International Journal of Plant & Soil Science

Volume 34, Issue 24, Page 317-322, 2022; Article no.IJPSS.93580
ISSN: 2320-7035

Effect of Front Line Demonstration on Integrated Nutrient Management of Soil Fertility in Wheat Crop in Eastern Part of Uttar Pradesh, India

D. P. Singh [a++*], V. Chandra [a#] and Abhishek Govind Rao [a‡]

[a] *NICRA Project, Krishi Vigyan Kendra, (ANDUAT), Basuli, Mahrajganj (U.P.), India.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2022/v34i242645

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/93580

Original Research Article

Received: 15/10/2022
Accepted: 23/12/2022
Published: 26/12/2022

ABSTRACT

A field experiment was carried out during the rabi season of 2020-21 and 2021-22 at Krishi Vigyan Kendra (ANDUAT), Mahrajganj. The study is Frontline Demonstration at adopted farmers' field in six blocks viz. Sadar, Siswa Bazar, Meethora, Laxmipur.Ghughali and Nichlol of Mahrajganj, U.P, India. A total of 110 participating and 110 non-participating farmers from 10 representative villages were selected through stratified random sampling method to evaluate the different levels of INM on soil fertility of wheat. The experiment was comprising sixteen treatments viz. T1- control, T2- 100%RDF, T3- 100%RDF+S+Zn, T4- 100% R.D.F. + S + Zn + bio-fertilizer (Azotobactor+ P.S.B.), T5- 100% R.D.F. + 25% N through F.Y.M. + S, T6- 100% R.D.F. + 25% N through F.Y.M. + S + Zn, T7-100% R.D.F. + 25% N through F.Y.M. + S + Zn + bio-fertilizer (Azotobactor+ P.S.B.), T8- 100% R.D.F. + 25% N through vermi compost + S+Zn + bio-fertilizer (Azotobactor+ P.S.B.), Integration of organic manures showed slight increase in EC value while inorganic fertilizers

[++] *Senior Scientist & Head;*
[#] *Senior Scientist;*
[‡] *Young Professional;*
**Corresponding author: E-mail: kvkmahrajganj2019@gmail.com;*

showed slight decrease in EC values in comparison to its initial value which is obviously due to decomposition of organic matter in soil. Maximum increase in organic carbon content was noted with the integration of organic treatments followed by inorganic treatments. It could be due to organic matter decomposition and mineralization caused by a low C: N ratio. During both years, the status of N, P, K,S, and Zn increased slightly in all treatments when compared to their initial values, with the exception of the control. Maximum increase in available status of N, P, K, S and Zn was recorded with integration of inorganic, organic and bio-fertilizers with 100% RDF.T_{11} (100 % R.D.F. + 25% N through vermicompost+S + Zn + bio-fertilizer (*Azotobactor*+P.S.B.) followed by T_9 (100% R.D.F. + 25% N through F.Y.M. + S + Zn+bio-fertilizer (*Azotobactor*+P.S.B.) and minimum at control (T_1) during both the years. Maximum microbial population was recorded with T_{11} (100% R.D.F. + 25% N through vermicompost+S + Zn + bio-fertilizers (*Azotobactor*+P.S.B.) followed by T_7 (100% R.D.F. + 25% N through F.Y.M. + S + Zn+bio-fertilizers (*Azotobactor*+P.S.B.) and minimum at control during both the years.

Keywords: Wheat yield; organic and inorganic fertilizers; RDF; bio-fertizers.

