



Effect of organic and inorganic plant nutrient sources on nutrient content & their uptake in wheat

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Abstract

An investigation was carried out to study the effect of organic and inorganic plant nutrient sources on nutrient content & their uptake in wheat under pot experiment. The pot culture laid out in Completely Randomized Block Design with twelve treatments replicated three times. N, P, K were applied through urea, single super phosphate and muriate of potash, respectively. While the total amount of organics was applied 15 days before sowing of the wheat as test crop. The results indicated that the application of N through 120 kg ha⁻¹ by urea and 10 kg ha⁻¹ through different organic sources increase the N, P and K contents significantly (except K in grain) in grain and straw. Total uptake of N was maximum and minimum recorded in the treatment of 100% NPK + 10 kg N ha⁻¹ through C.W. and control respectively. Whereas, P and K content and their uptake were maximum observed in the treatment of in grain and straw. The results of N content in the treatments were at par; most of the similar trends were found in the case of P and K content.

Keywords: Organic sources, Inorganic sources, nutrient content, uptake, wheat

Introduction

The population of the country was within limit during ancient time and food production was sufficient to feed the population. But with the passage of time, population growth rate became more as compared to increase in food production. With the result scarcity of food started coming up and it became the cause of concerned authorities. Attempts were started to boost the production by various manipulations of agricultural technologies and inputs. In the meantime, during the last sixties 'green revolution' came into existence which brought tremendous boost to the agricultural production in India due to greater use of high yielding varieties, more fertilizers, pest management and other improved agricultural technologies. Increased yield ha⁻¹ result in greater removal of nutrients from soil and use of high analysis fertilizers was unable to supplement all nutrient elements. The use of organic manures went on decreasing due to their limited availability resulting in stagnation or decrease in fertility status of soil. This also affected the biological characters of soils and lead to decline in soil quality and soil health.

India is a country with a lot of natural resources of organic materials. Organic wastes available in India are estimated to supply about 7.1 million tonnes; 3.0 million tonnes and 7.6 million tonnes of nitrogen, phosphorus and potassium, respectively. Many of resources are not being utilized. The considerable nutrient requirement for crop production can be obtained from proper bioconservation of organic wastes, FYM, compost etc. This alone will give a clean and protected environment. The sugar industries in India release about 3-4 million tonnes of waste as press mud annually Shahi (2002) [20]. The municipal solid waste is the solid matter discarded as waste by citizens. The solid waste is a mixture of several items having different physical properties

with a daily generation rate of about 500.0 g per individual. These wastes include combustible and recyclable inert materials. The cotton wastes (33, 000t), jute mill waste (5000.0t), coir waste (0.67 metric tonne), wool waste (2.0 metric tonne) are the important ones they may find use as plant nutrient sources. In Varanasi region present status of different organic waste generation are viz., carpet waste 5000.0 metric tonne per year, pressmud about 600 metric tonne per year, sludge 25000 metric tonne per year and sewage about 240.0 million liter per day (Tiwari, 2002) [27]. The reported organic wastes are the testimony of valuable role of organic matter in maintaining a good soil health of the soil in terms of improving physio-chemical properties, microbial population and their activities, and increasing nutrient availability to the crop plant.

The study was made on the topic entitled "effect of organic and inorganic plant nutrient sources on nutrient content and uptake in wheat". The complete study included pot experiments conducted at the department of Soil Science and Agricultural chemistry, KNIPSS, Sultanpur with following objectives. To study the influence of supplements on nitrogen content and uptake in grain and straw of wheat, to study the influence of supplements on P-content and uptake in grain and straw of wheat and to study the influence of supplements on K- content and uptake in grain and straw of wheat.

Materials and methods

This chapter elaborates the materials used, experimental procedures followed and techniques adopted during the present investigations. The present investigation entitled "Effect of organic and inorganic plant nutrient sources on nutrient content & their uptake in wheat" involving pot

culture experiments was carried out on the soils of Agricultural Research Farm Department of Soil Science & Agricultural Chemistry, Kamla Nehru Institute of Physical and Social Sciences, Sultanpur, Uttar Pradesh, India,(KNIPSS) during *rabi* seasons of 2023-24 and 2024-25. The details of materials used and methods employed during the course of experimentation are presented in this chapter.

Pot Culture Experiments

Two sets of pot culture experiments, in *rabi* season were conducted in two years.

Pot Filling

Eight kg soil was filled in suitable earthen pot. All pots were lined with polythene for checking the nutrient loss and nutrient interaction with earthen pots.

