www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(4): 1476-1476

www.thepharmajournal.com
Received: 10-02-2022
Accepted: 31-03-2022

Lakshya Choudhary
Department of Soil Science and Agricultural chemistry, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

KN Singh
Department of Soil Science and Agricultural chemistry, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Kritagya Gangwar
Division of Soil Science and Agricultural Chemistry, ICAR-IARI, New Delhi, India

Ravindra Sachan
Department of Soil Science and Agricultural chemistry, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Corresponding Author:
Lakshya Choudhary
Department of Soil Science and Agricultural chemistry, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Effect of FYM and Inorganic fertilizers on growth performance, yield components and yield of wheat (*Triticum aestivum* L.) under indo-gangetic plain of Uttar Pradesh

Lakshya Choudhary, KN Singh, Kritagya Gangwar and Ravindra Sachan

Abstract
The present field experiment was conducted at pot house of department of Soil Science and Agricultural Chemistry of C.S.A.U.A&T Kanpur (campus) under the Central Plain zone of Uttar Pradesh, during Rabi season of 2018-19. The experiment comprised of 5 treatment combinations in randomized block design with four replications consisted of T_1: [Control], T_2: [100% RDF], T_3: [75% RDF + FYM @ 6 t ha^{-1}], T_4: [50% RDF + FYM @ 12 t ha^{-1}], T_5: [25% RDF + FYM @ 18 t ha^{-1}]. On the basis of the results emanated from present investigation, it could be concluded that application of 25% RDF + FYM @ 18 t ha^{-1} shows maximum plant height (14.35 cm and 85.79 cm at 30 DAS and 90 DAS respectively) and yield attributes i.e. no. of tiller $plant^{-1}$ (6.17), no. of ear $plant^{-1}$ (5.97), ear length (10.25 cm), weight of ear (3.80 g), no. of grain $spike^{-1}$ (55.70), grain weight $plant^{-1}$ (3.00 g) and test weight (38.95 g). An appraisal of data showed that among the different combination of FYM and inorganic fertilizers treatment T_5 [25% RDF + FYM @ 18 t ha^{-1}] also produced maximum grain yield (43.95 q ha^{-1}), straw yield (72.95 q ha^{-1}), biological yield (116.90 q ha^{-1}) and harvest index (37.59%).

Keywords: Ear, FYM, spike, tiller, wheat and yield

Introduction
Wheat (*Triticum aestivum*) is the most important staple food grain crop that has been labelled as “king of cereals”. India is the second largest wheat producer country in the world (Jat *et al.*, 2013) [9]. The approximate chemical composition of the wheat kernel is starch 63-71%; protein10-12%; water 8-17%; cellulose 2-3%; fat1.5-2%; sugar2-3%; and mineral matter 1.5-2%. Gluten of the wheat kernel contains about 17.6% nitrogen. (Anonymous, 2017) [1].
The major wheat producing states are Uttar Pradesh, Madhya Pradesh, Punjab, Rajasthan, Haryana and Bihar which occupy 33%, 18%, 12%, 10%, 9% and 8% area of total wheat cultivation in the country, respectively. In India, the highest productivity of wheat is recorded in Punjab (Sharma *et al.*, 2012) [18].
Wheat is generally grown in intensive cropping system with higher use of inorganic specially NPK fertilizers. Optimal fertilizer management is necessary to maintain sustainable yields, improve nutrient use efficiency of fertilizers and save fertilizer resources (Chuan *et al.* 2016) [3]. Nitrogen is one of the major deficient plant nutrients particularly in sandy loam soil of semi-arid region of western Uttar Pradesh. An optimum supply of nitrogen is important for vigorous vegetative growth, chlorophyll formation and carbohydrate utilization. But N use efficiency in cereals is quite low. Conjoint use of inorganic and organic sources of N is recommended to maintain soil and crop productivity. The integrated N management also increased organic carbon content and availability of plant nutrients in soil. Integration of chemical and organic sources and their efficient management have shown promising results not only in sustaining the production but also in maintaining soil health (Singh *et al.* 2017). Jat *et al.* (2014) [12, 10] suggested that further improvement in nutrient use efficiency will become possible by balanced use of N, P and K fertilizers and by rational use of organic manures in wheat systems.
Phosphorus (P) is the second most important essential nutrient for crop production after nitrogen (Venkatesh *et al.*, 2020) [22]. This nutrient plays various roles in the plant metabolism including a structural role in molecules, such as nucleic acids and proteins, for energy transfer, respiration, glycolysis, carbohydrate metabolism, redox reactions, enzyme activation/ inactivation, membrane synthesis and stability, and in nitrogen fixation (Yousuf *et al.* 2017) [23].