1. INTRODUCTION

"Wheat (*Triticum aestivum* L.) is one of the most important cereal crops of the world. Among the world's most important food grains, it ranks next to rice. It is eaten in various forms by more than one billion in the world. In India, wheat cultivated on 29.6 m ha area with 93.5 m tonnes of production and 31.5 q/ha of average productivity" (FAO, 2013). "In Uttar Pradesh, it is grown on 9.73 m ha area with production 30.3 m tons and productivity of 31.14 q/ ha" (Anonymous, 2013). "The requirement of wheat will be around 109 million tonnes for feeding the 1.25 billion populations by 2020 AD" (Singh, 2010). "Organic matter like FYM has supplied available nutrients to the plants provided favourable soil environment and increase water holding capacity of soil for longer time. Application of Farm yard Manure helps to increase the DMP, yield and nutrient uptake by wheat" [1]. "The soil incorporation of mustard/taramira + FYM and FYM at 10 t ha-1significantly increased grain yield of wheat across the years" (Regar et al.,2005). The study also reported that "soil density undergoes greater reduction with the use of FYM than chemical fertilizers. Application of FYM @ 10 and 20 tonnes / ha increased the grain yield and the total N P and K uptake in wheat crop" [2]. "Organic manure such as farm yard manure, vermin-compost, crop residues, biofertilizer, green manure and chemical fertilizer are considered to be an integral component of integrated nutrient management and may help to recover soil health in cropping system [3,4]. As they improve soil fertility and physical properties such as soil structure, aeration, porosity, infiltration rate and water holding capacity and decrease soil crusting, organic matter in soil improve physical condition of the soil for better performance of micro-organism and physical status of soil . Organic matter affects crop growth and yields either directly supplying nutrients or indirectly by modifying soil physical properties such as stability of aggregates, porosity and available water capacity that can improve the root environment and stimulate plant growth [5-7]. Organic matter not only increases the water holding capacity of the soil but also proportion of water available for plant growth and improves physical properties of soil" [8].

2. MATERIALS AND METHODS

"The present study was carried out by Krishi Vigyan Kendra, Maharajganj Achrya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya for two consecutive years from 2020-21 and 2021-22 to evaluate the different levels of INM on yield and economics of wheat" [9]. "Total 110 demonstrations were conducted in different villages viz. Goniriya Babu, Gopala, Parsa Gidghi, Karauta, Devrua, Samerdhira, Khutwa Maidan, Paikoli and Parsouli Basantpur of 75 farmer's on 28.0 ha lands. Each frontline demonstration was laid out on 0.2 ha area while adjacent 0.2 ha was considered as control for comparison (farmer's practice). The selection of farmers was done on basis of survey by KVK and special training was organized for selected farmers on rice cultivation of wheat variety HD 2967" [2]. The experiment was comprising sixteen treatments viz. T1-control, T2- 100%RDF, T3- 100%RDF+S+Zn, T4- 100% R.D.F. + S + Zn + bio-fertilizer (Azotobactor+ P.S.B.), T5- 100% R.D.F. + 25% N through F.Y.M. + S, T6- 100% R.D.F. + 25% N through F.Y.M. + S + Zn, T7-100% R.D.F. + 25% N through F.Y.M. + S + Zn + bio-fertilizer (Azotobactor+ P.S.B.), T8- 100% R.D.F. + 25 %

N through vermi compost + S+Zn + bio-fertilizer (Azotobactor+ P.S.B.). The experiment consists of one farmer one replications. Physio-chemical characteristics of soil of the experimental field of sand 56.80, silt 23.40%, clay 19.85 and Organic Carbon (%) 0.420. "The soil sample was taken before sowing and analyzed with the standard procedures. Organic carbon was determined by Walkley and Black's rapid titration method as described" by Jackson [10]. "Available nitrogen was estimated by Alkaline potassium permanganate method as described by Subbiah and Asija [11]. Available potassium was first extracted by using 1 NNH_4 OAC Morgan's solution and estimated by Flame photometer as described" by Jackson [10]. Available sulphur was determined by 0.15% Ca Cl_2 (Williams and Steinbergs, 1959**)** and was determinedby Turbidimetric procedure [12]. Available zinc was made by 0.005 with dilute HCl and Zn was measured with the help of an Atomic absorption spectro photometer. The extraction was done by Lindsay and Norvell [13] procedure. "The assessment of impact of these frontline demonstrations is equally important, as carried out" by Sagar and Ganesh [14], in case of kharif rice, [9] in case of sunflower, [15] in case of mustard, [16].

