Int.J.Curr.Microbiol.App.Sci (2019) *8*(2): 2265-2269

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 02 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.802.263

Precision Nutrient Management in Wheat using Nutrient Expert

Mukesh Kumar* and Bhagat Singh

Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana, 125004, India

**Corresponding author*

Keywords

Wheat, Nutrient Expert, RDF and grain yield

Article Info

Accepted:
18 January 2019
Available Online:
10 February 2019

A B S T R A C T

Nutrient management has played a main role in achieving self-sufficiency in food grain production. A field experiment was conducted during *Rabi* 2016-17 and 2017-18 to evaluate nutrient requirement of wheat using Nutrient Expert Model (NE is a simple computer based decision support system or delivery tool developed by IPNI [International Plant Nutrition Institute] that can rapidly provide nutrient recommendations for N, P and K for crops). The experiment was conducted in Randomized Block Design replicated thrice at Wheat and Barley Research area, CCS HAU, Hisar, Haryana. Seven treatments executed were absolute control (without NPK), Recommended dose of fertilizer (RDF; 150 kg N/ha, 60 kg P_2O_5/ha and 40 kg K_2O/ha), 150% RDF, 150% PK, 150% NK, 150% NP and compared with NE (Nutrient Expert Recommendation).Based on pooled two years data 2016-17 and 2017-18, experiment revealed that the highest grain yield (61.27 q/ha) was recorded when 150% recommended dose of fertiliser was applied which was significantly higher than other treatments except when fertiliser was applied on the basis of nutrient expert model (58.80 q/ha). Similarly, the maximum biological yield (146.22 q/ha) was obtained from 150% RDF followed by NE (145.67 q/ha). Minimum grain and biological yield was recorded from absolute control treatment which was without fertilizer application. Maximum number of effective tillers/m^2 (428) and plant height (101.4 cm) were also recorded when 150% recommended dose of fertiliser was applied. Boldest grain was produced by control (no fertilizer; 41.06 g) treatment. Maximum number of grains per ear head (38.89) was recorded from 150% NK treatment. Lowest grain yield (41.06 q/ha) was recorded from control (no fertilizer) followed by application of 150% recommended dose of phosphorus and potash without nitrogen. Nutrient Expert based practices produced higher productivity in comparison to recommended dose of fertilizer. Nutrient expert significantly reduced N fertilizer input while maintain higher yield when compared with 150% RDF. The application of fertilizers on the basis of recommendation of decision support system "Nutrient expert" proved satisfactory.

Introduction

Wheat is the second most important cereal crop next to rice in Asia. Wheat is grown on about 29.72mha in India with production of 98.61mt in 2017-18 and an average yield of 3318 kg/ha (ICAR-IIWBR, 2018). There are considerable yield gaps between the major wheat-growing states in the country with highest yield recorded in Punjab (5032 kg/ha)

and lowest in Chhattisgarh (933kg/ha). The need for precise management of N fertilizer in wheat for both economic and environmental prospective. Static fertilizer recommendations based on average response lead to excessive and inadequate fertilizers with high N losses. Inappropriate nutrient management is one of the major factors causing such yields gap (Majumdar *et al.*, 2013). In addition, considerable yield gaps exist (Ladha *et al.*, 2003) between researcher-managed optimum NPK plots and farmers' fertilizer practices, indicating an opportunity for increasing wheat productivity through improved nutrient management practices.

Plant nutrient plays very important role in the production of the crop as well as for the environment. Asian agriculture is characterized by small land holdings for cultivation with high variability in plant nutrient availability between different fields. Site specific nutrient management (SSNM), integrates information from different scales to make field specific decisions on N P K management. SSNM is a set of nutrient management principles that aims to supply a crop's nutrient requirements tailored to a specific field and for a location specific environment. Its purpose is to account for indigenous nutrient sources, including crop residues and manures; and apply fertilizer at optimal rates and at critical growth stages to meet the deficit between the nutrient needs of a high-yielding crop and the indigenous nutrient supply.

