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Response of triticale (*Triticosecale*) to nitrogen and seeding rate under Turkey conditions

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ABSTRACT

A study was conducted during 1997–99 to determine the effect of nitrogen levels (0, 40, 80 and 120 kg/ha) and seeding rates (80, 130, 180 and 230 kg/ha) on yield and yield attributes of *Triticosecale* at Dicle University, Diyarbakir, Turkey. Plant height, spike length, yield and protein cotent of the seeds increased with increasing nitrogen levels. The highest seed yield (2,011 kg/ha) was obtained with 120 kg N/ha. Seeding rate also affected spike length, spikelet number, 1,000-seed weight and protein content.

Key words : Triticale, Nitrogen, Seeding rates, Seed yield, Yield components

Triticale (*Triticosecale)* is a crop obtained by combining the genomes of wheat and rye. Plants of triticale are similar to those of wheat except for having larger spikes and kernels and greater vigour of growth. Martin and Maurer (1974) reported that triticale gives higher yield than wheat in dry and cold regions and has high potential as livestock feed in highland areas where growing of wheat and other field crops is not feasible.

Kochhann *et al.* (1991) reported that nitrogen rates applied to triticale affects the spike numbers and nitrogen content of the seeds and straw (2.2% and 0.55%) in Brazil. The production of triticale is limited in Turkey; however, it has a big potential for feed and food production in dry and cold areas where the production of the other grain crops such as wheat and barley is not feasible to produce. Hence an experiment was conducted to determine the effect of nitrogen and seeding rates on yield and yield related traits of triticale in Diyarbakir located in South Eastern part of Turkey.

MATERIALS AND METHODS

A field experiment was conducted at research field of Dicle Univesity during 1997–98 and 1998–99 seasons using the bulk of 181 triticale lines obtained from the Cukurova University (Adana, Turkey). This variety is tall with white spikes and shows resistance to diseases, cold and lodging.

The amount of rainfall during 1997–98 season (491.3 mm) was higher than 1998–99 (302.1 mm) and long term (453.6 mm). Air temperatures (10.45°C and 12.24 °C) and relative humidity values (65.37 and 59.87%) in 1998 and 1999 were similar to long-term average (10.75 °C and 64%). The soil samples were taken from 0–60 cm depth and analysed according to Kacar (2000); and texture, pH, total salt, organic matter, $CaCO_3$ and available phosphorus levels were determined. The soil was alkaline (pH 7.7), medium to fine textured loam in available nitrogen (227 kg/ha) and had low organic matter and phosphorus level.

Split-plot design with 3 replications was adopted. Four seeding rates (80, 130, 180 and 230 kg/ha) were treated as main plots and nitrogen levels (0, 40, 80 and 120 kg/ha) as subplots. Half of the nitrogen and the entire phosphorus (80 kg/ha) were applied at seeding through ammonium nitrate (26%) and triple superphosphate (43%) and the remaining nitrogen was applied at booting stage. The rows were spaced at 20 cm and each experimental unit consisted of 8 rows of 5 m length. Planting was done on 29 October 1997–98 and 13 November in 1998–99.

RESULTS AND DISCUSSION

Plant height increased with increasing nitrogen application (Table 1). While plant height was 74.55 cm in the control treatment (no nitrogen), it was 84.10 cm with 120 kg/ha nitrogen, on an average. However, plant height did not differ statistically among different nitrogen levels. The seeding rates did not affect the plant height statistically. The spike length is important for spikelet and seed numbers and thus affects yield and is controlled by the genetic make-up of the variety and the environment; especially, the amount of rainfall, air temperatures and fertili-

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Table 1. Effect of nitrogen and seeding rate on plant height and spike length of triticale