3. RESULTS AND DISCUSSION

After harvest of the crop soil samples were collected in each treatments and analysis for physico-chemical properties of the soil. Soil microbial populations were also studied in same soil sample.Maximum organic carbon content 0.439 and 0.415% was recorded with T_8 (100% R.D.F. + 25% N through vermicompost +S + Zn + bio-fertilizers (*Azotobactor*+ P.S.B.)followed by T_7 (100% R.D.F. + 25% N through F.Y.M. + S + Zn +bio-fertilizers (*Azotobactor*+ P.S.B.)and minimum 0.398 and 0.382% in control (T_1) during 1st year and 2nd year. Integration of vermicompost showed higher increase in organic carbon % in comparison to FYM during both the years (Table 1). Maximum available status of nitrogen 215.50 and 200.80 kg ha $^{-1}$ was recorded with T_8 (100 % R.D.F. + 25% N through vermi compost +S + Zn + bio-fertilizers (*Azotobactor*+ P.S.B.)followed by T_7 (100% R.D.F. + 25% N through F.Y.M. + S + Zn +bio-fertilizers (*Azotobactor*+ P.S.B.)and minimum 207.00 and 192.00 kg ha^{-1} in control (T_1) during 1st year and 2nd year, respectively (Table 2). Available status of phosphorus within all the treatments varied from 12.20 to 11.50 and 11.50 to 13.25 kg ha^{-1} during 1st year and 2nd year, respectively. Integrated application of organic, inorganic and bio-fertilizers showed higher increase in the available status of phosphorus in comparison to inorganic fertilizers treatments during both the years (Table 3). Maximum increase in available status of potassium 134.50 and 127.70 kg ha^{-1} was recorded with T_8 (100% R.D.F. + 25% N through vermicompost +S + Zn + bio-fertilizers (*Azotobactor*+ P.S.B.) followed by T_9(100% R.D.F. + 25% N through F.Y.M. + S + Zn +bio-fertilizers (*Azotobactor*+ P.S.B.) and minimum 129.50 and 121.80 kg ha^{-1} at control (T_1) during 1st year and 2nd year, respectively (Table 4).The data pertaining to the available status of sulphur given in Table 4 showed none significantly influenced by application of different treatments except control during both the years. Like-wise nitrogen, phosphorus and potassium available status of sulphur also varied from minimum in control (T_1) and maximum under (T_8) (100% R.D.F. + 25% N through vermicompost +S + Zn + bio-fertilizers (*Azotobactor*+ P.S.B.) during both the years.Integration of zinc showed higher increase in available status of zinc with 100% RDF and 75% RDF treatments during both the years.It is also visualized from the data that all the treatments showed slight increase in available status of zinc except control during both the years. It was also observed that 100% RDF showed higher increase in available status of zinc during both the years (Table 3). Integration of bio-fertilizer and organic manures showed favorable influence in soil bacterial population in comparison to inorganic fertilizers treatments during both the years. Table 3 showed linear and significant influence in all the treatments in comparison to control. Table 3 showed linear and significant increase in all the treatments in comparison to control during both the years.

The perusal of data (Table 4) indicate that due to maximum under (T_8) (100% R.D.F. + 25% N through vermicompost +S + Zn + bio-fertilizers (*Azotobactor*+ P.S.B.) during both the years (55.10 and 55.26 q/ha) was obtained under demonstration plots as compared to minimum in control (T_1) 32.10 and 33.40 q/ha. The average yield of rice is increased by (T_8) (100% R.D.F. + 25 % N through vermicompost +S + Zn + bio-fertilizers (*Azotobactor*+ P.S.B.) during both the years 71.65 and 65.44 percent. The yield of wheat could be increased over the yield obtained under (T_8) (100% R.D.F. + 25 % N through vermicompost +S + Zn + bio-fertilizers (*Azotobactor*+ P.S.B.)

