

# Optimization of Seeding Density and Nitrogen Application in Wheat cv. Inqalab-91 under Faisalabad Conditions

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## ABSTRACT

Studies were undertaken to optimize the seeding density and nitrogen fertilization in wheat cv. Inqalab-91 for realizing maximum yield under the agro-climatic conditions of Faisalabad. For these purpose three seeding densities viz, 100, 150 and 200 kg ha<sup>-1</sup> and three nitrogen levels of 0, 125 and 175 kg ha<sup>-1</sup> were used as experimental treatments. Results revealed that spikes per square meter significantly increased with increasing seeding density and nitrogen levels. Plant height increased with nitrogen application but seeding density had no effect on it. Seeding density had no effect on spikelets per spike, 1000-grains weight and harvest index. Seeding density and nitrogen levels had significant effect on grains per spike, grain yield, and crude protein percentage in grain and straw. Plant height, 1000-grain weight showed significant differences among nitrogen levels only. Highest grain yield of 5.34 t ha<sup>-1</sup> was obtained when the crop was planted at the seeding density of 200 kg ha<sup>-1</sup> with 125 kg ha<sup>-1</sup> nitrogen under Faisalabad conditions.

**Key Words:** Seeding density; Nitrogen rate; Grain protein content; Wheat.

## INTRODUCTION

Wheat (*Triticum aestivum* L.) is an important cereal crop. It is staple food of Pakistan. Wheat is cultivated on an area of 8.3 million hectares with total production of 18.6 million tons and an average yield of 2224 kg ha<sup>-1</sup> (Anonymous, 1998). Average wheat yield is much lower than the potential yield of wheat in Pakistan. There are many factors responsible for such low yields. Among these, inadequate crop nutrition and low plant population are the major factors. Bhatti *et al.* (1990) reported that maximum grain yield was obtained when the crop was grown at the seeding rate of 150 kg ha<sup>-1</sup> with 120 kg ha<sup>-1</sup> nitrogen. Khokhar *et al.* (1985) concluded that highest yield was obtained with the application of 110 kg ha<sup>-1</sup> nitrogen and 3.75 million seeds ha<sup>-1</sup>. Sharma and Dhillon (1993) revealed that seed rate had non-significant effect on mean grain yield but it increased with increasing fertilizer rate up to 120 kg ha<sup>-1</sup> nitrogen.

Singh *et al.* (1992) used seeding rate of 100, 125 and 150 kg ha<sup>-1</sup> and nitrogen rate of 80, 100 and 120 kg ha<sup>-1</sup> and concluded that grain yield and grain protein contents were increased by increasing nitrogen application but sowing rate only increased the yield, but did not affect the protein content. Fuehring (1996) concluded that grain yield was increased economically by N-application up to 300 kg ha<sup>-1</sup>.

Literature suggested that seeding density and nitrogen application influenced the growth and yield performance of wheat. The present study was undertaken to compare the influence of seeding density and nitrogen application rate for wheat cv. Inqalab-91 under Faisalabad conditions.

## MATERIALS AND METHODS.

The experiment was conducted at Agronomic Research Area, University of Agriculture, Faisalabad, during rabi 1998-99. Wheat cultivar Inqalab-91 was sown on 12 November, 1998 to explore its yield potential, different plant characters and quality under three seeding densities viz, 100, 150 and 200 kg ha<sup>-1</sup> grown with three nitrogen levels viz. 0, 125 and 175 kg ha<sup>-1</sup> along with 125 kg ha<sup>-1</sup> of P<sub>2</sub>O<sub>5</sub> as a basal dose.

The experiment was laid out in randomized complete block design with split arrangement and was triplicated having a plot size of 3.0 m x 7.5 m. Normal cultural operations during the growth period were performed at the appropriate time in all the treatments. Data on various growth and yield components were collected using standard procedures and were analyzed statistically by using Fisher's analysis of variance technique (Steel & Torrie, 1984). Least significant difference test at 0.05 probability was employed to compare the means.

## RESULTS AND DISCUSSION

Seeding densities did not show significant effect on plant height, number of grains per spike and 1000 grain weight (Table-I). Number of fertile tiller m<sup>-2</sup> increased significantly when seeding density was increased upto 150 kg ha<sup>-1</sup>. However, a further increase in seeding density up to 200 kg ha<sup>-1</sup> did not bring any change in fertile tillers m<sup>-2</sup>.