Phosphorus is a component of DNA and RNA, which carries genetic information used to synthesize proteins. Phosphorus is essentially important to human beings also; it is involved in the growth and repair of body cells and tissues. Its deficiency in children affects normal bone and teeth development Thus, there is rising concern over widespread deficiency of P in the agricultural lands of the world (Sheetal, 2013) [19].
Potassium is a "work horse" plant nutrient. Perhaps this is why it is not bound into any specific plant compound. Therefore, potassium is free to travel and to wheel and deal with in the plant almost at well. It should not be surprising that a shortage of potassium can result in loss of crop yield, quality and profitability (Ducan *et al.*, 2018) [5]
The inclusion of organic manure with inorganic fertilizers may serve as a chelating and complexing agent which prevents the nutrients from precipitation, fixation, oxidation and leaching. Application of organic manures may also improve availability of native nutrients in soil as well as the efficiency of applied fertilizers (Sawrup, 2010) [17]. The role of organic matter is well established in governing the nutrient fluxes, microbial biomass and improvement in soil physical chemical and biological properties (Malav *et al.*, 2019) [13]. Maintaining soil health is of utmost important to ensure food and nutritional security of the country (Jadhao *et al.*, 2019) [8]. For most efficient use of fertilizers, all nutrients must be used in balance proportion. However, there is a lack of information regarding the performance of FYM and nitrogen in relation to productivity and fertility of soil under wheat cultivation (Hassan *et al.*, 2018) [6].
FYM is a good source of nutrients and contributed towards build-up of organic matter in soil (Kumar *et al.*, 2017) [15]. Nitrogen is an indispensable element for optimum functioning of crops. The increase in eco-friendly production of wheat can be made possible by widespread adoption of improved technologies of which fertilizer management particularly that of nitrogen through organic manure can play a key role. Hence, present investigation was carried out to study the growth, yield and nutrient uptake behaviour of wheat to define optimum dose under integrated use of FYM (Chesti *et al.*, 2013) [2].

Material and Methods

Soil of the Experimental Field

The experimental field is sandy loam in texture, good aeration (42.9% porosity), alkaline in reaction (pH 7.6), low in organic carbon (0.32%), low in available N (169.4 kg ha^{-1}), medium in available P (16.3 kg ha^{-1}), and high in available K (154.7 kg ha^{-1}).

Layout and Design of the Experiment

The experiment was laid out in randomized block design with four replications. The total numbers of unit plots were 20. The size of a unit plot was 1.0 m X 1.0 m. The width of the main irrigation channel is 1.5 m.

Treatments of the Investigation

The experiment comprised of 5 treatment combinations in randomized block design with four replications consisted of T_1: [Control], T_2: [100% RDF], T_3: [75% RDF + FYM @ 6 t ha^{-1}], T_4: [50% RDF + FYM @ 12 t ha^{-1}], T_5: [25% RDF + FYM @ 18 t ha^{-1}].

Fertilizer and Manure Application

Fertilizers were applied as per treatments whereas nitrogen, phosphorus and potash were applied through urea, DAP, Murate of Potash, respectively. The amount of nitrogen in DAP was adjusted in the amount of urea. Recommended dose of fertilizer i.e. NPK @ 120:60:40 ha^{-1}, were applied. Half of nitrogen and full dose of phosphorus and potash were applied as basal at the time of sowing by placement method. The remaining half of the nitrogen was applied at the time of first irrigation. The quantity of FYM required for substituting a specified amount of nitrogen as per treatment was calculated and incorporated into soil 15 days before sowing of the crop.

