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Evaluation of wheat cultivars and nitrogen scheduling under surface seeding method for rice-wheat system in S. E. part of Bihar

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Abstract
An adaptive research trail was conducted during *rabi* season of 2010-11 and 2011-12 for the evaluation of wheat cultivars and nitrogen scheduling under surface seeding condition in low land soil. The treatment comprised of four cultivars (PBW 343, HD 2733, HD 2824 & K 307) and two nitrogen scheduling N_1 - ½ dose at 11 DAS and ½ at CRI; and N_2 - 2/3 equal splits basal and two top dressing at the time of tillering and panicle initiation respectively. Maximum plant height, leaf area index, spike length and number of grains per spike were recorded by treatment V_2 N_1 (HD 2733 + 80% N at basal and rest 20% top dressed at tillering stage). However, maximum number of plant m^{-2} was recorded by V_4 N_2 (K 307 + 50% N at basal and rest 50% two equal split application at tillering and panicle initiation stage). Highest number of effective tillers m^{-2}, test weight, grain yield, straw yield and harvest index was also recorded in V_2 N_1. Data further showed that V_2 N_2 (HD 2733 + 50% N at basal and rest 50% two equal split application at tillering and panicle initiation stage) was found to be at par with V_2 N_1.

Keywords: surface seeding, nitrogen scheduling, wheat, varieties

1. Introduction
Wheat (*Triticum aestivum* L.) is of great significance in Indian agriculture for triggering green revolution and in coming years. It is expected to play a more decisive role in stabilizing national food production. Besides, being a major source of food, it is the main component of food security in the country owing to its prominent share (70 %) in the buffer food grain stock. Wheat the *king of cereals* is thus of immense importance in the national food economy and nutritional adequacy. Wheat is second most important cereal of India contributing about 30 – 36% of total food grain production of the country and occupies 29.4 million hectares area with production of 87.39 million tonnes and productivity of 3009 kg ha^{-1} whereas total area in Bihar under wheat is 2.26 million hectares with production of 5.08 million tonnes and productivity of 2251 kg ha^{-1} (Anonymous (2015) [1].
As the population of our country is increasing rapidly the requirement of wheat will be around 105 to 109 million tonnes for feeding the country population by 2020. India's population in 1901 was 27.01 crores and it is estimated that by 2020 it will be 130.42 crores by the present growth rate. It means we will have to add within 20 years another 30 million tonnes of wheat, which is an opportunity as well as challenge. Irrespective of area, it is evident that there exists a yield gap of 1.5 – 2.0 tonnes ha^{-1} between what is being achieved and what can be achieved. This can be achieved with annual growth rate of 1.8 percent. Since, there is no space for horizontal expansion; additional grain yield can be achieved by increasing vertical expansion or productivity (Nagrajan, 1995) [4]. Besides staple food for human beings, wheat straw is a good source of feed for large population of cattle in our country. Broadcasting of wheat in the moist field before rice harvesting avoids delay in wheat sowing and cost of cultivation is minimal. Amongst various agronomic manipulations, the time of sowing play an important role in influencing the quality and yield of wheat. A delay in sowing of wheat crop is exposed to sub optimal temperature at establishment and supra-optimal temperature at reproductive phase, which leads to forced maturity coupled with reduction in grain yield (Kaur *et. al*. 2010) [3]. Therefore, keeping the view of above factors, there was a need of an experiment to find out the effect wheat cultivar and nitrogen scheduling on growth and yield of wheat.

2. Materials and Methods
An adaptive research trail was conducted at farmer's field (Dakra village in Lakhisarai district) of S.E. Part of Bihar during winter (*rabi*) season of 2010-11 & 2011-12 under CSISA project. The climate of South Eastern part of Bihar is sub-tropical, semi-arid with an annual rainfall of 1100 mm, about 80% of which occurs from June to September. The experimental field was sandy loam in texture (58% sand, 24% silt and 24%clay), low in organic carbon (0.38 %) and available N (140 kg/ha), medium in available P_2 O_5 (17.4 kg/ha) and K_2O (151 kg/ha). Four wheat cultivars viz. V_1 PBW 343, V_2 HD 2733, V_3 HD 2824 and V_4 K 307, two nitrogen scheduling viz. N_1 (nitrogen applied ½ dose at 11 DAS and ½ at CRI) and N_2 nitrogen given in 2/3 equal splits

(50 % basal and rest top dressing in two equal splits at maximum tillering stage and panicle initation stage). Soaked wheat (04 cultivars) seeds were broadcasted on 04 December in both the years before one week of rice harvesting under saturated condition by using 150 kg/ha seed rate. In N_1 60 kg N + 60 kg P_2 O5 + 40 kg K_2 O per ha has applied at 11 days after sowing and remaining 60 kg N was top dressed at crown root initiation stage. In N_2 60 kg N + 60 kg P_2O5 + 40 kg K_2O per ha was applied at the time of sowing and remaining 60 kg N were top dressed in two equal splits at tillering and panicle initiation stage. The experiment was laid out in split plot design with three replications. The observations *viz.* plants height, number of plants m^{-2}, number of effective tillers m^{-2}, spike length, number of grains $spike^{-1}$, test weight, grain and straw yield were recorded. Diammonium phosphate, urea and murate of potash were applied as a source of N, P and K respectively. Data recorded from an area enclosed in the quadrate of 0.5 square meter randomly selected at three places in each plot. Other packages of practice rather than treatments were followed as per recommendation for wheat crop

