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Effect of seeding rate on growth and yield of wheat

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Abstract
A field experiment was conducted during winter seasons of 2018-19 at the Agronomy Research Farm of Agricultural Faculty at Takhar University with the objective to study the effect of seeding rate on growth and yield of wheat. The experiment was in five seeding rate *viz*. 80, 100, 120, 140 and 160 $kgha^{-1}$ and laid out in RCBD with four replication. All of the growth and yield characters were significantly affected by seeding rate except straw yield and harvest index. The highest plant height (104.50cm), tillers $plant^{-1}$(9.50), spike plant-1(8.50), spikelets $spike^{-1}$ (16.50), 1000 grain weight (33.75) and grain yield (4.94 t ha^{-1}) were recorded from the seeding rate of 140 kg ha^{-1}. So it may be stated that the seeding rate of 140 kg ha^{-1} will be better performance of wheat Mazar-99.

Keywords: Seeding rate, Mazar-99, wheat

Introductions
Bread wheat (*Triticum aestivum* L.) is one of the most important cereal crops; in the world in terms of area coverage and production. It is a major source of nutrition for humans and livestock, estimated to contribute as much as 60 million tons of protein per year (Shewry *et al*. 2009) [14]. The total worldwide production of wheat in 2012 was around 671 million tons on an area of 215 million ha (FAOSTAT. 2014) [6]. Wheat requirements in Afghanistan are growing at an exorbitant rate due to its rapid expansion in population. The climate and soil of Afghanistan are quite favorable for the cultivation of wheat. To get maximum yield, it is necessary to use quality seeding and improved agronomic techniques such as optimum seeding rate, time of seeding, irrigation, fertilizer application, weeding, water management, time of harvest etc. Higher wheat grain yield with better quality requires appropriate seeding rate for different cultivars. Increase in seeding rate may only enhance production cost without any increase in grain yield (Rafique *et al*. 2010) [12]. There is a need to increase the yield of wheat per unit area in Afghanistan to provide the ever-increasing food requirement of the country, as the cultivable area is very limited and there is little scope to expand the area for production of wheat. Seeding rate plays a vital role for optimum plant densities which is a pre-requisite for increased seed yield. It influences the yield and yield attributes of wheat (Singh and Singh, 1987) [15]. Seeding rate depends on seeding method. The broadcasting method requires more seeds than line sowing. Higher seeding rate produces more plants in unit area resulting in less intra-crop competition hereby affecting the yield and production cost. On the other hand, lower seeding rate may reduce the yield drastically. In Afghanistan, wheat having an annual production 5 million metric tons and grown approximately on 2.55 million hectares area. however, the average yield of wheat is very low, it is about 1.7-1.9 ton/ha in last 5 year 2015-2019 as compared to the world's average of about 3.4 ton/ha (MAIL. 2020) [11].

Materials and Methods
An experiment was conducted during the winter seasons of(1st of December) of 2018 to spring seasons (1st of June) of 2019 on clay loam soil (40% sand, 25% silt and 35% clay), with medium fertility and almost neutral in reaction at the Agronomy Research Farm of Agricultural Faculty at Takhar University. The experimental site is situated between (36.73º 19" N and 68º 65.4"E, 800 m above the mean sea-level). The rainfall received during the crop growing season extending from December to June was 256.30 mm for 2018–119 respectively. Wheat variety Mazar-99 was used as planting material which is a high yielding variety. Treatments included in the experiment were as follows: Seeding rate (kg ha-1) *viz*. 80, 100, 120, 140, 160. The experiment was laid out in randomized completely blocked design with four replication.

The experimental field was finally prepared by a country plough followed by laddering for breaking clods and leveling the land. All weeds, stubbles and crop residues of the field were removed prior to sowing of seeds and whole experimental area was divided into unit plots maintaining the desired spacing. The field was fertilized with urea, di ammonium phosphate, @ 220 and 180 kg ha-1 respectively. Two-third of urea and the whole amount of di ammonium phosphate was applied at the time of final land preparation and the rest urea was at the top dressed. Seeds were sown by hand at depth of 4-5 cm a part furrows with a tine made of iron. After sowing, the seeds were covered with soil. Care was taken to avoid damage of the seeds. Intercultural operations such as weeding and Irritation were done. The crop was harvested at full maturity. Ten plants (excluding border plants) were selected randomly from each unit plot and uprooted before harvesting for recording data. The harvested crop of each plot was bundled separately, tagged properly and brought to the clean threshing floor. The bundles were dried sun, threshed and then grains were cleaned. The seed and straw weight for each plot were recorded after sun drying to constant weight. The dry weight of grains of sample plants was added to the respective unit plot to record the final yield plot^{-1}. The grain and straw yield was finally converted in to t ha^{-1}. All the collected and calculated data were analyzed following the ANOVA-technique. The mean differences among the treatments were adjudged by least significant deference Test (Gomez and Gomez, 1984) [6], using a computer operated program named MSTAT-C.