Nutrient Expert (NE) for Wheat is a new nutrient decision support system tool, based on the principles of SSNM and recommends balanced application of nutrients based on crop need. NE is based on the principles of SSNM developed for rice (Dobermann and Witt, 2004) and later adapted in maize and wheat. The tool was a joint development of wheat stakeholders in India including representatives from national research and extension system, private industries, International Maize and Wheat Improvement Centre (CIMMYT), and International Plant Nutrition Institute (IPNI). It enables crop advisers to rapidly develop field-specific nutrient recommendations for wheat using existing site information. A user-friendly nutrient decision support tool that enables researchers, extension specialist and industry agronomists to quickly develop field specific fertilizer recommendations for wheat. Nutrient Expert considers the most important factors affecting nutrient management recommendations in a particular field and enables crop advisers to provide fertilizer guidelines that are suited to their farming conditions. The tool uses a systematic approach of capturing site specific information that is important for developing a location-specific recommendation. Nutrient Expert does not require a lot of data nor very detailed information as in the case of many sophisticated nutrient decision support tools and models, which could overwhelm the user. It allows users to draw the required information from their own experience, the farmers' knowledge of the local region, and the farmers' practices. Nutrient Expert can use experimental field data, but it can also estimate the required SSNM parameters using existing location information.

Materials and Methods

A field experiment was carried out during the *Rabi* season of 2016-17 and 2017-18 at Research Farm, Wheat & Barley Section, Department of Genetics & Plant breeding, CCS HAU, Hisar, Haryana (India) situated at 29°10' N latitude and 75° 46' E longitude at an elevation of 215.2 m above mean sea level. The soil of experimental site was sandy loam in texture, having a pH 7.9, electrical conductivity 0.27 dS/m, low organic carbon 0.27 per cent, available low N 126 kg/ha,

available medium P 12.3 kg/ha and K 328 kg/ha. The experiment was laid out in Randomised Block Design with seven treatments replicated thrice. Seven treatments was absolute control (without NPK), Recommended dose of fertilizer (150 kg N/ha, 60 kg P_2O_5/ha and 40 kg K_2O/ha), 150% RDF, 150% PK, 150% NK, 150% NP and compared with NE (Nutrient Expert Recommendation). The basal fertilizers in all the treatments including all the P and K fertilizers and 1/3 N fertilizer were applied before wheat sowing, remaining the 2/3 dose of N fertilizer was applied as top-dressed in two splits, 1/3 at the time of first irrigation and 1/3rd at second irrigation as per different treatments. Nutrient expert recommendation dose for wheat was 200 kg N/ha, 71 kg P_2O_5/ha and 75 kg K_2O/ha. To carry out the experiment the land preparation operation *viz.* pre sowing irrigation, plowing and levelling were done. Wheat variety, WH 1105 was sown at a row spacing of 20 cm manually on 14th November, 2016 during first year and on 10th November, 2017 during second year. Other management practices including irrigation, weeding and hoeing was adopted as per package and practices of wheat crop. Yield attributing parameters were recorded at the time of harvest. Five plants were selected randomly from each treatment to record the observations of yield attributing characters. The crop was harvested on 10th April, 2017 and 17th April, 2018 during first and second year, respectively. The data were analysed using appropriate analysis of variance (ANOVA). OPSTAT software was used to carry out statistical analysis.

