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Effect of different nutrient Scheduling on Yield attributes and yield of different timely sown wheat cultivars

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ABSTRACT
An experiment was conducted at SGT University field to study the effects of different nutrients fertilizer doses as Control, 100% RD NPK, 4T VC + 100% PK + 75% N (3-splits), 5T VC + 100% PK 75 % (N in 3-splits), 6T VC + 100% PK + 75% N (3-splits) on different wheat cultivars. The experiment was laid out in a Split Plot Design (SPD) with three replications. Higher number of days to heading, days to maturity, yield and yield attributing traits of three wheat cultivars (PB-343, WH-711 and Tiger) reported in fertilizer scheduling of 100% NPK. The Tiger cultivar (39.7 q ha^{-1}) produced highest grain yield followed by WH-711 (39.5 q ha^{-1}) and PBW-343 (37.6 q ha^{-1}). Recorded maximum grain yield at 100% NPK recommended dose with three splits of nitrogen at the highest rate of nitrogen (69 kg ha^{-1}) application probably due to highest response of the cultivars to N fertilizer scheduling. Choice of variety and N application and scheduling is one of the important cultivation techniques that have large influence on wheat grain production. Strategies of fertilization material and method are one of best way to sustain crop production and productivity. Significant differences were detected among the three wheat varieties in all characters studied and their interaction.
Keywords: *Nutrients fertilizer, SPD, Wheat*

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INTRODUCTION
Wheat (*Triticum aestivum* L.) is the most important staple food crop for human being in India and world. The total harvested area, production and grain productivity of wheat in India in the year 2016-17 was 2.5 million hectare, 93.5 million tonnes and 3093 kg ha^{-1}, respectively [1]. Haryana is the front runner contributed state in achieving food self sufficiency of the country. The area, production and productivity of wheat crop in Haryana is 2.5 million hectare, 11.12 million tonnes and 4452 kg ha^{-1} [2]. The total food grains productivity in the State is 1.8 times higher than the average at country level. Fertilizer input and nitrogen are one of the most limiting practices for wheat production that affects the plant growth, development and improves grain yield. Asif *et al.* [3] reported that yield attributes, yield and harvest index were significantly increased by increasing nitrogen application doses. Noureldin *et al.* [7] concluded that effective tillers, spike length, test weight and grains per spike were increased with N up to 180 kg ha^{-1}. This research shows that the N doses affects expression of quantitative traits of wheat and utilization of genetic yield potential as well as the efficiency of N utilization in years with different weather conditions. Nitrogen application and input quality and their scheduling are the limiting factors for crop production in the arid and semi-arid regions. Kumar *et al.* [4] found that grain and straw yields of wheat was increased with increasing nitrogen level from 75 to 100

and 125 kg N ha^{-1} application as well as with their increased number of splits at same dose. Shams El-Din *et al.* [10] reported that equal amount of nitrogen from different sources (anhydrous NH_4, urea, NH_2SO_4 and NH_4NO_3) of nitrogen fertilization and their interaction have no significant affect on the yield.

MATERIAL AND METHODS

The experiment was conducted in Rabi season of 2017 at Research Farm, Faculty of Agricultural Sciences, SGT University, Gurugram on sandy loam soil. Three wheat cultivars *i.e* (PBW-343, WH-711 and Tiger) and five nutrient doses *viz.* (Control, 100% RD, 4t Vermi-compost (VC) + 75% RD, 5t Vermi-compost (VC) + 75% RD and 6t Vermi-compost (VC) + 75% RD) were considered for this study. The sowing was done on 24th November, 2017. One deep ploughing and twice harrowing followed by planking was done for the seed bed preparation. Secondary tillage operations were done after the pre sowing irrigation. The seedbed was prepared two days prior to sowing. Seed rate of wheat cultivars applied at the rate of 100 kg ha^{-1} after been soaked in water and dried in shade. Seed treatment was done by chloropyphos @ 1 ml kg^{-1} seed to avoid termite attack. Metsulfuron methyl was used for weed control after 28 days after sowing (DAS) followed by hand weeding at 50 DAS. Nitrogen was applied by urea (46% N) at three equal split according to treatments considering 125 kg N ha^{-1} at CRI stage, maximum tillering stage and flowering stage. Full dose of phosphorous (60 kg N ha^{-1}) was applied through Di-ammonium phosphate (DAP) and 30 kg K_2O ha^{-1} through muriate potash as basal dose at the time of seed bed preparation. Ten crop plants were taken randomly from each treatment, after that the averages of the plant height, tiller numbers, number of grains $spike^{-1}$ and spike length was recorded.