Results and Discussion

All of the growth contributing characters were significantly affect due to seeding rate (table 1). The tallest plant (104.50 cm) was found from the seeding rate of 140 kg ha^{-1} which were statistically same with (100.75, 99.75 and 94.75 cm) with seeding rate of 160, 120 and 100 kg ha^{-1} respectively. The difference in plant height might attributed to difference in their genetic make-up. These findings were in line with those of (Khaliq *et al*. 1999) [9] and (Hussain *et al*. 2001) [8]. (Soomro *et al*. 2009) [16], showed that wheat sowing at higher seeding rate, that is, 175 kg ha-1 produced greater plant height, that is, 101.25 cm. the shortest plant (85.75 cm) was found for the seeding rate of 80 kg ha^{-1}.

Table 1. revealed that increase in seeding rate significantly affected the tillers plant^{-1} and spikes plant^{-1}, seeding rate of 120, 140 and 160 kg ha^{-1} produced the maximum number of tillers plant^{-1}, spikes plant^{-1} (8.00 and 6.75, 9.50 and 8.50, 9.29 and 8.00) while the minimum number of tillers plant^{-1}, spikes plant^{-1} (6.00 and 4.5, 6.50 and 5,75) with lowest seeding rate of 80 and 100 kg ha^{-1}. This might be due to higher plant population in the present study, since the seeds were treated with fungicide, which led to competition among tillers and resulted in lower number of tillers or spikes. These findings were similar with those of (Bodruzzaman *et al*. 2003) [4], (Saifuzzaman *et al*. 2003) [17]. On the other hand the highest number of spikelet spike^{-1} (16.50) was produced by the seeding rate of 140 kg ha^{-1} and it decreased (11.75) with the seeding rate of 80 kg ha^{-1}. (Talukder *et al*. 2004) [18], obtained similar results.

The results in table 2. Showed that the numerically the highest 1000-grain weight (33.75g) was obtained from the seeding rate of 140 kg ha-1 which was statically similar to (33.00 g) seeding rate 120 kg ha-^{1} while other treatments obtained the lowest measure of 1000 grain weight (30.25, 31.25 g). The decreases in 1000-grain weight might be due to the competition on nutrient in soil, moisture, air and light. Obtained results are in good accordance with those previously reported by (Ali *et al*. 2004) [1], (Soomro *et al*. 2009) [16], Baloch *et al*. (2010) [3] and Kiliç and Gürsoy (2010) [10].

Table 1: Effect of seeding rate on growth of wheat

Seeding rate kg ha^{-1}	Plant height (cm)	No. tillers plant^{-1}	No. spick plant^{-1}	No. spikelet spick^{-1}
80	85.75 b	6.00 b	4.50 c	11.75 c
100	94.75 ab	6.50 b	5.75 bc	12.25 c
120	99.75 a	8.00 ab	6.75ab	14.50 b
140	104.50 a	9.50 a	8.50 a	16.50 a
160	100.75 a	9.25 a	8.00 a	14.00 b
	*	*	**	**
SEM±	3.48	0.68	0.60	0.55
CV (%)	7.12	17.33	17.92	7.91

The results showed that the highest grain yield (4.94 t ha^{-1}) was obtained by the seeding rate of 140 kg ha^{-1}, because of higher total tillers plant-1, spike plant-1, highest number of spikelets spike-1. The lowest grain yield (3.03 and 3.22 t ha-1) were produced by the seeding rate of 80 and 100 kg ha^{-1}, this result is in agreement with the findings of (Talukder *et al*., 2004) [18].

The highest straw yield (3.73 t ha-1) and highest harvest index (42.43%) were found from the seeding rate of 140 kg ha^{-1} These results are in agreement with those of (Allam, 2005) [2], (El Hag, 2006) [5], (Ramadan and Awaad, 2008) [13]. and the lowest (3.26 t ha-1 and 34.87%) was found for the use seeding rate of 100 kg ha-1 It was observed that by using low amount of seeding rate harvest decreased harvest index.

Table 2: Effect of seeding rate on growth of wheat

Seeding rate kg ha-1	1000 grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
80	30.25 b	3.03 c	5.15	34.87
100	31.25 b	3.22 c	5.65	35.60
120	33.00 a	3.94 b	6.00	39.17
140	33.75 a	4.94 a	6.98	41.27
160	31.25 b	3.96 b	6.15	39.51
Level of significance	**	**	NS	NS
SEM±	0.40	0.21	0.45	1.74
CV (%)	2.49	10.95	15.3	9.13

Level of significance

Conclusion

From the above results, it may be concluded that the growth and yield for the optimum seeding rate was estimated at 140 kg ha^{-1} for wheat grown successfully on Takhar climatic conditions.

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