**Table I. Influence of different seeding densities and nitrogen levels on different yield Components of wheat**

Treatment	Plant height at maturity (cm)	No. of fertile tillers/m <sup>2</sup>	No. of grains per spike	1000-grain weight (g)
<b>Seeding densities (kg ha<sup>-1</sup>)</b>				
100	95.80 <sup>NS</sup>	319.56 b*	43.40 <sup>NS</sup>	37.94 <sup>NS</sup>
150	96.31	344.79 a	43.07	38.34
200	96.53	357.78 a	40.25	38.56
LSD	-	20.44	-	-
<b>Nitrogen levels (kg ha<sup>-1</sup>)</b>				
0	88.08 b	286.44 b	37.85 b	36.19 b
125	99.56 a	361.89 a	44.86 a	37.89 b
175	101.00 a	373.89 a	44.01 a	40.77 a
LSD	4.07	26.66	3.54	2.2

N.S = Non-significant

\*Any two means not sharing a letter in common differ significantly at 0.05% probability level

Application of 125 kg ha<sup>-1</sup> nitrogen increased plant height, number of fertile tillers per unit area and number of grains per spike over control. However, the difference between application of 125 and 175 kg ha<sup>-1</sup> nitrogen remained non-significant for all these parameters. Application of 175 kg ha<sup>-1</sup> nitrogen increased 1000-grain weight than 125 kg ha<sup>-1</sup> and control. Khokhar *et al.* (1985) also reported increase in 1000-grain weight due to nitrogen application in wheat.

**Table II. Influence of seeding densities and nitrogen levels on grain yield of wheat**

Seeding density (kg ha <sup>-1</sup> )	Nitrogen levels (kg ha <sup>-1</sup> )			Mean
	0	125	175	
100	3.32 cd*	3.49 cd	4.52 b	3.78 B
150	3.09 d	3.70 c	4.83 b	3.87 B
200	3.41 cd	5.34 a	4.66 b	4.47 A
Mean	3.27 C	4.18 B	4.67 A	

\* Any two means not sharing a letter in common differ significantly at 0.05% probability level.

LSD (α = 0.05) Seeding density = 0.45

LSD (α = 0.05) Nitrogen = 0.26

LSD (α = 0.05) Combinations = 0.45

Grain yield was significantly affected by seeding densities and nitrogen levels (Table II). Each level of nitrogen significantly gave greater yield than the previous one. Seeding densities of 100 and 150 kg ha<sup>-1</sup> gave statistically similar yield. However, statistically highest grain yield was recorded at seeding density of 200 kg ha<sup>-1</sup>. Highest grain yield (5.34 kg ha<sup>-1</sup>) was recorded at seeding density of 200 kg ha<sup>-1</sup> and nitrogen application level of 125 kg ha<sup>-1</sup>. Grain yield in respect of higher seeding density and nitrogen level was due to interplay of yield components like plant population

and number of fertile tillers per unit at such seeding density and nitrogen levels. These findings are in close agreement with those reported by Khokhar *et al.* (1985), Rashid and Salim (1992) and Bhatti *et al.* (1990).

Nitrogen levels significantly affected grain protein content whereas seeding density had non-significant effect on crude protein % (Table III). Higher protein content (11.53%) was obtained from nitrogen level of 175 kg ha<sup>-1</sup> followed by 10.71% protein which was received with low fertility level of 125 kg ha<sup>-1</sup> nitrogen. These results confirm the findings of Anjum *et al.* (1986) and Hunter *et al.* (1958). Combination of seeding density and nitrogen application level resulted in significant variation in

**Table III. Influence of seeding densities and nitrogen levels on crude protein (%) in Wheat grain**

Seeding density (kg ha <sup>-1</sup> )	Nitrogen levels (kg ha <sup>-1</sup> )			Mean
	0	125	175	
100	10.80 d*	11.10 c	11.69 a	11.19 <sup>NS</sup>
150	10.88 d	10.30 e	11.62 a	10.93
200	10.08 f	10.72 d	11.28 b	10.69
Mean	10.58 C	10.71 B	11.53 A	

\* Any two means not sharing a letter in common differ significantly at 0.05% probability level.

LSD (α = 0.05) Nitrogen = 0.10

LSD (α = 0.05) Combinations = 0.18

NS = Non-significant

grain protein content. Application of 175 kg ha<sup>-1</sup> nitrogen to wheat sown at 100 and 150 kg ha<sup>-1</sup> resulted in highest and similar grain protein content. Increasing seeding density at this level of N-application decreased grain protein content.

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