Table 1. Effect of Integrated nutrient management on soil properties (OC & N)

Treatment	Organic Carbon (%)		Available Nitrogen kg ha^{-1}	
	2020-21	2021-22	2020-21	2021-22
T_{1}- Control	0.398	0.382	0.398	0.382
T_{2}-100 % R.D.F.	0.422	0.392	0.422	0.392
T_{3}-100 % R.D.F. + S + Zn	0.426	0.396	0.426	0.396
T_{4}-100 % R.D.F. + S + Zn + Bio- fertilizers (*Azotobactor*+ P.S.B.)	0.428	0.398	0.428	0.398
T_{5}-100 % R.D.F. + 25 % N through F.Y.M. + S	0.434	0.405	0.434	0.405
T_{6}-100 % R.D.F. + 25 % N through F.Y.M. + S + Zn	0.435	0.408	0.435	0.408
T_{7}-100 % R.D.F. + 25 % N through F.Y.M. + S + Zn +Bio -fertilizers (*Azotobactor*+ P.S.B.)	0.436	0.410	0.436	0.410
T_{8}-100 % R.D.F. + 25 % N through vermicompost +S + Zn + Bio Fertilize (*Azotobactor*+ P.S.B.)	0.439	0.415	0.439	0.415

Table 2. Effect of integrated nutrient management on soil properties (P & K)

Treatment	Available P. (Phosphorus) Kg ha^{-1}		Available K. (Potassium) Kg ha^{-1}	
	2020-21	2021-22	2020-21	2021-22
T_{1}- Control	12.20	11.50	12.20	11.50
T_{2}-100 % R.D.F.	13.80	12.55	13.80	12.55
T_{3}-100 % R.D.F. + S + Zn	13.95	12.70	13.95	12.70
T_{4}-100 % R.D.F. + S + Zn + Bio- fertilizers (*Azotobactor*+ P.S.B.)	14.05	12.78	14.05	12.78
T_{5}-100 % R.D.F. + 25 % N through F.Y.M. + S	14.22	12.90	14.22	12.90
T_{6}-100 % R.D.F. + 25 % N through F.Y.M. + S + Zn	14.28	12.98	14.28	12.98
T_{7}-100 % R.D.F. + 25 % N through F.Y.M. + S + Zn +Bio -fertilizers (*Azotobactor*+ P.S.B.)	14.35	13.02	14.35	13.02
T_{8}-100 % R.D.F. + 25 % N through vermicompost +S + Zn + Bio Fertilize (*Azotobactor*+ P.S.B.)	14.50	13.25	14.50	13.25

Table 3. Effect of integrated nutrient management on soil properties (S & Zn)

Treatment	Available S. kg ha^{-1}		Available Zn.g ha^{-1}	
	2020-21	2021-22	2020-21	2021-22
T_{1}- Control	15.85	14.50	15.85	14.50
T_{2}-100 % R.D.F.	16.60	15.35	16.60	15.35
T_{3}-100 % R.D.F. + S + Zn	17.10	15.95	17.10	15.95
T_{4}-100 % R.D.F. + S + Zn + Bio- fertilizers (*Azotobactor*+ P.S.B.)	17.25	16.10	17.25	16.10
T_{5}-100 % R.D.F. + 25 % N through F.Y.M. + S	17.30	16.15	17.30	16.15
T_{6}-100 % R.D.F. + 25 % N through F.Y.M. + S + Zn	17.60	16.40	17.60	16.40
T_{7}-100 % R.D.F. + 25 % N through F.Y.M. + S + Zn +Bio -fertilizers (*Azotobactor*+ P.S.B.)	17.85	16.65	17.85	16.65
T_{8}-100 % R.D.F. + 25 % N through vermicompost +S + Zn + Bio Fertilize (*Azotobactor*+ P.S.B.)	18.10	16.85	18.10	16.85

Table 4. Yield analysis of FLD on wheat at farmers field

Treatment	Grain Yield q/ha		Grain Yield increase over Control	
	2020-21	2021-22	2020-21	2021-22
T_{1-} Control	32.10	33.40		
T_{2-}100 % R.D.F.	36.60	37.90	14.01	13.47
T_{3-}100 % R.D.F. + S + Zn	39.80	39.92	23.98	19.52
T_{4-}100 % R.D.F. + S + Zn + Bio- fertilizers (*Azotobactor*+ P.S.B.)	42.16	43.17	32.92	29.25
T_{5-}100 % R.D.F. + 25 % N through F.Y.M. + S	45.33	46.19	41.21	38.29
T_{6-}100 % R.D.F. + 25 % N through F.Y.M. + S + Zn	48.80	48.93	52.02	46.49
T_{7-}100 % R.D.F. + 25 % N through F.Y.M. + S + Zn +Bio -fertilizers (*Azotobactor*+ P.S.B.)	54.60	54.97	70.09	64.58
T_{8-}100 % R.D.F. + 25 % N through vermicompost +S + Zn + Bio Fertilize (*Azotobactor*+ P.S.B.)	55.10	55.26	71.65	65.44