Table 1: Details of Experiment: Given below

Total number of treatments	=	12
Replications	=	3
Total number of pots	=	36
Pot capacity	=	10 kg
Design	=	Completely Randomized Block Design (CRD)

Crop and Variety used

Crop - Wheat
 Variety - HUW – 234

when required. Weeding was done by manual means. The agronomic intercultural operations were done from time to time for maintaining proper condition.

HUW –234 characteristics: It was developed from the Institute of Agricultural Sciences, B.H.U., Varanasi and recommended for late sowing under irrigated conditions for north eastern plain zones. It has tremendous yield potential and excellent tall variety and high dry matter producer per unit area. It has wider adaptability and amber hard, good shining and lustrous grains.

4. Irrigation management: Irrigation was duly given frequently and whenever required to maintain field capacity condition in experimental soil throughout crop growth in pot culture experiments.

Date of Sowing : 29th November in both years.

Pot Operations

1. Application of nutrient sources: The total amount of organic manures/wastes, viz. FYM, CW, PM, DS, PyM were applied 7 days before sowing of the wheat in order to facilitate the complete decomposition of organic manures/wastes. The organic manures/wastes were uniformly mixed with soil and applied on the basis of nitrogen content as per treatments. Nitrogen through urea was applied in two splits, half at basal and half at tillering stage whereas the total amount of P₂O₅ and K₂O were applied at the time of sowing of seed.

Harvesting: The experimental crop of wheat was harvested at proper maturity stage. The harvested experimental crop was tagged. After tagging fresh weight was taken immediately. Then these experimental samples were allowed to dry first in air then hot oven at 70°C. After this dry weight was taken immediately. Harvesting was done 25th March.

2. Sowing of wheat: Sowing of wheat was done on 29th November, 2023 and 2024. A well pulverized but firm soil condition is imperative to attain uniform and good germination of wheat. Ten seeds were sown initially but after proper germination of seeds, thinning was done to maintain 5 seedlings at uniform distance.

Threshing: The weighed samples of wheat were threshed manually. The grain and straw weight were recorded (g pot⁻¹) by subtracting grain weight from total biomass after winnowing and cleaning.

3. Intercultural operations: Weeding was done as and

Collection of Plant Samples: Plant samples were collected carefully from each experimental pot at the time of harvest. The plant sample (straw and grain) were oven dried at 70°C, powdered with the help of grinder and packed in polythene bag for chemical analysis.

Grain and straw yield (in gram): The harvested material from each replication was weighed and threshed. The grains are separated, cleaned, winnowed and weights were recorded. The grain yield was deducted from sample weight. Grain and straw yields (g pot⁻¹) was computed.

Table:2 Details of Treatment: Details of Treatment given below

T₁	:	Control (Natural farming)
T ₂	:	100 % of NPK (N: P ₂ O ₅ :K ₂ O) 130: 75: 70 kg ha ⁻¹
T ₃	:	100% of NPK + 6 tonne ha ⁻¹ FYM (equivalent to 30 kg N)
T ₄	:	100% of NPK + 255 kg CW ha ⁻¹ (equivalent to 30 kg N)
T ₅	:	100% of NPK + 3.0 tonne PM ha ⁻¹ (equivalent to 30 kg N)
T ₆	:	100% of NPK +3.0 tonne DS ha ⁻¹ (equivalent to 30 kg N)
T ₇	:	100% of NPK + 1.2 tonne PyM ha ⁻¹ (equivalent to 30 kg N)
T ₈	:	130 kg N as FYM + P: K (75: 70) kg ha ⁻¹
T ₉	:	130 kg N as CW + P: K (75: 70) kg ha ⁻¹
T ₁₀	:	130 kg N as PM + P: K (75: 70) kg ha ⁻¹
T ₁₁	:	130 kg N as DS + P: K (75: 70) kg ha ⁻¹
T ₁₂	:	130 kg N as PyM + P: K (75: 70) kg ha ⁻¹

Nutrient uptake (mg pot⁻¹)

The nutrient uptake by grain and straw were calculated by multiplying the content of nutrient element in grain and straw with the respective yield.

$$\text{Nutrient Uptake in straw} = \frac{\text{Nutrient content in straw} \times \text{yield of straw}}{100} \times 1000$$

$$\text{Nutrient Uptake in grain} = \frac{\text{Nutrient content in grain} \times \text{yield of grain}}{100} \times 1000$$

All the experimental data of soil, plant and soil microorganism were statistically analysed to drawn conclusion of significance by using the method as prescribed by Panse and Sukhatme (1967) [13]. The test of significance was carried out at 5% level of significance by referring to 'F' table value. Critical differences were worked out for the effects which were significant.