RESULT AND DISCUSSION

The data in table 1 showed that cultivar had highly significant effect on days to heading. Tiger cultivar took maximum (91.3) number of days to heading which was statistically at par with WH-711 (90.1) but significantly higher than PBW 343 cultivar. Hayam and Sayed [9] reported that differential growth and yield response of two wheat cultivars toward different nitrogen doses. Minimum number of days (88.3) taken by the PBW-343.

Fertilizer doses and scheduling also react significantly with all the cultivars under study. Maximum number of days to heading (93.3) recorded with recommended dose of N in three equal split which was significantly higher than rest of the treatments under study except 6T VC + 100% PK 75% (N in 3-splits). Similarly, 6T VC + 100% PK + 75% N (3-splits) fertilizer scheduling reported significantly higher number of days to heading than 5T VC + 100% PK + 75% N (3-splits), 4T VC + 100% PK + 75% N (3-splits) and no fertilizer scheduling. Minimum number of days (85.9) to heading reported in control may be due to lower availability of nutrient supply forces plant to complete their vegetative phase.

Table 1: Effect of fertilizer scheduling on days to heading, days to maturity, number of grains per spike of different wheat cultivars

Cultivars	Days to heading	Days to maturity	Grains/spike
PBW-343	**88.3**	**129.6**	**49.1**
WH-711	**90.1**	**136.7**	**50.7**
Tiger	**91.3**	**135.2**	**51.3**
CD at 5% level	**1.8**	**4.2**	**NS**
Fertilizer dose kg/ha			
Control	**85.9**	**124.7**	**38.2**
100 % PK N (in 3-splits)	**93.3**	**136.1**	**58.4**
4T VC + 100% PK + 75% N (3-splits)	**87.9**	**133.2**	**48.7**
5T VC + 100% PK + 75% N (3-splits)	**89.7**	**135.9**	**51.0**
6T VC + 100% PK + 75% N (3-splits)	**92.7**	**139.3**	**55.6**
CD at 5% level	**1.3**	**1.4**	**1.6**

The data pertaining in Table 1 showed that cultivar had highly significant effect on days to maturity. WH-711 cultivar took maximum number of days to maturity (136.7) which was statistically at par with Tiger (135.2) but significantly higher than PBW 343 cultivar. Minimum number of days to maturity (129.6) taken by the PBW-343.

Fertilizer doses and scheduling also responded significantly with the wheat cultivars under study. Maximum number of days to maturity (139.3) recorded with 6T VC + 100% PK + 75% (N in 3-splits) which was significantly higher than rest of the treatments under study. The number of days to maturity at recommended dose recorded statistically similar to 5T VC + 100% PK+ 75% N (3-splits) fertilizer application but significantly higher number of days to maturity than 4T VC + 100% PK + 75% N (3-splits) and no fertilizer scheduling. Bhorghi [8] also reported increase in growth attributes with increase in nitrogen scheduling. Minimum number days (124.7) to maturity reported in control may be due to more stress of nutrients.The data in Table 1 showed that there is no any significant effect on number of grains per spike among the different wheat cultivars. The Tiger cultivar obtained maximum number of grains (51.3) followed by WH-711 (50.7) and PBW 343 (49.1). Singh *et al.* [5] also reported similar results. Minimum number of days to maturity (129.6) taken by the PBW-343.

Fertilizer doses and scheduling also responded significantly with the wheat cultivars under study. Maximum number of grains per spike (58.4) recorded with at recommended dose recorded which was significantly higher than rest of the treatments under study. The number of grains per spike recorded with 6T VC + 100% PK + 75% (N in 3-splits) which was significantly higher than 5T VC + 100% PK+ 75% N (3-splits), 4T VC + 100% PK + 75% N (3-splits) and no fertilizer scheduling. Minimum number of grains per spike (38.2) to maturity reported in control with no fertilizer application.

Table 2: Effect of fertilizer scheduling grain yield, stover yield, biological yield and harvest index of different wheat cultivars

Cultivars	**Grain Yield (q/ha)**	**Stover Yield (q/ha)**	**Biological Yield (q/ha)**	**Harvest Index (%)**
PBW-343	37.6	65.8	103.4	36.5
WH-711	39.5	65.9	105.4	37.8
Tiger	39.7	64.8	104.5	38.4
CD at 5% level	1.5	NS	NS	
Fertilizer dose kg/ha				
Control	26.2	38.5	64.8	40.6
100% PK N (in 3-splits)	44.1	73.2	117.3	37.6
4T VC + 100% PK + 75% N (3-splits)	40.4	69.4	109.8	36.7
5T VC + 100% PK+ 75% N (3-splits)	41.5	71.9	113.5	36.6
6T VC + 100% PK + 75% N (3-splits)	42.5	74.3	116.8	36.3
CD at 5% level	1.6	2.2	3.6	

The data in Table 2 different wheat cultivars showed significant effect on grains yield. The Tiger cultivar recorded highest grains yield (39.7 q ha^{-1}) which was statically at par with WH-711 (39.5 q ha^{-1}) and significantly higher than PBW 343 wheat cultivar.