Seed and Sowing

The seeds of Wheat PBW - 343, were sown @ 125 kg ha^{-1} in shallow furrows with the help of manual labour at a row spacing of 22.5 cm and plant spacing 10 cm apart. Depth of sowing was kept 4-5 cm.

Irrigation

Besides one pre-sowing irrigation, the crop was given six irrigations at different stages *viz.*, CRI, tillering, late jointing, flowering, milking and dough stage during the period of experimentation.

Harvest Index (%)

The harvest index was worked out with the help of following formula given by Donald *et al.* (1976) [4].

Harvest Index (%) = [Grain Yield (q ha^{-1}) / Biological Yield (q ha^{-1})] x 100

Result and Discussion

Growth Parameter

Plant Height

The data portrayed that the maximum plant height was recorded as 14.35 cm, 85.79 cm and 88.45 cm in T_5: [25% RDF + FYM @ 18 t ha^{-1}]. at 30 DAS, 90 DAS and at harvest stage respectively which was statically at par with par with T_4: [50% RDF + FYM @ 12 t ha^{-1}] with 13.40 cm, 82.72 cm and 85.50 cm at 30 DAS, 90 DAS and harvest stage respectively and the minimum plant height was recorded as 9.85 cm, 66.33 cm and 68.55 cm T_1 [Control] at 30 DAS, 90 DAS and at harvest stage respectively. The results of present investigation are also in agreement with the findings of Prakash *et al.*, (2011) and Suryawanshi *et al.*, (2018) [21].

Table 1: Effect of treatment combinations on Plant Height

Treatments	Treatment Combinations	Plant Height (cm)		
		30 DAS	90 DAS	At Harvest
T_1	Control	9.85	66.33	68.55
T_2	100% RDF	12.25	79.31	81.96
T_3	75% RDF + FYM @ 6 t ha^{-1}	12.75	81.12	83.35
T_4	50% RDF + FYM @ 12 t ha^{-1}	13.40	82.72	85.50
T_5	25% RDF + FYM @ 18 t ha^{-1}	14.35	85.79	88.45

SE(d)	0.516	2.065	2.581
C.D.	1.124	4.499	5.623

Yield Components: The data portrayed that the maximum no. of tiller plant^{-1} (6.17), no. of ear plant^{-1} (5.97), ear length (10.25 cm), weight of ear (3.80 g), no. of grain spike^{-1} (55.70), grain weight plant^{-1} (3.00 g) and test weight (38.95 g) in T_5: [25% RDF + FYM @ 18 t ha^{-1}] which was statically at par with par with T_4: [50% RDF + FYM @ 12 t ha^{-1}] with no. of tiller plant^{-1} (5.84), no. of ear plant^{-1} (5.73), ear length (9.87 cm), weight of ear (3.66 g), no. of grain spike^{-1} (53.36), grain weight plant^{-1} (2.85 g) and test weight (38.65 g). The minimum no. of tiller plant^{-1} (4.75), no. of ear plant^{-1} (4.15), ear length (7.15 cm), weight of ear (2.65 g), no. of grain spike^{-1} (38.65), grain weight plant^{-1} (1.75 g) and test weight (36.85 g). Similar findings were reported by Pandey *et al.,* (2009) and Kulkarni *et al.*, (2018) [14, 11].