Results and Discussion

Growth studies

Plant height

Pooled means of two year data 2016-17 and 2017-18 revealed that the plant height was significantly higher (101.4 cm) in T_3 (150% RDF) treatment over control, RDF and 150% PK treatment but statistically at par with 150% NK, 150% NP and nutrient expert treatment (Table 1). Minimum plant height was recorded in absolutely control treatment. The plant height was maximum in 150% RDF treatment because of higher levels of NPK fertilisers, which provide NPK levels in adequate proportion resulted in increased crop growth. It may be due to the fact that NPK are the major nutrients being the important constituents of chlorophyll, nucleotides, nucleic acid, enzymes, protein, phospholipids, osmotic and ionic regulation, which takes part in various metabolic processes of plant, it increase cell size and cell number by converting the carbohydrates into protoplasm. So, NPK applications were able to cause considerable positive in growth. Plant height in control *i.e.* 0 kg N/ha was reduced significantly than increased doses of nitrogen might be because of under nourishment of the plant because of low availability of nutrients as no nitrogen was applied in this treatment (Mukesh and Pannu, 2014).

Yield attributes and yield

Pooled results of experiment during 2016-17 and 2017-18 data (Table 1) pertained that maximum number of effective tillers/m^2 (428) were also recorded when 150% recommended dose of fertiliser was applied, which was significantly superior than other treatments but statistically at par with nutrient expert treatment (410) and 150% NK treatment (406). Absolutely control treatment produced significantly lower number of effective tillers than all other nutritional treatments. Boldest grain was recorded from absolute control (no fertilizer; 41.06 g) treatment. Grains/ear head was not affected significantly by different nutrient management treatment; however, it was numerically higher (38.89) in 150% NK treatment.

Table.1 Effect of nutrient management practices on yield attributes and yield of wheat (pooled data of 2016-17 and 2017-18)

Treatments	Plant height (cm)	Effective tillers m^{-2}	Grains earhead^{-1}	1000-grain weight (g)	Grain yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest index (%)
T_1- Absolute Control	82.8	228	35.67	41.06	32.09	85.15	37.85
T_2- RDF*	96.5	397	37.75	38.18	56.88	140.41	40.47
T_3- 150% RDF	101.4	428	38.60	37.28	61.27	146.22	41.97
T_4- 150% PK	92.7	300	35.24	40.83	43.01	112.23	38.30
T_5- 150% NK	100.0	395	38.89	36.51	55.47	141.15	39.30
T_6- 150% NP	100.8	406	38.38	35.50	54.66	139.45	39.21
T_7- Nutrient expert**	100.3	410	37.63	38.30	58.80	145.67	40.39
LSD (P=0.05)	**2.55**	**24.61**	**NS**	**2.01**	**4.12**	**8.69**	**0.97**
SE(m)±	**0.82**	**7.90**	**1.14**	**0.65**	**1.32**	**2.79**	**0.31**

*Recommended dose of fertiliser (RDF: 150 kg N/ha, 60 kg P_2O_5/ha and 40 kg K_2O/ha)
**Nutrient expert- 200 kg N/ha, 71 kg P_2O_5/ha and 75 kg K_2O/ha

Based on pooled two years data 2016-17 and 2017-18, experiment revealed that the highest grain yield (61.27 q/ha) was recorded when 150% recommended dose of fertiliser was applied which was significantly higher than other treatments except when fertiliser was applied on the basis of nutrient expert model (58.80 q/ha). Similarly, the maximum biological yield (146.22 q/ha) was obtained from 150% RDF followed by NE (145.67 q/ha). Minimum grain and biological yield was recorded from absolute control treatment which was without fertilizer application. Nutrient expert treatment produced 45.4, 3.3, 26.9, 5.7 and 7.0% higher grain yield than absolutely control, RDF, 150% PK, 150% NK and 150% NP treatment. High nitrogen availability plays vital role in cell division or high no. of effective tiller/m^2 (Shrestha *et al.*, 2016).Number of tillers per/m^2, plant height, 1000-grain weight and grain yield were significantly increased by increasing the nitrogen levels over control (Ali *et al.*, 2011). The increase in grain and straw yield with increased doses of fertilisers might be due to improvement in growth, yield attributed characters and higher photosynthetic activity (Kumar *et al.*, 2017).Nitrogen application displayed significant effect on plant height, total dry matter production, test weight and grain yield. Plant height, grains number per ear head, biological yield and grain yield were increased with increasing N level (Soleimanzadeh *et al.*, 2013). Plant height, number of tillers m^{-2}, 1000-grain weight, grain yield, biological yield and harvest index were highest at higher level of nitrogen (Iqbal *et al.*, 2012). Increasing nitrogen fertilizer rates resulted in significant increase in plant height, number of grain/spike, number of spikes/m^2, 1000 grain weight, grain yield and biological yield. Nutrient Expert based practices produced higher productivity in comparison with recommended dose of fertilizer. Nutrient expert significantly reduced N fertilizer input while maintain higher yield when compared with 150% RDF.