"It was also observed that integration of bio-fertilizers and organic manures showed favorable influence in comparison to inorganic fertilizers during both the years, this may be due to that added organic matter acts as a source of the nutrients and also as a substrate for decomposition and mineralization of nutrients, thereby creating a favorable condition for the proliferation of microbes in the soil" (Gill et al. 2016).

4. CONCLUSION

Millions of farmers in developing countries require adequate resources to boost crop productivity and soil sustainability. To keep soil fertility and productivity at a sustainable for a long period of time, the concept of integrated nutrient management must be implemented.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Singh V, Tomer JS. Effect of K and FYM levels on yield and uptake of nutrients by wheat. Journal of Potassium Research. 1991;7(4):309-313.
2. Singh R, Agrawal SK. Effect of levels of farm yard manure and nitrogen fertilizer on grain yield and use efficiency of nutrients on wheat (*Triticum aestivum*). Indian Journal of Agricultural Science. 2005;75(7):408-413.
3. Singh DP, Chandra V, Tiwari T. Impact analysis of front line demonstration on rice (*Oryza sativa* L.) the yield, economics and farmer's knowledge in Eastern Uttar Pradesh, India. Int. J. Curr. Microbiol. App. Sci. 2020;(10):308-313.
4. Priyavart Mishra, Tiwari US, Hanuman Prasad Pandey, Pathak RK, Sachan AK. Effect of INM on physico-chemical properties of soil of maize (*Zea mays*) crop in inceptisol of Central U.P. International Journal of Chemical Studies. 2019; 7(2):631-635.
5. Reddy PS. Patil D. "Indian oilseeds: Present status and future needs". Indian J. Agric. Sci. 1998;68:453-459.
6. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soil by extraction with sodium bicarbonate. Circ.US Dept. of Agric. Washington D.C. 1954;939.
7. Piper CS. soil and plant analysis, university of Adelaide, Australia. 1996.
8. Sial RA, Chuadhary EH, Hussain S, Naveed M. Effect of organic manures and chemical fertilizer on grain yield of wheat. Soil and Environment. 2007;26(2):130-133.
9. Yadav DB, Kamboj BK, Garg RB. Increasing the productivity and profitability of sunflower through front line demonstrations in irrigated agro ecosystem of eastern Haryana. Haryana Journal of Agronomy. 2004;20(1&2): 33-35.
10. Jackson ML. Soil chemical analysis, prentice hall of India Pvt. Ltd., New Delhi; 1967.
11. Subbiah, Asija GS. A rapid procedure for the estimation of available nitrogen in soil. Current Sci. 1956;25:259-260.

12. Chesnin L, Yien CH. Turbidimetric determination of available sulphur. Proc. Soil Sci. Soc. America. 1951;14:149-151.
13. Lindsay WL, Norvell WA. Zinc in soil and plant nutrient. Adv. Pergamum press, oxford; 1978.
14. Sagar RL, Ganesh C. Performance of frontline demonstration on kharif rice (*Oryza sativa* L) in Sundarban, West Bengal. Journal of the Indian Society of Coastal Agricultural Research. 2003; 21(2):69-70.
15. Singh SN, Singh VK, Singh RK, Singh KR. Evaluation of on farm front line demonstrations on the yield of mustard in central plains zone of Uttar Pradesh. Indian Research Journal of Extension Education. 2007;7(2&3):79-81.
16. Mishra DK, Paliwal DK, Tailor RS, Deshwal AK. Impact of frontline demonstrations on yield enhancement of potato. Indian Research Journal of Extension Education. 2009;9(3): 26-28.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/93580