Standard methods used for the analyses of soil, manures & plants for organic carbon, N,P,K, micronutrients along with physical properties of the soils Walkley and Black's (1934) [28], Tandon H.L.S. (1998), Jackson (1967) [9], Anonymous (1984), Black *et al.* (1965) [3], Jackson (1973) [10], Bouyoucos (1927) [4], Black *et al.* (1966) [3], Subbiah and Asija (1956), Watanabe and Olsen (1965) respectively.

Plant Analysis for Nitrogen, phosphorus and potassium in straw and grain samples: Processed straw and grain samples were digested in diacid mixture [H₂SO₄ and HClO₄ in volume ratio of 9:1 and by adding drop by drop hydrogen peroxide (H₂O₂) to colourless] for N, P and K estimation. Digested extract analysed for nitrogen content by using Nessler's reagent (Jackson, 1973) [10]. Phosphorus content of extract was estimated by Vanado-molybdo phosphoric acid

yellow colour method and potassium content in sample was estimated by flame photometer (Jackson, 1967) [9].

Results and Discussion

The physico-chemical characteristics of the initial soil samples collected Agricultural Research Farm for pot culture study have been reported in table 3. The soils of this area belong to the soil order Inceptisol.

Microbial counts for total bacteria, fungi and actinomycetes including enzymic activities of dehydrogenase, urease and alkaline phosphatase as well as respiration rate in terms of CO₂-evolution in initial soil sample are presented in table 1.

Physico-chemical properties of organic sources used during experimentations: The locally available organic wastes such as digested sludge (DS), farm yard manure (FYM), carpet waste (CW), sulphinated pressmud (PM) and poultry manure (PyM) were analyzed for the evaluation of the manurial value i.e., for the plant nutrients present in them. The data regarding chemical composition of organic wastes are given in table 4. As indicated by chemical composition of organic wastes, the water holding capacity, organic carbon and nitrogen content were highest in woolen carpet waste and while phosphorus and potassium contents were highest in poultry manure. As far as Zn, Cu, Fe, and Mn are concerned; these were more in PM and DS than CW, PyM and FYM.

Physico-chemical characteristics of Soils

The physico-chemical characteristics of the initial soil samples collected from KNIPSS, Sultanpur block of Agricultural Research Farm for incubation study have been reported in table 3. The soils of this area belong to the soil order Inceptisol.

Table 3: Physico-chemical properties of Initial soil.

Soil Properties	Values
Texture of the soil	Sandy loam
Bulk density (Mg m ⁻³)	1.15
Particle density (Mg m ⁻³)	1.82
Water holding capacity (%)	41.20
pH	7.20
E.C. (dSm ⁻¹)	0.042
O.C. (g kg ⁻¹)	5.2
C.E.C. [cmol (p ⁺) kg ⁻¹ soil]	11.45
Available N (mg kg ⁻¹)	78.34
Available Olsen's P (mg kg ⁻¹)	4.31
Available K (mg kg ⁻¹)	67.41
Micronutrients (mg kg⁻¹)	
Available Zn	0.34
Available Fe	5.50
Available Cu	0.46
Available Mn	6.90

Table 3: Microbiological and biochemical properties of the initial soil.

Soil Properties	Values
A. Microbial counts	
Total fungi (x10 ³ g ⁻¹ soil)	4.70
Total bacteria (x10 ⁵ g ⁻¹ soil)	9.50
Total actinomycetes (x10 ⁴ g ⁻¹ soil)	7.87
B. Enzymic activities	
Dehydrogenase activity (µg TPF produced g ⁻¹ soil day ⁻¹)	47.69
Urease activity (µg urea hydrolysed g ⁻¹ soil hr ⁻¹)	261.55
Alkaline phosphatase activity (µg p-nitrophenol produced g ⁻¹ soil hr ⁻¹)	58.85
CO ₂ - evolution (mg - CO ₂ 100 g ⁻¹ dry soil)	1.75

Physico-chemical properties of organic sources used during experimentations

The locally available organic wastes such as digested sludge (DS), farm yard manure (FYM), carpet waste (CW), sulphinated pressmud (PM) and poultry manure (PyM) were analyzed for the evaluation of the manurial value i.e., for the plant nutrients present in them. The data regarding chemical composition of organic wastes are given in table 4. As indicated by chemical composition of organic wastes, the water holding capacity, organic carbon and nitrogen content were highest in woolen carpet waste and while phosphorus and potassium contents were highest in poultry manure. As far as Zn, Cu, Fe, and Mn are concerned; these were more in

PM and DS than CW, PyM and FYM.

