

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.907.179>

Effect of Fertilizers and Foliar Application of Nutrient on Wheat (*Triticum aestivum* L.) Grain Yield through conduct on Farm Trails at Farmers Fields

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ABSTRACT

Keywords

Conduct OFT
Wheat, Fertilizer
application,
18:18:18 NPK,
Technology
dissemination,
Yield and
Economics

Article Info

Accepted:

14 June 2020

Available Online:

10 July 2020

The field experiment on farm trial (OFT) was conducted on effect of balanced fertilizers doses of fertilizers and foliar spray of nitrogen, phosphorus and potassium on grain yield of Wheat during the Rabi season of the year 2013-14 in order to develop fertilizer prescriptions for the desired yield targets treatments viz., farmers practice, recommended fertilizers –RDF (Balanced fertilizers) and RDF +18:18:18 NPK 1% foliar application at flowering stage. In this experiment application of chemical balanced fertilizers -RDF +18:18:18 NPK 1% foliar spray application increased 09.63 per cent in economic yield than the farmers practice during the year. The net return also showed increase of Rs. 6275/- ha⁻¹ under chemical balanced fertilizers -RDF +18:18:18 NPK 1% foliar spray application than farmer practices during the year. Application of 18:18:18 NPK 1% spray at flowering recorded maximum yield (6260 kg ha⁻¹), higher net return (6275 Rs. ha⁻¹) with benefit cost ratio of 2.39.

Introduction

Wheat (*Triticum aestivum* L.) is the most important food grain crop cultivated Rabi season crop grown in the tropics and subtropics despite the relatively high temperature that occur during the growth cycle. Heat stress is an important constraint to wheat productivity affecting growth stages specially anthesis and grain filling. It has already been established that heat stress is significant factor in reducing the yield and

quality of grains and it is a major challenge to wheat productivity in India. The current problem of wheat contributing in low yield is the use of old technology like unawareness about the efficient method and time of application of fertilizer etc. In Rajasthan, it has occupied an area of 3050235 hectare (average of 2012-13 to 2016-17) with annual production of 11280500 tonnes and average productivity is 3698 kg ha⁻¹. It is grown in all parts of Rajasthan but major area has been covered by district Sriganganagar,

Hanumangarh, Alwar, Bharatpur, Jaipur, Bundi, Baran, Kota and Chittorgarh. The average productivity of wheat in Rajasthan ranged between 1282 kg ha⁻¹ in district Jaisalmer and 4102 kg ha⁻¹ in district Bharatpur with the state average of 3698 kg ha⁻¹ (Anonymous 2017-18). The average of last five years Wheat in Chittorgarh district was 153564 hectare area with annual production of 625979 tonnes and productivity 4076 Kg ha⁻¹ in year ending 2016-17, respectively. This district has greater potential of Wheat production due to favourable climatic and soil condition. Balanced and Foliar fertilization has become an established technology to enhance yield and improve quality of crop production. It also improves nutrient utilization and lower environmental pollution through reducing the amount of fertilizers added to soil especially wheat (Yaseen *et al.*, 2011). The efficacy of foliar fertilization is higher than that of soil fertilizer application under drought and salinity situations. The reasons for this are because of the supply of the required nutrient directly to the location of demand in the leaves and its relatively quick absorption (e.g. 0.5-2.0 h for N and 10-24 h for K), and the independence of root activity and soil water availability (Romheld and El-Fouly, 1999). Commercial fertilizers when applied during the period of low soil moisture are rapidly absorbed through foliage and enhance crop yield and quality (Smith *et al.*, 1992). The judicious use of inorganic fertilizers can increase grain yield by 30-40 percent (Maqsood, *et al.*, 1999). The N, P and K are major plant food nutrients and most of soils are deficient in these nutrients (Tahir, 1980). Adequate nitrogen must be supplied to crop during growing season for achieving their full yield potential (Angus *et al.*, 1998). Phosphorus counter balances the effect of excessive nitrogen by hastening plant maturity, improving grain quality and retarding excessive vegetative growth. It is also

involved in many metabolic activities and if soil is deficient in phosphorus, the response of crop to nitrogen would be reduced (Senigaglia *et al.*, 1983). At early growth stages, foliar fertilization could increase P and K supplies at a time when the root system is not well developed (Mallarino *et al.*, 2001). The foliar application of nutrients is more effective as compared to soil applied nutrients because of effective utilization by plant and minimum cost per unit area (Narang *et al.*, 1997). Foliar application is credited with the advantage of quick and efficient utilization of nutrients, elimination of losses through leaching, fixation and regulating the uptake of nutrients by plant (Manonmani and Srimathi, 2009).

