin obtained from varying nitrogen doses are presented in Table 2. It can be seen from the table, varying nitrogen doses had no significant effect on plant height in the both experimental years but there were significant differences between 2010 – 2011 average values. In the present study, plant height values were found in the range of 23.95 cm and 40.95 cm. Plant height of black cumin in different studies varied in a wide range from 27.9 cm to 95.1 cm (Das et al. 1992, Telci 1995, Geren et al 1997, Ozguven et al. 2001, Tuncturk et al. 2011)

There were significant differences between the numbers of capsules values of black cumin in the experimental years. Average number of capsules values varied in the intervals of 4.83 - 5.70 and 10.60 - 11.45 in 2010 and 2011, respectively (Table 2). Higher the numbers of capsules values were measured in the second year. These differences in the average the number of capsules values could be explained by the different rainfall regimes in the years. In the present study, the number of capsules increased by increasing nitrogen doses and they produced more capsules. There were no statistical differences between the 0 and 120 kg/ha nitrogen doses. According to two year average values, the highest number of capsules (8.58 capsule/plants) was determined in 80 kg/ha nitrogen doses and the lowest number of capsules (7.72 capsule/plants) were obtained from control plots. In different studies, researchers found that the number of capsules for black cumin were in the ranges of 5.75 - 6.00 (Ozguven and Tansı 1989) 3.93 – 7.43 (Tuncturk et al. 2011) Our findings are more than the researchers' results. The number of branches directly affects the number of capsules. In optimum growing conditions plants can produce more fruitful branches. Besides optimum growing conditions, additional nutrient applications promote both branch number and the number of capsules per plant (Tuncturk et al. 2011).

As shown in the Table 2, there were significant differences the numbers of branches values of black cumin in the second experimental year. But, there were not significant differences in the number of branches by varying nitrogen doses in the first year. According to two-year averages the highest the number of branches (5.41 branch/plants) was obtained from 120 kg N/ha doses.

According to the measurements of 100 samples, 82% of There were significant differences in the number of seeds in the capsule by varying nitrogen doses the first experimental year. In the present study, the numbers of seeds in the capsule values were found in the range of 51.35 – 63.50 and 58.68 – 67.30 seeds/capsule in 2010 and 2011 respectively. According to two year averages the number of seeds in the capsule varied from 55.02 to 65.40 seeds / capsule.

There were significant differences on thousand seed weight of black cumin by varying nitrogen doses the second experimental year (Table 2). Thousand seed weight increased with increasing nitrogen levels from the control to the highest level (80 kg/ha) and then it decreased. The highest thousand seed weight was recorded in 80 kg/ha nitrogen application, while the lowest value was found in the control. According to two-year averages the highest thousand seed weight (3.54 g) was obtained from 80 kg/ha nitrogen doses (Table 1). In different studies, thousand seed weight of black cumin was reported as 3.50 g (Das et al.1992) and 2.15 g (Ceylan 1995). Thousand seed weight is affected by a wide range of factors such as variety, growing conditions, climatic factors and soil properties (Sadegh 2009, Tuncturk et al. 2011).

Table 2
2010 – 2011 experimental years results of black cumin yield components

Nitrogen Doses kg/Ha	Plant Height (cm)			Nitrogen Doses kg/Ha	The Number of Capsule (Capsule/Plant)		
	2010	2011	Mean		2010	2011	Mean
0	23.95 A	39.10 A	31.53 A	0	4.83 A	10.60 A	7.72 A
40	24.30 A	39.20 A	31.75 A	40	5.35 A	10.65 A	8.00 A
80	25.30 A	39.70 A	32.50 A	80	5.70 A	11.45 A	8.58 A
120	26.02 A	40.95 A	33.49 A	120	5.65 A	10.40 A	8.03 A
Nitrogen Mean	24.89 B	39.74 A	32.31	Nitrogen Mean	5.38 B	10.78 A	8.08
LSD (%1)	4.89	3.02	2.44	LSD(%1)	1.67	4.48	1.97
Nitrogen Doses kg/Ha	The Number of Branch (Branch/Plant)			Nitrogen Doses kg/Ha	The Number of Seeds in Capsule (Seed/Capsule)		
	2010	2011	Mean		2010	2011	Mean
0	3.00 A	6.20 B	4.60 B	0	51.35 B	58.68A	55.02 A
40	3.10 A	6.60 AB	4.85 AB	40	53.55 B	64.80 A	59.18 A
80	3.20 A	7.40 AB	5.30 A	80	63.50 A	67.30 A	65.40 A
120	3.20 A	7.62 A	5.41 A	120	55.15 AB	61.85 A	58.50 A
Nitrogen Mean	3.13 B	6.96 A	5.04	Nitrogen Mean	55.89 B	63.16 A	59.52
LSD (%1)	0.82	1.37	0.70	LSD(%1)	8.88	16.11	7.73
Nitrogen Doses kg/Ha	Thousand Seed Weight (g)			Nitrogen Doses kg/Ha	Seed Yield (Kg/Ha)		
	2010	2011	Mean		2010	2011	Mean
0	2.55 A	3.06 C	2.81 B	0	585 A	705 B	645 A
40	2.83 A	3.45 BC	3.14 AB	40	631 A	712 AB	672 A
80	2.90 A	4.18 A	3.54 A	80	689 A	740 A	715 A
120	2.88 A	3.97 AB	3.43 AB	120	672 A	708 B	690 A
Nitrogen Mean	2.79 B	3.66 A	3.23	Nitrogen Mean	645 B	716 A	680
LSD (%1)	0.69	0.59	0.43	LSD(%1)	139	29.3	168

There were significant differences between the seed yields values of black cumin in the experimental years. Average seed yield values varied in the intervals of 585 - 689 kg/ha and 705 - 740 kg/ha in 2010 and 2011, respectively (Table 2). Higher the seed yield values were determined in the second year. These differences in the average seed yields could be explained by the different rainfall regimes and temperature variation in the years. Seed yield increased by increasing nitrogen doses, and the highest seed yield (715 kg/ha) was obtained from 80 kg/ha fertilizer application in two years average values. Yield components such as the number of branches and capsules affects directly seed yield in the field crops (Geren et al. 1997, Ozguven and Sekeroglu, 2007). Nitrogen fertilization had significant effects on the seed yield in second experimental years. The more fertilizer gave the higher seed yields. Seed yields increased with increasing fertilizer levels and the highest values were obtained from 80 kg N/ha then it decreased. It is well accepted that adequate use of chemical fertilizer improve yield and quality of plants (Tuncturk et al. 2011).

4. Conclusion

In the present study, the effects of varying nitrogen doses on yield and yield components of black cumin in Konya/Cumra ecological conditions located in Center Anatolia of Turkey in 2010 and 2011 were studied. Varying nitrogen doses including control were applied to plots. In conclusion, increasing nitrogen doses positively affected the number of branch, thousand-seed weight, plant height, the number of capsule, the number of seed in capsule and seed yield in black cumin. According to the data obtained from the two-year study, varying nitrogen levels increased the yield of black cumin. The highest seed yield was obtained from 80 kg N/ha fertilizer applications. According to two years average values the effect of increasing fertilizer levels on plant height, the number of capsule, the number of seeds in the capsule and seed yield were not significant differences. As a result, nitrogen fertilization considerably af-

fects yield of black cumin. Further agricultural and technological studies should be developed for obtaining black cumin with high yield and quality. The information provided by the experiment might be helpful for recommending the optimum nitrogen doses in black cumin production in similar climatic and soil conditions.

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