The nutrient status of the different organic wastes employed in this experiment was in the following order:

Nutrient contents in organics

N = CW > PyM > PM = DS > FYM
 P = PyM > PM > DS > FYM > CW
 K = PyM > FYM > DS > PM > CW
 Zn = DS > PM > PyM = CW > FYM
 Cu = PM > DS > PyM > CW > FYM
 Fe = PM > DS > FYM > PyM > CW
 Mn = PM > DS > PyM > FYM > CW

Table 4: Physico-chemical properties and nutrient contents in various organic sources.

Parameters	Organic Sources				
	FYM	CW	PM	DS	PyM
WHC (%)	121.22	334.80	211.80	89.50	121.22
pH	6.7	7.3	7.2	7.4	6.9
Organic carbon (%)	18.50	56.55	15.08	8.70	13.25
N (%)	0.5	12.0	1.0	1.0	2.5
P (%)	0.38	0.05	0.94	0.40	1.9
K (%)	0.90	0.05	0.28	0.33	1.6
Micronutrients (mg kg⁻¹)					
Zn	40	90	440	760	90
Cu	2.8	20	260	130	71
Fe	1665	20	5040	4740	1400
Mn	40	20	460	250	90
C: N ratio	37.0	4.52	14.36	5.03	5.26

Pot Cultue Experiment

Effect of organic and inorganic sources of nutrients on N content (grain and straw) and its uptake in wheat: The data pertaining to N content and uptake have been given in table 5a and table 5b. The content of N in grain and straw of wheat were in the range of 1.02 to 1.66 per cent and 0.30 to 0.53 per cent during 2023-24, and 1.07 to 1.80 and 0.35 to 0.58 per cent during 2024-25, respectively. Similarly, the poled data of the both years have shown grain N content of wheat in the range 1.05 to 1.73 per cent and content of straw 0.33 to 0.58 per cent. The minimum values in grain as well as in straw was in control (T₁) while the maximum was with 100% NPK + 30 kg N ha⁻¹ through PyM (T₇). All the treatments shoved significant increase in N content over control (T₁) during both the years. The data have revealed that combined application of 100 per cent RDF and organics was superior as compared to their independent application. However, some independent organic treatments have shown its superiority even over integrated approaches. The results of treatment T₃ to T₇ were at par.

The data regarding uptake of N by grain, straw have been shown by table 5a, 5b and figure for uptake 1. In grain it varied from 54.37 to 211.65 mg pot⁻¹ while in straw it varied from 48.00 to 109.24 mg pot⁻¹. Similarly, the pooled data of both years have shown 64.63 to 229.40 (grain), 54.33 to 121.60 (straw) and 118.96 to 350.99 (total uptake by grain and straw). The lowest values of the all three parameters were recorded in control (T₁) treatment. However, the highest were recorded due to treatments of 100% NPK+30 kg N ha⁻¹ through C. W. (T₄) All the treatments have shown significant increase in N uptake over control (T₁) during both the years of experimentation and pooled data. The treatments of integrated approached of 100% RDF along with different organic sources equivalent to 30 kg N ha⁻¹ have been showed significant superiority in both years and

in pooled data compare to alone treatments of inorganic (T₂) or organic sources (T₈ to T₁₂) during both years and in pooled data. Compare to first year of experimentation, second year experiment have shown maximum uptake of nitrogen (mg pol⁻¹). Nitrogen application through combined inorganic and organic sources (T₃ to T₇) has resulted in significantly higher N content as compared to independent application of either organic or inorganic sources. This might be due to faster mineralization of organic substances in presence of urea-N or there is also possibility of synergistic effect of both types of sources. Some workers (Biswas and Dravid,1998; Singh *et al.* 2001) [2, 21] have also reported higher content of N in straw and grain due to application of D.S., C.W. and P.M. Higher production and greater content of N gave the higher value of uptake.

Effect of organic and inorganic sources of nutrients on content (%) and uptake (mg pot⁻¹) of phosphorus is wheat: The data have been presented in table 6a, 6b and figure for uptake 2. Phosphorus content (%) in straw was less than the P content of grain. The content of P of grain and straw in 2023-24 was in the range of 0.40 to 0.54% and 0.45 to 0.56% while during 2024-25 it ranged from 0.12 to 0.22%; and 0.16 to 0.26%, respectively. The pooled data of both years have shown in the range of 0.425 to 0.550 % in grain and 0.14 to 0.24% in straw. The lowest values of the both parameters were observed in control treatment. While, the highest was due to combined treatments of 100% NPK+30 kg N ha⁻¹ through C.W. (T₄). The total uptake (mg pot⁻¹) in 2023-24 was observed in the ranged from 40.52 to 115.97 while during 2024-25 it ranged from 59.23 to 139.08 mg pot⁻¹. The pooled data reflected the range from 49.87 to 127.52 mg pot⁻¹. But the highest and lowest values were with T₄ and T₁ respectively. All the treatments have shown significant increase in content and uptake of phosphorus

