

## Productivity of Wheat Varieties under Normal and Late Sown Conditions of Chottanagpur Plateau

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### Abstract

A field experiment was conducted during two consecutive rabi seasons with 13 wheat cultivars (K-9507, K-9508, HD-2690, HUW-484, HUW-485, NW-1038, NW-1043, RW-3448, HUW-206, HP-1731, K-9107, NW-1012 and HUW-468) under two seeding dates (18 November and 15 December) in split plot design, replicated thrice to study the relative performance of wheat cultivars under normal and late sown condition. The interactional effect of seeding time and cultivars showed that NW-1038 performed equally well under both the seeding time, whereas under timely seeding (18 November) HD-2690 (55.4 q/ha) and HUW-468 (52.1q/ha) showed their superiority over rest of cultivars. However, under late sown condition (15 December) HUW-484 (55.4 q/ha), HUW-485 (55.4 q/ha), K-9107 (51.3 q/ha) proved their superiority over rest of the cultivars. Similarly, HD-2690 on timely seeding (18 November) gave maximum net return (Rs 33017/ha) with B : C ratio of 5.88 whereas, NW-1038 showed significant edge over rest of the cultivars irrespective of their seeding time.

**Key words :** Timely and late sown wheat, Cultivar, Biomass production rate, Heat unit.

Wheat (*Triticum aestivum* L.) is the world's widely cultivated cereal crop. It is second important staple food rice in India. Wheat productivity may be enhanced by providing copious water and fertilizer at the right time, sowing seeds of superior variety and maintaining plant population. Time of sowing is also an factor which is directly related to the production of wheat. There is drastic reduction in yield with each day delay in sowing. Wheat sown after end of November in South East Asia leads to linear decline in yield of 1–1.5% per day for crops sown after that date (Ortiz-Monasteric et al. 1994). Under irrigated condition, timely sowing of wheat is not possible due to late harvesting of rice and unsuitability of land for tillage operation. Some varieties perform well under normal sown condition while, some varieties are found fit for late sown condition. So, identification of varieties for normal and late sown condition is essential to harness the maximum possible yield. Keeping above points in view, the present investigation was carried out to access the relative performance of wheat varieties and to identify suitable varieties for normal and late sown condition.

### Methods

The experiment was conducted at Birsa Agricultural University, Ranchi during *rabi* season to study the performance of wheat cultivar under normal and late sown condition. The soil of the experimental plot was sandy loam, slightly acidic in reaction with pH 6.4, low in available nitrogen (185 kg/ha), available phosphorus (10.9 kg/ha) and medium in potassium (185.6 kg/ha). The experiment was conducted in split-plot design with two dates of sowing (18 November i.e. normal and 15 December i.e. late) as main plot treatments and 13 wheat cultivars (K-9507, K-9508, HD-2690, HUW-484, HUW-485, NW-1038, NW-1043, RW-3448, HUW-206, HP-1731, K-9107, NW-1012 and HUW-468) as sub-plot treatments. The total numbers of treatment combinations were twenty six. The treatments were replicated thrice to avoid any effect of heterogeneity and the treatments were randomly allocated as per standard procedure. The crop (wheat) was raised at 23 cm rows spacing with seed rate (125 kg/ha) and a uniform fertilizer dose of 100:50:25 N: P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O kg/ha was applied to all treatments. Nitro-

**Table 1.** Interactional effect of date of sowing and cultivar on growth character of wheat.

Treatment	Plant height (cm)		Biomass production rate		Heat unit (degree day)	
	18 Nov	15 Dec	18 Nov	15 Dec	18 Nov	15 Dec
K 9507	95.8	88.0	83.0	82.0	1618.0	1379.2
K 9508	105.1	93.3	87.3	88.6	1839.4	1550.9
HD 2690	103.4	99.2	95.6	84.3	1856.0	1411.4
HUW 484	93.6	88.6	91.0	85.3	1819.7	1411.4
HUW 485	87.9	81.9	96.6	86.0	1707.1	1389.8
NW 1038	89.2	87.2	93.0	85.6	1733.5	1394.8
NW 1043	97.4	97.8	83.6	88.6	1753.6	1394.8
RW 3448	105.9	97.6	84.3	95.3	1839.4	1542.2
HUW 206	101.8	98.9	83.6	90.6	1851.6	1524.4
HP I731	87.2	85.2	86.6	85.3	1736.0	1390.5
K 9107	106.6	106.4	90.0	79.3	1835.5	1532.8
NW 1012	90.5	92.6	84.6	86.0	1835.5	1560.7
HUW 464	90.8	87.2	89.6	85.3	1618.1	1389.8
CD at 5%						
V × D	NS		7.1		11.4	

gen was applied in two equal splits  $\frac{1}{2}$  basal +  $\frac{1}{2}$  at 30-35 days after sowing) while, phosphorus, potassium were applied as basal row placement.

