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Effect of integrated nutrient management on yield attributes and yield of wheat (*Triticum aestivum* L.)

Brij Mohan, Pradeep Kumar and Ram Achal Yadav

Abstract
The field experiment was conducted during Rabi season of 2013-14 and 2014-15 to explore the extent of substitution of nitrogen through organic sources in wheat, to find out the suitable combination of fertilizers and organic manures for higher and sustainable wheat production. The experiment consists of twelve treatments *viz.*, T_1-Control ($N_0P_0K_0$), T_2- 75% RDF, T_3- 100% RDF, T_4- 125% RDF, T_5-100% RDF+ 25% N FYM, T_6-100% RDF + 25% N vermicompost, T_7-100% RDF + 25% N Pressmud, T_8-100% RDF+ 25% N Neem cake, T_9-75% RDF + 25% N FYM, T_{10}-75% RDF +25% N vermicompost, T_{11}-75% RDF + 25% N Pressmud, T_{12}-75% RDF + 25%N Neem cake. The soil of the experimental field was silt loam in texture. The results revealed that the application 100% recommended dose of fertilizers (RDF) i.e. 150: 60: 60, N:P:K kg ha^{-1} +25 % N through vermicompost (T_6), the extent substitution of nitrogen through integrated nutrient management was obtained increased the growth, development and yield of wheat than other treatments. The INM with 100% RDF + 25% N through vermicompost (T_6) was obtained the suitable combination of fertilizers and organic manures for higher and sustainable wheat production and maximum increased the nutrients availability.

Keywords: Economics, Neem cake, vermicompost, pressmud, FYM, wheat

Introduction
The dwarf wheat varieties of wheat have great potential but due to exhaustive nature they require heavy amount of nutrients which are mat mainly by chemical fertilizers. It passed a great treat to long-term sustainability of crop production. Although the balanced use N, P and K fertilizers could maintain wheat productivity, in practices it has sown a declining trend in yield response. This deteriorating yield response was found associated with degrading of soil physical and biological qualities besides imbalance in secondary and micronutrients. The integrated nutrient management which involves integrated use of chemical fertilizers along with biofertilizers in addition to organic manures. Organic manuring improves soil physical, chemical and biological characteristics when applied in conjunction with biofertilizers, it supplies energy to beneficial micro-organism including Azotobactor and PSB. Biofertilizers like Azotobactor and PSB offer a low cost, low capital intensive and ecofriendly route to lowest the crop productivity depending upon their activity of mobilizing different nutrients. They also play an important role in increasing the availability of N, P and K whether applied or native. Keeping the above facts in view the present investigation entitled "Effect of integrated nutrient management on growth and yield of wheat" has been planned for two consecutive rabi seasons of 2013-14 and 2014-15 at Agronomy Research Farm, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad U.P.

Materials and Methods
Field experiments were conducted during winter 2013-14 and 2014-15 at Agronomy Research Farm, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad U.P. The soil was silt loam in texture having pH (8.13, 8.18), OC (0.45, 0.42%), available N (187, 196 kg ha^{-1}), P (19, 21 kg ha^{-1}), K (251, 241 kg ha^{-1}) and EC (0.33, 0.31 dSm^{-1}). The experiment consists of twelve treatments *viz.*, T_1-Control ($N_0P_0K_0$), T_2- 75% RDF, T_3- 100% RDF, T_4-125% RDF,, T_5-100% RDF+ 25% N FYM, T_6-100% RDF + 25% N vermicompost, T_7-100% RDF + 25% N Pressmud, T_8-100% RDF+ 25% N Neem cake, T_9-75% RDF + 25% N FYM, T_{10}-75% RDF +25% N vermicompost, T_{11}-75% RDF + 25% N Pressmud, T_{12}-75% RDF + 25%N Neem cake were tested in Randomised Block Design (RBD) with four replications. All the treatments were applied at the time of sowing as per the treatment. Wheat cultivar HUW-234 was sown in rows 20 cm apart on 25th November 2013, 28th November 2014, harvested on 18th April in 2014 and 25th April in 2015 respectively. Half of nitrogen and full dose of phosphorus and potash were applied at the time of sowing as per the treatment combination. The remaining nitrogen as per treatment was top dressed after first irrigation.

N, P, and K were applied through urea. DAP and muriate of potash respectively. The crop received four irrigations (at CRI, flowering, milking and dough stages). Organic carbon, pH, available N, P, K of soil and N, P, K content in plant were estimated by standard methods. The data obtained from different observations were analyzed statistically as per standard procedure suggested by Pause and Sukhatme (2000) [4]. Nutrient uptake was estimated by multiplying the dry-matter accumulation at maturity in grain and straw of wheat by their respective percentages. Total uptake was calculated by adding uptake of grain and straw. The yield parameters and yields were recorded and analyzed as per Gomez and Gomez (1984) [3]. The treatments comparisons were made using t-test at 5% level of significance. The economics was calculated on the basis of prevailing local market price of wheat grains and cost of inputs.