Foliar applications of macro -nutrients are more effective in term of getting maximum yield and reduce losses. In the present investigation, the crop was free from any biotic stresses. Foliar application of water soluble fertilizer is an effective method and there is a need to supplement wheat crop with proper nutrients supply in a balanced way. A liquid fertilizer is ideally suited to supply the nutrients through foliar application to help mitigate heat stress management. Application of inorganic spray will also enhance the nutrient availability and in turn increase the productivity. Nutrients play a pivotal role in increasing yield. Foliar application of major and minor nutrients like NPK shall be more effective than soil application and also avoiding the depletion of these nutrients in leaves, thereby resulting in an increased photosynthetic rate, better translocation of these nutrients from the leaves to the developing grains (Basant *et al.*, 2020). The present study was conducted with the objectives to determine and demonstrate the effect of balanced fertilizers and foliar application of nutrients on grain yield of wheat through conduct on farm trial at farmer's fields.

Materials and Methods

An on farm testing (OFT) was conducted at the locations in Tie, taluka of Nibaheda district of Rajasthan state during 2013-14. Wheat cv.Raj.-4037 was grown under the irrigated conditions. Soils of the experimental sites were tested and rated as per the data given in Table 1. In general the soils were neutral in reaction. Organic carbon content was found low in all the locations. Available phosphorus under medium rating and available potassium status of the soil was estimated as medium to high. In all the locations the average availability of phosphorus and potassium were medium, respectively. Generally farmers were utilizing more only NP fertilizers than recommendation but not use balanced, proper method and time, which resulted into high cost of cultivation and also affected the soil health. Therefore the treatments were RDF + 18:18:18 NPK 1% foliar spray application compared in these trials in order to check the performance of existing production farmers practices with the RDF- 120 Kg N₂ + 40 kg P₂O₅ + 30 Kg K₂O ha⁻¹ + 18:18:18 NPK 1% foliar spray (Foliar spray were applied at flowering stage of wheat crop) application technique. The details of the treatment are given in Table 2.

Liquid mix 18:18:18 (NPK)

18-18-18 mix is a balanced liquid N-P-K fertilizer, suitable for all crops, during all stages of plant growth. 18-18-18 mix liquid fertilizer provides an additional source of nitrogen, phosphorous and potassium during the growing season. 18-18-18 mix NPK liquid fertilizer is in the form readily absorbed by plant tissue. 18-18-18 mix NPK is manufactured by utilizing quality raw materials to provide a very ergonomically efficient source of N-P-K. The quality of the raw materials used to formulate 18-18-18 mix

NPK maximized plant nutrient solubility. The average yield of OFT treatments and farmer practice has been taken in the year for interpretation of the results. The economic-parameters (gross return, net return and B: C ratio) were worked out on the basis of prevailing market prices of inputs and minimum support prices of outputs.

Results and Discussion

The results presented in **Table 3** revealed that Wheat yields were influenced due to different treatments. The increasing trend in yield was observed under different treatment. Treatment T₃- RDF – 120Kg N₂ + 40 kg P₂O₅ + 30 Kg K₂O ha⁻¹ (Whole P + 1/3 N as basal & remaining N as two split at 25 & 45 DAS + 18:18:18 NPK 1% foliar spray (Foliar spray were applied at flowering stage of wheat crop) recorded highest yield of Wheat (62.60 q ha⁻¹) as compared to treatment T₂-120Kg N₂ + 40 kgP₂O₅+ 30 Kg K₂O ha⁻¹ (RDF) Whole P + 1/2 N as basal & remaining 1/2 N at 25 DAS (61.30 q ha⁻¹) than T₁- Farmers practice (100 kg N + 40 kg P₂O₅ ha⁻¹) were recorded (57.10 q ha⁻¹) respectively-. It was observed that farmers practice (T₁) recorded lower yield than that of recorded under existing recommended practices (RDF). Similar findings of our studies are in line with by Kirar *et al.*, (2006) and Muhammad *et al.*, (2006), reported that by the use of foliar application all respects of wheat crop found very significant.

The balanced fertilizers application of treatment T₃- 120 Kg N₂ + 40 kg P₂O₅ + 30 Kg K₂O ha⁻¹ + 18:18:18 NPK 1% foliar spray at flowering stage recorded higher yield to the tune of 2.12 and 09.63 per cent, over treatment T₂ - (120 Kg N₂ + 40 kg P₂O₅ + 30 Kg K₂O ha⁻¹) and T₁ (Farmers practice -100 kg N + 40 kg P₂O₅ ha⁻¹) respectively. With regards to economics, again T₃-120 Kg N₂ + 40 kg P₂O₅ + 30 Kg K₂O ha⁻¹ + 18:18:18 NPK

1% foliar spray at flowering stage treatment recorded maximum gross monetary return (Rs. 90720 ha⁻¹), net return (Rs. 63970 ha⁻¹)

and B: C ratio (2.39) as compared to treatment T₂ and T₁.