## Results and Discussion

### *Effect of Date of Sowing*

The study indicates that plant height under normal sown condition was greater than late sown condition. This might be due to favorable condition under normal sown condition resulting in better growth and development of plants. However, the difference in plant height at different date of sowing was not found significant. The biomass production rate of HD-2690, HUW-485, NW-1038 and K-9107 decreased significantly due to delay in sowing from 18 November to 15 December, whereas the biomass production rate of cultivar RW-3448 increased significantly (95.3 kg/ha/per day) under late sown condition. The heat unit (growing degree days) of all cultivars were significantly higher under normal sown condition i.e. 18 November than late sown condition 15 December (Table 1) due to better weather condition in November.

As a result of delay in sowing from 18 November to 15 December, the number of effective tiller of HUW-484 (233.0), HUW-485 (235.8) and K-9107 (235.0) increased significantly to the tune of 11.6, 10.3 and 11.6% respectively. In other cultivars, the effect of date of seeding was not significant. On late sowing, the spike

length of cultivars was more than normal sown cultivars but, significant improvement in spike length was observed only in case of K-9507, NW-1043, RW-3448 and NW-1012 when sowing time was shifted from middle of November to middle of December. The number of grains per spike of K-9507 and HD-2690 decreased significantly when sowing was delayed from 18 November to 15 December. On the other hand, in NW-1038 and K-9107, the numbers of grains/spike were significantly higher under late sown condition. Date of seeding failed to cause significant influence on 1000 grain weight (Table 2). However, 1000-grain weight was higher under normal sown condition. As under late sowing the grain filling stage coincided with the high temperature of March. These results are in close conformity with the findings of Singh et al. (2002).

The wheat cultivars K-9507 and HD-2690 performed well under normal sown condition and delay in sowing from 18 November to 15 December significantly decreased the grain yield. Under late sown condition, HUW-484, HUW-485 and K-9107 performed better than normal sown plants giving 17.3, 23.9 and 19.3 percent higher yield when sowing was shifted from 18 November 15 December. This can be ascribed to the ability of HUW-484, HUW-485 and K-9107 to perform better under late sown conditions. In other cultivars, change in date of sowing was not effective in bringing about significant variation in grain yield. The straw yield of cultivars K-9508, HD-2690, NW-

**Table 2.** Interaction effect of date of sowing and cultivar on yield attributes and yield of wheat.

Treatment	Effective tillers/m <sup>2</sup>		Spike length (cm)		Grains/spike		1000 grain wt (g)		Grain yield (q/ha)		Straw Yield (q/ha)	
	18 Nov	15 Dec	18 Nov	15 Dec	18 Nov	15 Dec	18 Nov	15 Dec	18 Nov	15 Dec	18 Nov	15 Dec
K 9507	253.0	250.5	10.8	11.6	48.1	44.0	44.0	42.0	47.2	40.5	68.7	75.3
K 9508	237.0	234.7	11.2	11.4	46.0	45.0	46.0	45.0	43.8	41.4	86.1	71.0
HD 2690	260.2	255.0	10.7	11.0	50.2	46.0	48.0	44.0	55.4	45.5	91.0	83.6
HUW 484	233.0	260.2	9.3	9.3	48.1	50.2	49.4	48.0	47.2	55.4	68.7	70.1
HUW 485	235.8	260.2	9.6	10.2	46.6	48.2	49.4	50.0	44.7	55.4	70.4	71.2
NW 1038	261.0	265.0	10.0	10.0	50.0	54.5	58.0	45.5	54.5	56.3	81.1	76.2
NW 1043	253.5	256.0	10.0	11.1	45.0	47.2	48.0	45.0	48.0	48.0	72.8	84.4
RW 3448	245.0	255.0	9.9	12.2	44.5	48.2	45.0	42.0	43.1	45.5	81.9	69.5
HUW 206	240.0	250.3	10.6	10.9	44.0	45.5	43.9	40.5	40.5	40.5	89.4	65.4
HP 1731	230.4	240.0	10.3	10.4	47.3	48.0	46.3	44.4	43.8	44.7	61.3	75.3
K 9107	235.0	262.3	11.8	12.0	44.5	50.2	45.0	44.0	43.0	51.3	88.6	72.0
NW 1012	256.0	245.0	8.5	9.3	47.0	44.5	46.0	45.0	48.0	43.0	72.1	67.1
HUW 468	263.3	258.0	9.5	10.2	48.4	46.2	46.2	44.0	52.1	46.3	71.2	75.2
CD at 5%												
V × D		18.3		0.81		3.9		NS		6.4		1.5

1038, RW-3448, HUW-206, K-9107 and NW-1012 was significantly higher under normal sown condition. On the other hand, the straw yield of K-9507, NW-1043, HP-1731 and HUW-468 was significantly higher under late sown condition over normal sown condition (Table 2).