Based on two years 2016-17 and 2017-18 data experiment concluded that the highest grain yield (61.27 q/ha) was recorded when 150% recommended dose of fertiliser was applied which was significantly higher than other treatments except when fertiliser was applied on the basis of nutrient expert model (58.80 q/ha). Nutrient Expert based practices produced higher productivity in comparison to recommended dose of fertilizer. Nutrient

expert significantly reduced N fertilizer input while maintain higher yield when compared with 150% RDF. Experiment indicates that production can be increased with the use of nutrient expert in Wheat.

References

Dobermann, A. and Witt, C. 2004. In: A. Dobermann, C. Witt, D. Dawe. (Eds.), Increasing productivity of intensive rice systems through site-specific nutrient management. Enfield, NH (USA) and Los Baños (Philippines): Science Publishers, Inc., and International Rice Research Institute (IRRI), pp. 75-100.

Ali, A., Ahmad, A., Syed, W.H., Khaliq, T., Asif, M., Aziz, M. and Mubeen M .2011. Effects of nitrogen on growth and yield components of wheat. *Science International (Lahore).*23 (4): 331-332.

ICAR-IIWBR. 2018. Director's report of AICRP on Wheat and Barley.2017-18, Ed: G.P. Singh. ICAR-Indian Institute of Wheat and barley Research, Karnal, Haryana, India. Pp. 94.

Kumar, M., Pannu, R.K. and Singh, B. 2017. Response of irrigation frequencies and nitrogen doses on yield and yield attributes of late sown wheat. *Annals of Biology*.33 (1): 69-73.

Ladha, J.K., Dawe, D., Pathak, H., Padre, A.T., Yadav, R.L., Singh, B., Singh, Y., Singh, P., Kundu, A.L., Sakal, R., Ram, N., Ragmi, A.P., Gami, S.K., Bandari, A.L., Amin, R., Yadav, C.R., Battarai, E.M., Das, S., Aggarwal, H.P., Gupta, R.K. and Hobbs, P.R. 2003. How extensive are yield declines in long-term rice-wheat experiments in Asia? *Field Crops Research*. 81: 159-180.

Majumdar, K., Jat, M.L., Pampolino, M., Dutta, S. and Kumar, A. 2013. Nutrient management in wheat: current scenario, improved strategies and future research needs in India. *Journal of Wheat Research*. 4: 1-10.

Mukesh and Pannu, R.K. 2014. Effect of irrigation and nitrogen levels on growth and yield of late sown wheat. *Haryana Journal of Agronomy*. 30 (2): 119-124.

Shrestha A, Gupta G. and Subedi R. 2016. Evaluation of improved nutrient management practice in yield of rice in Jhapa District. *International Journal of Research in Applied Natural and Social Sciences.* 4(3): 67-74.

Soleimanzadeh, H. and Gooshchi, F. 2013. Effects of azotobacter and nitrogen chemical fertilizer on yield and yield components of wheat (*Triticum aestivum* L.). *World Applied Sciences.* 21(8): 1176-1180.

How to cite this article:

Mukesh Kumar and Bhagat Singh. 2019. Precision Nutrient Management in Wheat using Nutrient Expert. *Int.J.Curr.Microbiol.App.Sci.* 8(02): 2265-2269.
doi: https://doi.org/10.20546/ijcmas.2019.802.263