Treatment	Plant height (cm)			Spike length (cm)			Spikelets/spike			1,000-seed weight (g)		
	1998	1999	Pooled	1998	1999	Pooled	1998	1999	Pooled	1998	1999	Pooled
Nitrogen (kg/ha)												
0	79.68	69.42	74.55	9.61	8.69	9.15	21.16	25.03	23.10	32.57	34.95	33.76
40	83.16	81.67	82.42	10.36	9.83	10.10	22.81	19.70	21.25	32.51	35.43	33.97
80	84.35	83.80	84.07	10.19	10.22	10.21	21.57	23.62	22.60	32.30	30.71	31.50
120	81.17	87.02	84.10	10.79	10.95	10.87	23.52	23.68	23.60	32.57	33.97	33.27
CD (P=0.05)	NS	5.187	6.303	NS	0.880	0.700	NS	1.964	1.363	NS	2.892	1.630
Seeding rate (kg/ha)												
80	82.10	87.55	84.82	11.00	11.02	11.01	23.64	21.80	22.72	33.81	41.49	37.65
130	77.09	83.26	80.17	9.54	10.33	9.94	20.78	21.27	21.02	36.15	36.02	34.58
180	81.29	76.95	79.12	9.92	9.39	9.66	21.79	24.12	22.95	31.81	29.10	30.45
230	87.88	74.15	81.02	10.48	8.95	9.72	22.85	24.85	23.85	31.18	28.46	29.82
CD (P=0.05)	NS	NS	NS	NS	0.625	0.638	NS	1.947	1.250	1.332	2.549	1.281

Table 2. Effect of nitrogen and seeding rates on seed yield and protein content of triticale

Treatment	Seed yield (kg/ha)			Protein content (%)		
	1998	1999	Pooled	1998	1999	Pooled
Nitrogen (kg/ha)						
0	1,525	1,340	1,432	8.51	8.13	8.32
40	1,571	1,503	1,537	8.65	8.70	8.67
80	2,042	1,614	1,828	12.40	11.72	12.06
120	2,156	1,866	2,011	12.68	11.49	12.09
CD (P=0.05)	421	188	225	0.669	0.671	0.462
Seeding rate (kg/ha)						
80	1,439	1,979	1,709	9.77	8.79	9.28
130	1,619	1,686	1,652	10.73	10.17	10.45
180	1,920	1,322	1,621	10.88	10.72	10.80
230	1,316	1,337	1,827	10,86	10.36	10.61
CD (P=0.05)	389.2	370.4	NS	0.379	0.567	0.304

zation. The highest spike length (10.87 cm) was obtained under 120 kg/ha nitrogen application compared to 9.15 cm in the control. Though seeding rates did not affect plant height, the highest spike length (11.01 cm) was obtained from 80 kg/ha seeding rate. There were no statistically differences among 130, 180 and 230 kg/ha seeding rates for the spike length.

Nitrogen and seeding rates affected spikelet number significantly (Table 1). The highest spikelet number was obtained from 120 kg/ha nitrogen and 230 kg/ha seeding rate with the values of 23.60 and 23.85 respectively. The highest 1,000 seed weight was obtained with 40 kg/ha from nitrogen application (33.97 g) and 80 kg/ha seeding rates (37.65 g). Increasing seeding rates from 80 to 230 kg/ha caused a reduction from 37.65 to 29.82 g in 1,000-seed weight confirmed by Yagbasanlar *et al.* (1989), who reported that nitrogen levels had no effect on 1,000-seed weight in contrast to seeding rate which causes a reduction when it increases. Toklu *et al.* (1999) reported that spike number increased with increasing nitrogen rates and this trend continued up to 160 kg/ha applied nitrogen level. The lowest (1,432.5 kg/ha) and highest seed yields (2011.2 kg/ha) were obtained from 0 and 120 kg/ha nitrogen levels respectively (Table 2).

Seed yield increased from 1,439 to 2,316 kg/ha, whereas it decreased from 1,979 to 1.337 kg/ha as seeding rate increased from 80 to 230 kg/ha in 1998 and 1999 respectively. The low seed yield in 1999 could be due to less and irregular rainfall during growing season. Protein content is the main quality factor in small grains and controlled by the genome of the varieties and environmental factors such as heavy rain during grain-filling period caused decrease in protein content while dry air increases it. Application of 0 and 40 kg N/ha resulted 8.32 and 8.67% protein content; on the other hand, 12.06 and 12.09% protein were obtained from 80 and 120 kg/ha nitrogen applications.

The seeding rates also affected the protein content of the seeds. The lowest protein content (9.28%) was obtained from 80 kg/ha seeding rates.

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