3. Results and Discussion

Wheat varieties and nitrogen scheduling significantly affected the various growth parameter of wheat crop under rice-wheat cropping system during both the years of experiment and pooled. Pooled data of two years experiment showed that maximum plant height, effective tillers m^{-2}, LAI, spike length and number of grains $spike^{-1}$ were recorded by V_2 N_1 (HD 2733 + 80% N at basal and rest 20% top dressed at tillering stage). However, maximum number of plant m^{-2} was recorded by V_4 N_2 (K 307 + 50% N at basal and rest 50% two equal split application at tillering and panicle initiation stage). Perusal of the mean showed that V_2 N_2 (HD 2733 + 50% N at basal and rest 50% two equal split application at tillering and panicle initiation stage) was found to be at par with V_2 N_1 in plant height, effective tillers m^{-2}, LAI, spike length and number of grains $spike^{-1}$. Similar finding was also reported by Dahal *et al.* (2010) [2]. The high yielding varieties of wheat were highly responsible for nitrogenous fertilizers. Application of nitrogen at earlier crop stage was effective for better growth of vegetative parts. Vigorous plant growth provide higher photosynthesis and allow the crop to grow to its potential thereby increases the plant height, effective tillers m^{-2}, LAI, spike length and number of grains $spike^{-1}$ in respective treatment.

A perusal of table revealed significant variation among yield attributes and yield by wheat varieties and nitrogen scheduling. V_2 N_1 (HD 2733 + 80% N at basal and rest 20% top dressed at tillering stage) recorded maximum performance of yield attributes and yield *viz.* number of effective tillers m^{-2}, test weight, grain yield, straw yield and harvest index during both the years of experiment and pooled. V_2 N_2 (HD 2733 + 50% N at basal and rest 50% two equal split application at tillering and panicle initiation stage) was found to be at par with V_2 N_1 among yield attributes and yield during both the years and pooled. Similar result was also reported by Dahal *et. al.* (2010) [2] Tripathi, (2010) [6]. This might be due to higher dose of nitrogen at early stage of wheat crop provided higher fertility level and also provide the luxury nutrition to wheat crop resulted vigorous growth and developed a good canopy. Reddy and Reddy (2015) reported that application of nitrogen at proper time increase nitrogen content of leaves in addition to chlorophyll and carotenoids as a consequence leaf and canopy photosynthesis is increased. Nitrogen application at early stage increased photosynthetic electron transfer rate, photosynthetic quantum rate, and photosynthetic quantum yield and also reduced dissipation of non-radiant energy. Thus, more leaf absorbed light was utilized in photosynthesis but this kind of improvement on photosynthetic function dependent on the cultivar used (Reddy and Reddy 2015) Well developed canopy is a source of higher sink formation and also provide maximum yield attributes and yield.

Table 1: Evaluation of wheat cultivars and nitrogen scheduling on growth attributes (pooled data of two years).

Treatments	No. of plants m^{-2}	Plant height at harvesting (cm)	Leaf area index at 60 DAS (%)	Spike length (cm)	No. of grains $spike^{-1}$
V_1 N_1	181	88.2	2.60	7.5	37.3
V_2 N_1	183	93.2	2.74	8.5	40.4
V_3 N_1	190	91.5	2.69	8.2	38.1
V_4 N_1	185	89.8	2.65	7.8	37.4
V_1 N_2	179	87.0	2.52	7.3	35.8
V_2 N_2	182	90.5	2.70	8.3	38.3
V_3 N_2	186	88.2	2.67	8.1	38.0
V_4 N_2	192	87.9	2.58	7.5	37.0
F test	S	S	S	S	S
SEd±	1.62	1.02	0.20	0.19	0.60
CD (P=0.05)	5.16	3.27	0.66	0.61	1.91

V_1- PBW 343, V_2- HD 2733, V_3- HD 2824, V_4 -K 307, N_1- 80% N at basal and rest 20% top dressed at tillering stage, N_2- 50% N at basal and rest 50% two equal split application at tillering and panicle initiation stage.

Table 2: Evaluation of wheat cultivars and nitrogen scheduling on wheat productivity (pooled data of two years).

Treatments	No. of effective tillers m^{-2}	Test weight (g)	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Harvest Index (%)
V_1 N_1	288	38.2	25.7	34.8	42.47
V_2 N_1	316	40.3	32.8	40.6	44.68
V_3 N_1	305	39.4	29.9	38.3	43.84
V_4 N_1	295	38.5	27.5	36.6	42.90
V_1 N_2	282	37.8	24.1	34.1	41.40
V_2 N_2	307	38.9	31.7	38.6	44.30

$V_3 N_2$	297	38.7	27.9	36.4	43.39
$V_4 N_2$	285	38.0	25.6	35.0	42.24
F test	S	S	S	S	S
SEd±	1.31	0.73	0.46	0.74	0.59
CD (P=0.05)	4.18	2.34	1.49	2.36	1.90

V_1- PBW 343, V_2- HD 2733, V_3- HD 2824, V_4 -K 307, N_1- 80% N at basal and rest 20% top dressed at tillering stage, N_2- 50% N at basal and rest 50% two equal split application at tillering and panicle initiation stage.

4. Conclusion

The result of our two year study concluded that variety V_2- HD 2733 and nitrogen scheduling N_1- 80% N at basal and rest 20% top dressed at tillering stage were the most suitable variety and nitrogen management for wheat growing which gave maximum grain and straw yield; and recommended for marginal farmers as well as big farmers.

5. References

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