Table 2: Effect of treatment combinations on Yield Components

Treatment	No. of Tillers plant^{-1}	No. of Ear plant^{-1}	Ear Length (cm)	Ear weight (g)	No. of Grain spike^{-1}	Grain weight Plant^{-1}	Test weight(g)
T_1	4.75	4.15	7.15	2.65	38.65	1.75	36.85
T_2	5.68	5.50	9.47	3.51	51.25	2.78	38.25
T_3	5.73	5.60	9.65	3.58	52.14	2.82	38.35
T_4	5.84	5.73	9.87	3.66	53.36	2.85	38.65
T_5	6.17	5.97	10.25	3.80	55.70	3.00	38.95
SE(d)	0.38	0.29	0.37	0.12	1.29	0.102	0.47
C.D.	0.84	0.64	0.82	0.28	2.81	0.225	1.04

Productivity Parameters

A cursory glance of data revealed that the maximum grain yield (43.95 q ha^{-1}), straw yield (72.95 q ha^{-1}), biological yield (116.90 q ha^{-1}) and harvest index (37.59%) was recorded in T_5: [25% RDF + FYM @ 18 t ha^{-1}] followed by T_4: [50% RDF + FYM @ 12 t ha^{-1}] with 42.20 q ha^{-1}, 71.05 q ha^{-1}, 113.25 q ha^{-1} and 37.26% respectively and the minimum grain yield (29.75 q ha^{-1}), straw yield (50.65 q ha^{-1}), biological yield (80.40 q ha^{-1}) and harvest index (37.00%) in T_1 [Control]. These result are accordance with the finding of Singh *et al.*, (2018) and Hussain *et al.*, (2018) [7, 20].

Table 3: Effect of treatment combinations on Productivity Parameters

Treatment	Treatment Combination	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Biological Yield (q ha^{-1})	Harvest Index (%)
T_1	Control	29.75	50.65	80.40	37.00
T_2	100% RDF	40.45	67.41	107.86	37.05
T_3	75% RDF + FYM @ 6 t ha^{-1}	41.15	69.40	110.55	37.22
T_4	50% RDF + FYM @ 12 t ha^{-1}	42.20	71.05	113.25	37.26
T_5	25% RDF + FYM @ 18 t ha^{-1}	43.95	72.95	116.90	37.59
SE(d)		1.01	1.91	1.33	1.69
C.D.		2.22	4.16	3.01	3.37

Conclusion

Based on the finding of the present study, it can be inferred that application of T_5[25% RDF + FYM @ 18 t ha^{-1}] resulted maximum growth performance and yield attributes which results more yield of wheat crop during rabi season under Indo-Gangetic plain of Uttar Pradesh. It is strongly recommended that farmer of the U.P adopt the dose of T_5 [25% RDF + FYM @ 18 t ha^{-1}] doses for better crop yield.

References

1. Anonymous. Directorate of Economics and Statistics, Department of Agricultural and Corporation, New Delhi, 2017.
2. Chesti, Kohli MHA, Sharma AK. Effect of integrated nutrient management on yield of and nutrient uptake by wheat (*Triticum aestivum*) and properties under inter mediate zone of Jammu and Kashmir. Journal of the India society of soil science. 2013;61(1):1-6.
3. Chuan L, He P, Zhao T, Zheng H, Xu X. Agronomic characteristics related to grain yield and nutrient use efficiency for wheat production in China. PLoS One. 2016;11(9):e0162802. DOI: 10.1371/ journal. pone.0162802.
4. Donald CM, Hamblin J. The biological Yield and Harvest Index of Cereals as Agronomic and Plant Breeding Criteria. Advances in Agronomy. 1976;28:361-405.
5. Duncan EG, O'Sullivan CA, Roper MM, Biggs JS, Peoples MB. Influence of co-application of nitrogen with phosphorus, potassium and sulphur on the apparent efficiency of nitrogen fertiliser use, grain yield and protein content of wheat. Field crops research. 2018;226:56-65.
6. Hassan, A, Malik, Ahmad S, Asifmalik, Mir SA, Owais Bashir, *et al*. Yield and nitrogen content of wheat (*Triticum aestivum* L.) as affected by India. International Journal of current microbiology and applied science. 2018;7(2):332-332.
7. Hussain M, Cheema SA, Abbas RQ. Allometry, biological nitrification inhibition, wheat cultivars, nitrogen source, grain yield. 2018;41(18).
8. Jadhao SD, Mali VD, Sonune AB. Impact of continuous manuring and fertilization on change in soil quality under sorghum – wheat sequence on a vertisols. Journal of the Indian society of soil science. 2019;67(1):55-64
9. Jat, Kumar, Lokesh, Singh SK, Latare AM, Singh RS, Patel CB. Effect of dates of sowing and fertilizer on growth and yield of wheat (*Triticum aestivum*) in an Inceptisol of Varanasi, Indian Journal of Agronomy. 2013;58(4):611-614