Table.1 Soil nutrient of selected location (Average) for conduct OFT

S.No.	Parameters	Result	Category
1	pH	7.94	Normal
2	Electrical Conductivity (dSm ⁻¹)	0.33	Normal
3	Available P (Kg ha ⁻¹)	28.0	Medium
4	Available K (kg ha ⁻¹)	316.0	Medium
5	Organic carbon (%)	0.48	Low

Table.2 Treatment details of conduct on farm trail at farmers fields

S.No.	Treatments	Treatment details
1	T ₁ -Farmer's Practices	Farmers practice (100 kg N + 40 kg P ₂ O ₅ ha ⁻¹ .)
2	T ₂ -Recommended dose of fertilizers(RDF)	120 Kg N ₂ + 40 kg P ₂ O ₅ + 30 Kg K ₂ O ha ⁻¹ (RDF) Whole P +1/2 N as basal & remaining ½ N at 25 DAS
3	T ₃ - Recommended dose of fertilizers + Refinement treatment use foliar spray 18 :18 :18 NPK 1%	120 Kg N ₂ + 40 kg P ₂ O ₅ + 30 Kg K ₂ O ha ⁻¹ (Whole P + 1/3 N as basal & remaining N as two split at 25 & 45 DAS) +18 :18 :18 NPK 1% spray use at flowering stage

Table.3 Yield and economics as influence by different treatments of OFT

S.No.	Treatments	Wheat Yield q ha ⁻¹	Cost of Cultivation (Rs.) ha ⁻¹	Gross Return (Rs) ha ⁻¹	Net Returns (Rs.) ha ⁻¹	B:C Ratio
1	T ₁ - Farmers practice (100 kg N + 40 kg P ₂ O ₅ ha ⁻¹ .)	57.10	25190	82825	57695	2.29
2	T ₂ -120 Kg N ₂ + 40 kg P ₂ O ₅ + 30 Kg K ₂ O ha ⁻¹ (RDF)	61.30	26400	88925	62585	2.37
3	T ₃ - 120 Kg N ₂ + 40 kg P ₂ O ₅ + 30 Kg K ₂ O ha ⁻¹ + 18:18:18 NPK 1% foliar spray at flowering stage	62.60	26750	90720	63970	2.39

In conclusion it may be concluded that the yield and returns in Wheat crop increased

substantially with the improved production technologies. However, the yield level under

OFT refinement treatment was better than the farmer practice and performance of these varieties could be further improved by adopting recommended production technologies. So, there is need to disseminate the improved technologies among the farmers with effective extension methods like conduct on farm trail demonstrations. The farmers should be encouraged to adopt the recommended balanced fertilizers-techniques for getting maximum returns in specific locations. Thus, it was clearly showed that the OFT of Wheat with full RDF package + applied 18:18:18 NPK 1% foliar spray was better to farmer's practices. The results indicated that the OFT treatment has given a good impact on the farming community of the district Chittorgarh (Rajasthan) as they were motivated by the new agricultural technology applied in the OFT plots. Similar findings were reported by Kirar *et al.*, (2006). Foliar spray of 1% soluble NPK, 1% DAP, 0.5% KCl and 1% urea at tillering and flowering stages enhance the grain yield of wheat and found economical also. Therefore, the use of these fertilizers may be promoted at farmer's fields for augmenting the Wheat production in Rajasthan. The maximum gross monetary return of Rs 90720 ha⁻¹ and benefit: cost ratio of 2.39 was obtained. Therefore it is clear from the full recommendation dose fertilizers and applied 18:18:18 NPK 1% foliar spray at flowering stage performed better, enhance the wheat productivity as compared to other treatment.

Acknowledgement

I am sincerely thankful to all the farmers on whose field OFT were conducted. The financial assistance provided by Indian Council for Agricultural Research, New Delhi and Director, ICAR –Agricultural Application Research Institute (ATRI), Zone- II,, Jodhpur (Rajasthan) India. The opinions expressed in this paper are the author's own and do not

necessarily reflect the views of the donor or the authors' institution.

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How to cite this article:

Ratan Lal Solanki, Priyanka Swami, K. C. Nagar and Dashora, A. K. 2020. Effect of Fertilizers and Foliar Application of Nutrient on Wheat (*Triticum aestivum* L.) Grain Yield through conduct on Farm Trails at Farmers Fields. *Int.J.Curr.Microbiol.App.Sci.* 9(07): 1551-1556. doi: <https://doi.org/10.20546/ijcmas.2020.907.179>