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Effects of Increasing Nitrogen Doses on Yield and Yield Components in Some Triticale Lines under Dry Conditions in Eastern Anatolia

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Abstract: The study was carried out to determine the effects of increasing nitrogen doses on yield and yield components of three Triticale lines (7,9,13) introduced by ICARDA and CIMMYT during 1995 and 1996. Five different nitrogen doses including a control (0, 40, 80, 120 and 160 kg N/ha) were used.
Results revealed that there was a gradual increase up to 120 kg N/ha application for the traits examined in the *Triticale* lines and a decrease in yield and yield components with increasing nitrogen doses further. Among the Triticale lines the 9 gave best grain yield.

Key words: *Triticale*, nitrogen, cereals, yield components

Introduction

Cereals are the most widely grown crops in the world. Recently a new cereal genus Triticale has been developed. Which is a cross-bred small grain genus that associates the high yield of wheat and the resistance of rye. It has been reported to be more productive than other cold climate cereals even in dry and unsuitable conditions for plant production.
In dry and un-irrigated conditions especially, this strong feature of Triticale is very important (Ali and Rajput, 1977).
Nitrogen is the most important nutrient and affects physiological events in plant development. If there is sufficient nitrogen in surroundings, plants grow healthy and turn a bold green colour. But in high concentration of nitrogen the vegetation period will be longer and plants will ripe later.
Also with high nitrogen doses, plants grow feeble and become susceptible to diseases; they grow very tall. With low concentrations of nitrogen, plant development is weak, flower, fruit and seed formations are low and root development is weak. (Kacar, 1984; Eyupoglu, 1986).
In un-irrigated areas, moisture is one of the most important factors affecting yield and yield components. If there is sufficient moisture in the growing area, the effectiveness of nitrogen for plants will decrease and applying high nitrogen doses will decrease seed yield (Akten and Akkaya, 1986).
The main purpose of nitrogen fertilization is to increase grain yield and quality (Zabunoglu and Karacal, 1992).
Plants take in varying quantities of nitrogen and their nitrogen needs are different. Small grains take a lot of nitrogen from soil, as deficiency of nitrogen is common in these plant groups (Eyupoglu, 1986).
The present research area has got a high potential for stock breeding. In Eastern Anatolia there are a lot of rangelands, but these lands have been used unrantable. Consequently, the cereals are used for fodder as grain and hay. The research material, *Triticale* is a kind of cold climate cereal which produces high quality fodder.

Materials and Methods

The study was carried out in Eastern Anatolia in the Van-Lake district in 1995-1996. In this region for the research years the average climate values were 14.7 °C-58.5 mm rainfall and 17.3 °C-18.3 mm rainfall, respectively. The soil is sandy-loam and sandy-clay-loam and light alkaline (pH: 7.75). The lime content in the experiment was high, while nitrogen rate (% 0.04) and organic material were very poor.
Some properties of Triticale lines used in this study are given in Table 1.
The effects of increasing nitrogen doses on heading-maturity period, the number of ears per square meter, grain per ear, grain weight per ear, biological yield, grain yield, thousand grain weight, crude grain protein of three Triticale lines were investigated.
Five different nitrogen doses (0,40,80,120 and 160 kg N/ha) as $(NH_4)_2SO_4$ were used. The experiments were set up as factorial completely randomized design with three replications. The results were evaluated according to Duncan's new Multiple Comparison System.

Results and Discussion

Average values of all the traits examined for each nitrogen treatment are given in Table 2 and for each Triticale line in Table 3.
Overall analysis of variance results indicated that the higher nitrogen dose affects growth parameters significantly with the exception of heading-maturity period. There was significant difference among Triticale lines observed for the heading-maturity period, the number of grains per ear, grain weight per ear and thousand grain weight but not for the other traits examined.

Nitrogen Application: Increasing nitrogen doses prolonged the heading-maturity period. Sonmez (1995) reported that in Van the ecological conditions for the heading-maturity period in winter barley were affected by only one day by increasing nitrogen levels. Also, Yagbasanlar *et al.* (1988) observed that under Cukurova conditions the heading-maturity period was shortened by different nitrogen doses. Kirtok (1982) explained that there is a relation between heading-maturity period and growing area conditions. This period is very important for grain yield since assimilates are produced by the plant accumulates in the grain. The heading-maturity period was not affected by the increasing nitrogen levels, in present study.
Piench and Stankowski (1986) and Mazurek and Sabat (1984) reported that nitrogen application increases the number of ears per square meter in cereals. In this study, the different nitrogen doses increased the number of ears per square meter. The highest ear number (306.2 ear/m^2) was observed for 120 kg N/ha application. Piench and Stankowski (1986) and Yagbasanlar *et al.* (1988) observed that the number of grains per ear were increased with increasing nitrogen doses. There is close relationship among grains/ear, ear height and spikelets/ear. The greater the ear height and spikelets/ear the more will be the grains/ear. In this study, grains/ear were affected significantly with increasing nitrogen levels. The highest grains/ear (22.9) was obtained using 120 kg N/ha.
Grain weight per ear was increased by increasing nitrogen levels. As the highest grain weight per ear was 0.79 g for the 120 kg N/ha application, the lowest grain weight per ear was 0.56 g for the control.This finding is in accord with Yagbasanlar (1988), Sonmez (1995) and Kirtok (1982).