Fertilizer doses and scheduling also responded significantly with the wheat cultivars under study. Highest grains yield (44.1 q ha^{-1}) recorded with recommended dose which was significantly higher than rest of treatments. The grain yield recorded at 6T VC + 100% PK + 75% (N in 3-splits) was higher (42.5) than 5T VC+ 100% PK + 75% N (3-splits) but was significantly higher than 4T VC + 100% PK+ 75% N (3-splits) and no fertilizer scheduling. Singh and Yadav, [6] reported the increase in growth parameter with increasing nitrogen doses and splits. Minimum number of grains yield (26.2 q ha^{-1}) reported in control with no fertilizer application.

The data pertaining in Table 2 showed no significant effect on straw yield among the different cultivars under study. The cultivar WH-711 recorded maximum straw yield (65.9 q ha^{-1}) followed by PBW 343 and Tiger wheat cultivar. Lowest straw yield (64.8 q ha^{-1}) recorded in the Tiger cultivar.

Fertilizer doses and scheduling responded significantly with the wheat cultivars under study. Highest straw grains yield (74.3 q ha^{-1}) recorded with 6T VC+ 100 % PK 75 % (N in 3-splits) which is statically similar with 100 % recommended dose (73.2 q ha^{-1}) which was statistically at par with 5T VC+ 100 % PK+ 75 % N (3-splits) (71.9 q ha^{-1}) significantly higher than 4T VC+ 100 % PK+ 75 % N (3-splits) and no fertilizer scheduling. Minimum number of grains yield (38.5 q ha^{-1}) reported in control.

The data in Table 2 on biological yield showed no significant effect on biological yield among the different cultivars under study. The cultivar WH-711 recorded maximum biological yield (105.4 q ha^{-1}) followed by Tiger (104.5 q ha^{-1}) followed by PBW 343 (103.4 q ha^{-1}) in wheat cultivar.

Biological yield of the wheat cultivars responded significant variation with Fertilizer doses and scheduling under study. Highest straw and grain yield (117.3 q ha^{-1}) recorded with 100% RD which is statically similar 6T VC + 100% PK + 75% (N in 3-splits) (116.8 q ha^{-1}) which is statistically similar with which was statistically at par with 5T VC + 100% PK + 75% N (3-splits), 4T VC + 100% PK + 7 % N (3-splits) and no fertilizer scheduling. Lowest biological yield (64.8 q ha^{-1}) reported in control.

The data indicated in Table 2 on harvest index showed the ratio of economic yield and biological yield was also affected by different cultivars. Among the different cultivars higher harvest index was recorded of Tiger (38.4%) followed by WH-711 (37.8%) and PBW-343 (36.5%) under study.

The data in the Table 2 indicated the performance of the wheat cultivars with fertilizer doses and scheduling in terms of harvest index. Maximum harvest index (40.6%) recorded with control treatment without any fertilizer application followed by 100% recommended dose (37.6%) followed by 4T VC + 100% PK + 75% (N in 3-splits) (116.8 q ha^{-1}), 5T VC + 100% PK + 75% N (3-splits) and 6T VC + 100% PK + 75% N (3-splits). Asif *et al.* (2012) also found that harvest index of wheat affected by different nitrogen scheduling. Minimum harvest index was recorded with fertilizer scheduling. Minimum harvest index was recorded with 6T VC + 100% PK + 75% N (3-splits) (36.3%).

CONCLUSION

The study clearly revealed that highest grains yield (44.1 q ha^{-1}) recorded with recommended dose which was significantly higher than rest of treatments. The grain yield recorded at 6T VC + 100% PK + 75% (N in 3-splits) was higher (42.5) than 5T VC+ 100% PK + 75% N (3-splits) but was significantly higher than 4T VC + 100% PK + 75% N (3-splits) and no fertilizer scheduling. Among the different cultivars higher harvest index was recorded of Tiger (38.4%) followed by WH-711 (37.8%) and PBW-343 (36.5%) under study.

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