Among the cultivars, K-9507, K-9508, HD-2690, HUW-206, NW-1012 and HUW-468 gave significantly higher net of return under timely sown condition. While under late sown condition HUW-484, HUW-485, HP-1731 and K-9107 gave significantly more net return than timely sown condition. The interactional effect of date of seeding and cultivars failed to significantly influence the benefit : cost ratio. However, under timely sown condition K-9507, K-9508, HD-2690, NW-1038, RW-3448, HUW-206, NW-1012 and HUW-468 gave higher benefit : cost ratio than late sown condition. While, under late sown condition wheat cultivar HUW-484, HUW-485, NW-1043, HP-1731 and K-9107 gave maximum benefit : cost ratio over timely sown crop (Table 3). The findings of present investigation are in close conformity by those already reported by Sharma and Chaudhary (1996).

#### *Effect of Cultivars*

The result of the pooled data revealed that wheat variety K-9107 was the tallest cultivar (106.6 cm) under timely and late sown condition (106.4 cm). However, the difference in plant height among different

cultivars was found not significant. The biomass production rate of wheat cultivar HUW-485 (96.6 kg/ha/per day) found under normal sown condition was statistically at par to HD-2690, NW-1038 and K-9107 but significantly superior to other cultivars. However, under late sown condition (15 December) the highest biomass production rate 95.3 kg/ha/per day was recorded in the cultivar RW-3448, which was statistically at par to HUW-206 (90.6), K-9508 (88.6) and NW-1043 (88.6). Under normal sown condition, the heat unit (growing degree days) of cultivar HD-2690 had the highest value of 1856.0 day degree which, was at par to cultivar HUW-206 (1851.6) where as, under delayed sowing (13 December) the maximum heat unit of 1560.7 day degree was noted in the cultivar NW-1012 which was statistically at par to K-9508 (1550.92 day degree).

Among the genotypes, HUW-468 produced highest number of effective tillers/m<sup>2</sup> (263.3) under normal sown condition. However, HUW-468 was unable to show significant difference with K-9507, HD-2690, NW-1038, NW-1043 and NW-1012, but proved its distinct superiority over other cultivars. On late sowing i.e. 15 December the highest number of effective tillers (265.0) was found in NW-1038 which was at par with all other variety under test except K-9508, HP-1731, NW-1012 which has significantly less number of effective tillers than the former. Under timely sown condition, K-9107 showed significant edge over the other cultivars producing highest spike length (11.8 cm)

**Table 3.** Interaction effect of date of sowing and cultivar on economics of wheat.

Treatment	Net return		Benefit : Cost ratio	
	18 Nov	15 Dec	18 Nov	15 Dec
K 9507	25443	22186	4.54	3.95
K 9508	25463	22881	4.53	4.07
HD 2690	33017	26262	5.88	4.64
HUW 484	25365	30733	4.51	5.47
HUW 485	24073	30636	4.29	5.46
NW 1038	31821	31728	5.67	5.65
NW 1043	26360	27751	4.69	4.94
RW 3448	24469	24339	4.36	4.33
HUW 206	23891	20996	4.25	3.73
HP 1731	22483	24672	4.00	4.39
K 9107	25265	28745	4.50	5.12
NW 1012	26755	22683	4.76	4.04
HUW 468	28868	25664	5.14	4.77
CD at 5% V × D		2101		NS

except only to K-9508 having spike length of 11.2 cm. Under delayed sown condition (15 December) the maximum spike length (12.2 cm) was noted in RW-3448 which was closely followed by K-9107 (12.0 cm) and K-9507 (11.6 cm) but the former showed distinct superiority over rest of the other cultivars. Under timely sown condition, the spike of HD-2690 (50.2) produced maximum grains which were comparable with NW-1038, HUW-468, K-9507, HUW-484, HP-1731, NW-1012 and HUW-485. Under late sown condition, the maximum grain number (54.5) formed in the spike of NW-1038 which was significantly better than all other cultivars under test. The different cultivars failed to show significant differences in case of 1000 grain weight under both date of seeding. However, the wheat cultivars NW-1038 and HUW-485 recorded highest 1000 grain weight under timely and late sown condition, respectively (Table 2).

The cultivar NW-1038 gave the highest yield of

55.51 q/ha and 56.3 q/ha under normal and late sown condition, respectively which was statistically at par to HD-2690 and HUW-468 under normal sown condition while, under late sown condition (15 December) it is at par to HUW-484, HUW-485 and K-9107. In straw yield, HD-2690 and NW 1043 produced the maximum straw yield of 91.0 q/ha and 84.4 q/ha under normal and late sown condition, respectively (Table 2).

On timely seeding i.e. 18 November, HD-2690 showed significant edge over the other cultivars giving highest net return of Rs 33,017/ha except to NW-1038 giving net return of Rs 31,821/ha. Under late sown condition, NW-1038 gave maximum net return Rs 31,728/ha which was at par with HUW-484 Rs 30,733/ha and HUW-485 Rs 30,636/ha but the former proved its distinct superiority over rest of the other cultivars. The different cultivars were unable to show significant difference among themselves in terms of benefit : cost ratio (Table 3). However, The benefit : cost ratio follows the similar trend as of net return. This confirms the finding of Singh and Uttam (1994).

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