Table 1: Some properties of Triticale lines used in this study.

Lines	Pedigree	Source	Agronomic traits
7	Drira Out Crossx21295-OAP-9	ICARDA	Tall plant, tall ear, big and full grain, medium early
9	YOGU I"S"/ANTEATER62 CTM 10403-015M-OY-2B3Y-OB	CIMMITY	Tall plant, tall ear, wrinkled grain, medium early
13	HARE-7265/YOGUI"S" SWT 1697-05Y-OM-OY 4MIY-OB	CIMMITY	Medium height plant, tall ear, small grain, medium early

Table 2: Average values of all the traits examined for each nitrogen treatment.

Nitrogen (kg/ha)	Heading-maturity period	Ears per square meter	Grains per ear	Grain weight per ear	Biological yield	Grain yield	Thousand- grain weight (g)	Crude grain protein (%)
0	44.3	248.9 b**	18.9 c**	0.56 c**	3576 c**	1360 b**	27.2 b**	12.4 b**
40	44.8	263.3 b	20.9 b	0.66 b	3915 bc	1490 b	28.8 a	13.0 a
80	44.8	283.3 ab	22.5 ab	0.71 ab	4182 b	1602 ab	29.6 a	13.3 a
120	45.2	306.2 a	22.9 a	0.79 a	4812 a	1834 a	28.7 a	13.4 a
160	44.8	275.0 ab	21.8 ab	0.66 b	4844 a	1838 a	27.6 b	13.1 a

* and ** significantly different at 5 and 1 % probability levels, respectively.

Table 3: Average values of all the traits studied for each Triticale line.

Triticale Line No.	Heading-maturity period	Ears per square meter	Grains per ear	Grain weight per ear	Biological yield	Grain yield	Thousand- grain weight (g)	Crude grain protein (%)
7	45.5 a*	288.6	20.4 b*	0.70 a*	4289	1630	29.0 a*	12.9
9	44.7 ab	273.1	21.6 ab	0.62 b	4367	1672	27.8 b	13.1
13	44.2 b	264.4	22.2 a	0.71 a	4141	1572	28.3 ab	13.2

* and ** significantly different at 5 and 1 % probability levels, respectively.

Increasing nitrogen doses lead to increased biological yield in small grains. Mahdi (1985), Yagbasanlar *et al.* (1988) and Sonmez (1995) observed that biological yield was increased by raising nitrogen levels. Exactly in the same manner, increasing nitrogen applications increased biological yield of triticale lines in the present study. The highest and lowest biological yields were 4844 kg/ha and 3576 kg/ha for 160 kg N/ha and 0 kg N/ha applications respectively.

Grain yield was increased by raising nitrogen applications in small grains (Akten and Akkaya, 1986; Yagbasanlar *et al.*, 1988; Piench and Stankowski 1986). In present study, grain yields were affected significantly by increasing nitrogen levels. The highest grain yields were 1834 kg/ha for 120 kg N/ha and 1838 kg/ha for 160 kg N/ha applications. The lowest grain yield of 1360 kg/ha at control application.

By increasing nitrogen levels, 1000-grain weight is increased in small grains. Mazurek and Sabat (1984) and Sonmez (1995) explained that raising nitrogen doses increased the 1000-grain weight in small grains. In present study, 1000-grain weight was increased by increasing nitrogen applications. 1000-grain weights were 27.2, 28.8, 29.6, 28.7 and 27.6 g at 0, 40, 80, 120 and 160 kg N/ha applications respectively.

Nitrogen application increases crude protein content in the grains of cereals. Mahdi (1985) and Mazurek and Sabat (1984) reported that crude grain protein content in small grains were increased by raising nitrogen levels. In this study, raising the nitrogen levels increased the crude grain protein contents. The highest crude grain protein ratio was 13.4% at 120 kg N/ha application. The lowest crude grain protein ratio was 12.4 % at control application.

Lines: Significant difference among the Triticale lines was observed for the heading-maturity period, the number of grains per ear, grains weight/ear and 1000-grain weight, but not for the other traits investigated (Table 3).

Interaction (Nitrogen x *Triticale* lines): Nitrogen x *Triticale* line interactions for the traits examined were not significant except for the number of grains per ear. The highest number of grains per ear (24.5) was obtained from line 13 and 160 kg N/ha application. And the lowest value for the number of grains per ear (18.1) was for line 7 and the control application.

The best grain yield and yield components were obtained for 120 kg N/ha application from all the Triticale lines examined. The effects of lines on the traits were not significant for all nitrogen levels applied.

Accordingly to it is suggested that 120 kg/ha nitrogen application should be adopted to obtain maximum grain yield under dry conditions in Eastern Anatolia. Among the Triticale lines studied, Triticale line 9, which gave the best grain yield could also be cultivated.

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