10. Jat ML, Bijay Singh, Gerard B. Nutrient management and use efficiency in wheat sustains. Advances in Agronomy. 2014;125:171-259.
11. Kulkarni MV, Patel KC, Patil DD, Pathak Madhuri. Effect of organic and inorganic fertilizer on yield attributes of groundnut and wheat. International Journal of Chemical studies. 2018;6(2):87-9.
12. Kumar D, Prakash V, Singh P, Ahamid A, Kumar C, Kumar S. Effect of integrated nutrient management modules on yield, quality and economics of wheat. Journal of pharmacognosy and phytochemistry. 2017;6(6):709-711.
13. Malav JK, Patel VR. Effect of iron and zinc enriched FYM on growth, yield and quality of wheat (*Triticum aestivum* L) in salt affected soils. International journal of current micro biology and applied science. 2019;8(6):2960-2969
14. Pandey IB, Dwivedi DK, Pandey RK. Integrated nutrient management for sustaining wheat (*Triticum aestivum* L.) production under late sown condition. Indian J. Agron. 2009;54(3):306-309.
15. Pathak A, Kumar V. Measurement effectivess of zinc with and without FYM on protein production by pearl millet wheat sequence. International journal of current micro biology and applied science. 2017;6(9):2670-2678
16. Prakash YS, Bhadoria PBS. Influence of organic manures on crop tolerance to pathogens and pests in two varieties of rice. Annals of Agricultural Research. 2002;23(1):79-85.
17. Sawrup A. Integrated plant nutrient supply and management strategies for enhancing soil fertility, input use efficiency and crop productivity. J Indian Soc. Soil Sci. 2010;58:25-30.
18. Sharma, Amita, Rawat US, Yadav BK. Influence of Phosphorus Levels and Phosphorus Solubilizing Fungi on Yield and Nutrient Uptake by Wheat under Sub-Humid Region of Rajasthan, India. International Scholarly Research Network ISRN Agronomy, 2012,1-9.
19. Sheetal A. Malnutrition and its Oral Outcome-A Review. J. Clin. Diagn. Res. 2013;7:178-180. dx.doi.org /10.7860/JCDR/2012/5104.2702
20. Singh Gurwinder, Kumar Santosh, Singh Gur Jagdeep Sidhu, Kaur Ramandeep. Effect of integrated nutrient management on yield of wheat (*Triticum aestivum* L.) under irrigated conditions. Keywords: INM, plant height, Yield attributes, yield. International Journal of Chemical Studies. 2018;6(2):904-907.
21. Suryawanshi PK, Pagar VD, Sadhu AC, Kalasare RS. Response of wheat (Triticum aestivum L.) to integrated nitrogen management and their residual effect on succeeding forage cowpea (*Vigna unguiculata* L.). H.H. Sri Sri Muralidhara Swamiji College of Agriculture, Malegaon Camp, 2018.
22. Venkatesh P, Dhar S, Dass A, Kumar B, Kumar A, El-Ansary DO, *et al*. Role of Integrated Nutrient Management and Agronomic Fortification of Zinc on Yield, Nutrient Uptake and Quality of Wheat. Sustainability. 2020;12:3513; doi: 10.3390/su12093513.
23. Yousuf PY, Abd-Allah EF, Nauman M, Asif A, Hashem A, Alqarawi AA, *et al*. Responsive Proteins in Wheat Cultivars with Contrasting Nitrogen E_ciencies under the Combined Stress of High Temperature and Low Nitrogen. Genes (Basel). 2017;8:356. http://dx.doi.org/10.3390/genes8120356.