Results and Discussion

Effect on yield attributes

Integrated use of fertilizer with vermicompost increased number of tillers, dry matter accumulation, number of spikes m^{-2} grains $spike^{-1}$, spike length and the test weight. The enhanced early vegetative growth in terms of higher leaf area, dry matter accumulation and vigorous root system resulted in more spikes which consequently increased the number of spikes bearing tillers significantly. Dry matter accumulation produced by the application of 100 % RDF along with 25% N through vermicompost (639.68,647.12 gm^{-2}) were found to the highest being followed by 100%RDF along with 25 % N through FYM and the lowest from the control (351.20,364.48 gm^{-2}). It might due to stimulated vegetative growth of wheat on account of adequate and prolonged supply of essential nutrients Rathore and Sharma (2009) [5]. Similarly, the number of tillers, grain/spike and test weight produced by the application of 100% RDF along with 25% N through vermicompost were found significantly higher being followed by 100 % RDF along with 25 % N through FYM than the other treatments and the lowest from the control. Afzal *et al.* (2005) [1] also reported that vermicompost along with RDF or with other combinations significantly increased the number of tillers/m^{-2}.

Effect on Yield

Grain and straw yields increased with increasing level of nutrient (NPK) upto 100% RDF applied alone or in combination with organic sources (FYM, vermicompost, pressmud and neem cake). Maximum grain yield of 35.90 and 36.40 q ha^{-1} and straw yield of 44.06 and 44.49 qha^{-1} was recorded with treatment T_6 (100% RDF + 25% N through vermicompost) which was at par with T_3, T_4, T_5, T_7 and T_8 during both the years. This might be due to adequate quantities and balanced proportions of plant nutrients supplied to the crop as per need during the growth period resulting in favourable increase in yield attributing characters which ultimately led towards an increase in economic yield. Similar results were reported by Devi *et al.* (2011) [2]. These results are in agreement to the findings of Kumar and Singh (2010) [6] and Rather and Sharma (2009) [5].

Table 1: Effect of integrate nutrient management on yield attributes characters of wheat

Treatments	Number of spikes (m^{-2})		Spike length (cm)		Number of grains $spike^{-1}$		1000-grains weight (g)	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
T_1	268.00	270.40	6.30	6.40	31.84	32.80	30.20	30.50
T_2	301.50	304.20	7.40	7.50	35.82	36.90	31.80	32.10
T_3	345.05	348.14	8.20	8.40	40.99	42.23	33.30	33.60
T_4	358.45	361.66	9.20	9.40	42.59	43.87	34.80	35.10
T_5	365.15	368.42	9.40	9.60	43.38	44.69	35.20	35.50
T_6	375.20	378.56	9.80	10.00	44.58	45.92	35.50	35.80
T_7	351.75	354.90	8.90	9.10	41.79	43.05	34.20	34.50
T_8	348.40	351.52	8.50	8.70	41.39	42.64	33.70	34.00
T_9	324.95	327.86	8.30	8.50	38.61	39.77	32.80	33.10
T_{10}	335.00	338.00	8.70	8.90	39.80	41.00	33.00	33.30
T_{11}	318.25	321.10	7.80	7.95	37.81	38.95	32.00	32.30
T_{12}	328.30	331.24	8.00	8.15	39.00	40.18	32.40	32.70
SEm±	9.85	9.84	0.25	0.25	1.17	1.27	1.03	1.02
CD at 5%	28.35	28.31	0.71	0.72	3.38	3.65	NS	NS

Table 2: Effect of of integrate nutrient management on grains and straw yield of wheat

Treatments	Grain yield (q/ha)		Straw yield (q/ha)	
	2013-14	2014-15	2013-14	2014-15
T_1	18.70	19.50	25.20	26.06
T_2	29.30	30.80	38.06	40.17
T_3	33.40	34.20	41.32	41.97
T_4	34.80	35.30	42.53	43.06
T_5	35.40	36.00	42.92	43.47
T_6	35.90	36.40	44.06	44.49
T_7	34.20	34.90	41.88	42.66
T_8	33.60	34.30	40.98	41.75
T_9	31.40	31.90	39.80	40.27
T_{10}	32.50	33.00	41.03	41.58
T_{11}	30.80	31.50	39.52	40.25
T_{12}	31.80	32.60	40.47	41.41
SEm±	1.02	1.04	1.22	1.19
CD at 5%	2.94	3.00	3.50	3.41

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