

Table 1. Effect of nitrogen management on yield attributes, yields, economics and nutrient-use efficiency of wheat

Treatment	Ear length (cm)	Ears/m ²	Grains/ear	Test weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Cost of cultivation ($\times 10^3$ ₹/ha)	Net returns ($\times 10^3$ ₹/ha)	Benefit: cost ratio	Apparent nutrient recovery (kg nutrient/kg applied)	Physiological efficiency (kg grain yield/kg nutrient uptake)	Agronomic efficiency (kg grain yield/kg nutrient applied)	Harvest index (%)
T ₁	7.1	172.6	20.6	39.6	1.60	2.24	24.79	5.06	0.20	-	-	-	41.75
T ₂	9.2	314.3	41.3	42.0	5.36	7.85	31.39	69.00	2.20	0.402	37.42	15.03	40.56
T ₃	9.9	367.6	44.0	43.6	5.93	9.18	34.07	77.94	2.29	0.382	30.27	11.56	39.27
T ₄	7.9	199.0	22.6	41.0	1.65	2.58	31.56	-0.40	-0.01	0.028	11.99	0.336	38.96
T ₅	9.8	303.3	38.6	43.0	5.38	8.89	30.03	72.55	2.42	0.432	30.73	13.27	37.72
T ₆	9.5	353.3	39.3	42.5	5.50	8.20	32.97	70.34	2.13	0.390	31.82	12.41	40.14
T ₇	9.0	314.3	38.3	41.3	5.21	7.38	31.27	65.94	2.11	0.461	35.95	16.57	41.37
T ₈	9.3	331.0	37.3	42.0	5.45	8.12	41.39	61.03	1.47	0.29	36.27	10.52	40.18
	0.3	20.4	3.1	0.6	0.06	0.32	0.15	-	0.16	0.06			
	0.9	61.9	9.5	1.9	0.17	0.98	0.47	-	0.49	0.18			

RDF, Recommended dose of fertilizer

nutrient recovery and physiological efficiency were found highest with the RDF, and GreenSeeker-guided N application.

On the basis of experimental findings it may be concluded that application of 150% of recommended dose of fertilizer (225 N + 90 P₂O₅ + 60 K₂O kg/ha) gave the highest yield and net returns and nutrient-use efficiency. Though GreenSeeker-guided nitrogen application saved fertilizer nitrogen (32 kg/ha) without significant reduction in yield than blanket recommendation of recommended dose of fertilizer in wheat 'HD 2967' under agro-climatic condition of Varanasi, eastern Uttar Pradesh. However, 150% NPK enhanced the grain yield, economics and nutrient-use efficiency (AE=13.27) of wheat as compared to rest of the treatments under study. But GreenSeeker-guided N application improved the agronomic efficiency of wheat crop (AE=16.57).

REFERENCES

- Adhikari, C., Bronson, K.F., Panuallah, G.M., Regmi, A.P., Saha, P.K., Dobermann, A. and Pasuquin, E. 1999. On-farm soil N supply and N nutrition in the rice-wheat system of Nepal and Bangladesh. *Field Crops Research* **64**(3): 273–286.
- Doberman, A. and Fairhurst, T. 2000. *Rice: Nutrient Disorders and Nutrient Management*. IRRI and PPI & PPIC, Makati City and Singapore.
- Dobermann, A., Witt, C., Abdurachman, S., Gines, H.C., Nagarajan, R., Son, T.T. and Phung, C.V. 2003. Soil fertility and indigenous nutrient supply in irrigated rice domains of Asia. *Agronomy Journal* **95**(4): 913–923.
- Gomez, K.A., Gomez, K.A. and Gomez, A.A. 1984. *Statistical Procedures for Agricultural Research*. John Wiley & Sons.
- Mohanty, S.K., Singh, A.K., Jat, S.L., Parihar, C.M., Pooniya, V., Sharma, S. and Singh, B. 2015. Precision nitrogen-management practices influences growth and yield of wheat (*Triticum aestivum*) under conservation agriculture. *Indian Journal of Agronomy* **60**(4): 617–621.
- Pathak, H., Aggarwal, P.K., Roetter, R., Kalra, N., Bandyopadhyaya, S.K., Prasad, S. and Van Keulen, H. 2003. Modelling the quantitative evaluation of soil nutrient supply, nutrient use efficiency, and fertilizer requirements of wheat in India. *Nutrient Cycling in Agroecosystems* **65**(2): 105–113.
- Raun, W.R. and Johnson, G.V. 1999. Improving nitrogen use efficiency for cereal production. *Agronomy Journal* **91**(3): 357–363.
- Raun, W.R., Solie, J.B., Johnson, G.V., Stone, M.L., Mullen, R.W., Freeman, K.W. and Lukina, E.V. 2002. Improving nitrogen use efficiency in cereal grain production with optical sensing and variable rate application. *Agronomy Journal* **94**(4): 815–820.
- Rouse, J.W. 1974. Monitoring the vernal advancement of retrogradation of natural vegetation. *NASA/GSFC, type III, Final Report, Greenbelt, MD*, 371.
- Singh, B. 2014. Site specific and need based management of nitrogen fertilizers in cereals in India. *Advances in Fertilizer*

- Technology: Biofertilizers*, vol 2, pp. 576–605. Studium Press LLC, New Delhi, India.
- Singh, B., Sharma, R.K., Kaur, Jaspreet, Jat, M.L., Martin, K.L., Singh, Yadvinder, Singh Varinderpal, Parvesh, C., Choudhary, O.P., Gupta, R.K., Thind, H.S., Singh, Jagmohan, Uppal, H.S., Khurana, H. S., Kumar, Ajay, Uppal, R.K., Monika, Vashistha, Raun, W.R. and Gupta, R. 2011. Assessment of the nitrogen management strategy using an optical sensor for irrigated wheat. *Agronomy for Sustainable Development* **31**: 589–603.
- Sadhukhan, R., Bohra, J.S. and Choudhury, S. 2018. Effect of fertility levels and cow urine foliar spray on growth and yield of wheat. *International Journal of Current Microbiology and Applied Sciences* **7**(3): 907–912.
- Sapkota, T.B., Majumder, K., Jat, M.L., Kumar, A., Bishnoi, D.K., McDonald, A.J. and Pampolino, M. 2014. Precision nutrient management in conservation agriculture based wheat production of Northwest India: Profitability, nutrient use efficiency and environmental footprint. *Field Crops Research* **155**: 233–244.