

High Fertilizer Input Can Increase the Yield of Late-Planted Wheat

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Higher nitrogen (N) rates along with phosphorus (P) and potassium (K) and other recommended inputs can help overcome the loss in yield potential of late-planted wheat.

The northern states of Punjab, Haryana and Uttar Pradesh (western districts) represent India's granary and contribute greatly to the wheat reserves of the country (Table 1). This

Table 1. Northern states contribution to India's total wheat procurement (million tonnes).

State	1989-90	1992-93	1993-94	1994-95
Punjab	6.74	6.50	7.29	7.29
Haryana	2.60	3.45	3.05	3.10
Uttar Pradesh	1.58	2.13	1.41	1.30
India (Total)	11.07	12.84	11.87	12.31

region, which encompasses the fertile Indo-Gangetic alluvial plain, is capable of producing above average wheat yields (Table 2).

The generalized state fertilizer recommendation for wheat on soils with low to moderate K fertility levels is 120-60-30 kg/ha of N-P₂O₅-K₂O. Regions considered high in K fertility are commonly prescribed a

Table 2. Wheat area, production and yield.

State	Area, '000 ha	Production, '000 tonnes	Yield, kg/ha
Punjab	3,282	12,724	3,877
Haryana	1,991	7,350	3,692
Uttar Pradesh	9,052	22,203	2,453
India (Total)	25,122	62,620	2,493

reduced rate of 120-60-0 kg/ha. The recommendations for correcting deficiencies in sulfur (S) or zinc (Zn) are to apply 250 kg/ha of gypsum or 60 kg/ha of zinc sulfate (ZnSO₄) every two to three years. In northern India, wheat is planted between the last week of October and the second week of November. However, untimely rains and a predominance of small holder farmers commonly delay and over extend the planting period. Sowing wheat during December

or early January results in reduced crop productivity and value. Recommendations for late-sown wheat include early maturing varieties and a reduction in fertilizer application rates to 90-60-30 kg/ha N-P₂O₅-K₂O, or about three-quarters of the originally recommended N rates.

This study evaluated several combinations of higher fertilizer input and other best management practices (BMPs) for the purpose of overcoming low yields in late sown wheat.

Materials and Methods

Field experiments on two varieties of wheat (cv. PBW-138 suited for late-sown conditions and cv. HD-2329, a high yielding variety also often adapted for late-sown conditions) were conducted at Punjab Agricultural University, Ludhiana, for four years. The test soil was a sandy loam Typic Ustochrept low in available N and organic carbon (0.34 percent) and medium in available P (22 kg/ha) and K (136 kg/ha). Wheat was sown late (January 6) using a row spacing of 15 cm, thereby establishing a higher plant population than obtained with the state recommended row spacing of 22.5 cm.



Late-sown wheat with normal recommended rates of fertilizer.



Maximum yield research rates of fertilizer improve growth of late-sown wheat.

Results

Grain yield was progressively increased through combination of higher fertilizer input and 50 percent higher plant densities (Table 3). The real breakthrough was obtained with 150-60-30 or 180-60-30 kg/ha N-P₂O₅-K₂O applied with 5 t/ha of poultry manure, which produced average yields of 4.4 t/ha (cv. PBW-138) and 4.0 t/ha (cv. HD-2329) over four years of study. These yields were 15.9 and 20.0 percent higher, respectively, than average yields obtained with the state recommended practice of reduced fertilizer input and lower plant population.

Poultry manure, a rich source of nutrients, contains 1.0 to 1.5 percent N, 1.4 to 1.8 percent P₂O₅ and 0.8 to 0.9 percent K₂O. Therefore, a rate of 5 t/ha supplies 50 to 75 kg N, 70 to 90 kg P₂O₅ and 40 to 45 kg K₂O/ha. As a result, the application of poultry manure along with higher fertilizer input significantly affects the supply of available nutrients to late-sown wheat. All earlier attempts to consistently boost the productivity of late-sown wheat have failed. It is evident that current state recommendations prescribing reduced fertilizer rates are not justified. Both wheat varieties had higher yields in three of the four years studied with increased inorganic fertilizer alone. The findings of this study will help farmers make better management decisions since 15 to 20 percent of total wheat planting is delayed each year.

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Table 3. Grain yield (t/ha) of two wheat varieties grown under different fertilizer treatments and late-sown conditions (January 6) for four years.

Treatment N-P ₂ O ₅ -K ₂ O kg/ha	Variety PBW-138					Variety HD-2329				
	1993 -94	1994 -95	1995 -96	1996 -97	Mean	1993 -94	1994 -95	1995 -96	1996 -97	Mean
90-60-30	3.7	3.8	3.5	3.6	3.7	3.6	3.2	3.0	2.9	3.2
120-60-30	3.9	4.3	3.8	3.9	4.0	3.7	3.6	3.4	3.5	3.6
150-60-30	4.2	4.3	3.7	3.5	4.0	3.6	3.8	3.3	3.4	3.5
180-60-30	4.2	4.4	3.7	3.5	4.0	3.6	3.9	3.3	3.5	3.6
180-90-45	4.2	4.3	3.8	3.8	4.1	3.6	3.8	3.3	3.4	3.5
150-60-30 + Manure	4.6	4.4	4.3	4.2	4.4	4.2	4.0	3.9	3.9	4.0
180-60-30 + Manure	4.7	4.1	4.4	4.2	4.4	4.3	3.9	3.8	3.8	4.0
C.D. (0.5)	0.3	0.4	0.4	0.2	—	0.2	0.3	0.3	0.3	—