over control during the both years. Here, again combined inorganic and organic (T₃ to T₇) induced higher content and uptake of phosphorus in grain and straw as compared to N applied through alone treatments of either inorganic fertilizers (T₂) or independent treatments of organic (T₈ to T₁₂). 100 percent NPK+30 kg N through carpet waste yielded the highest value while 100% NPK+30 kg N ha⁻¹ through D.S. gave the lowest value. Among the organic treatments 130 kg N as carpet waste + PK gave the highest value and 130 kg N as digested sludge + PK gave lowest value of content and uptake of phosphorus by grain and straw in both years. The treatments T₃, T₅, T₆, and T₇, gave almost at par values. Likewise, independent treatments yielded at par results regarding phosphorus content in grains. In case of straw T₃ showed at par value with T₄, T₅, T₇ and T₈ and also with T₁₀, T₁₁ and T₁₂. Here, again the main focus reflects on the effect of organics and in-organics not only on nutrient release but also side effect which are observed on comparative basis. No doubt, combination of organics and inorganic proved superior to only inorganic application. If only organic sources are considered, being better to inorganic, the content of nutrient elements is lower and this may be the reason nutrient sources only with control in grain that combination of organic and inorganic proved superior. In fact, organics, after breakdown or decay, release a number of compounds of varied nature which exert profound effect on the availability of nutrients and dynamics of living population involved in, various processes, such ideas were also advocated by Subramaniyan and Wahab (1997) [25]. The presence of not only nitrogen favoured the utilization of P and K efficiently by plants but the improvement in utilization of P is brought about through the indirect of N like root proliferation. Abdul Salem and Subramanian, (1988) [1] and Subramaniyan and Wahab (1997) [25] this element might have also helped in the efficient absorption and utilization of the other required plant nutrient which ultimately increased the grain and straw yields, confirming the findings of Modak (1992) [11], Ravi (1993) [18] and Singh and Rai (2002) [22].

Effect of organic and inorganic sources of nutrients on content (%) and uptake (mg pot⁻¹) of potassium by wheat crop: Results pertaining to the effect of different treatments of potassium content and its uptake by grain and

straw have been given in table 7a, 7b and figure for uptake 3. Potassium content in straw was more than grain. The content of K in the grain and straw ranged from 0.413 to 0.428 and 0.434 to 0.449 % respectively during 2023-24, and from 1.30 to 1.41 and 1.41 to 1.52 % respectively during 2024-25. Having observed the pooled data of content in grain was from 0.424 to 0.439 and is straw from 1.355 to 1.465 percent the uptake of K (mg pot⁻¹) by grain, straw and as well as total uptake was observed in the range of 22.01 to 54.57, 208.00 to 302.02 and 130.01 to 356 mg pot⁻¹ during 2023-24 and 30.38 to 61.65, 244.34 to 363.58 and 274.73 to 425.23 mg pot⁻¹ in 2024-25 respectively. According to pooled data the uptake ranged from 26.20 to 58.11 in grain, 226.18 to 332.80 in straw and 252.37 to 390.92 mg pot⁻¹ as total uptake. The lowest values were recorded in control and the maximum was RDF +30 kg N ha⁻¹ through carpet waste (T₄). All the treatments have shown significant increase in content as well as uptake of potassium over control during both years. Here again, the combination of inorganic and organic sources of nutrients resulted is higher content and uptake of potassium in grain as well as in straw compared to nutrients applied in the form of independent treatments either organic or inorganic. Here again, the best treatment was T₄ (100% NPK +30 kg N ha⁻¹ through carpet waste) and the poorest was T₆. Among the organic treatments T₉ was gave the maximum value and T₁₁ gave the minimum value of content and uptake of potassium by grain and straw during both the years. All treatments together T₂ resulted at par value with T₈, T₁₀, T₁₁, and T₃ shown at par value with T₅ and T₇ regarding K – content in grain. In case of straw mostly all the treatments have shown at par values with each other.

The out come of the results has revealed that not only N and P but K- content and uptake have been positively affected by organics the results agree with those of Patel and Singh (1993) [14] and Subramaniyam and Wahab (1997). Grune and Krant (1958) [8], Stanberry, (1948) [23], Abdul Salem and Subramanian, (1988) [1] and Subramanian and Wahab, (1997) and Rai et.al. (2019 & 2024) [17, 16] have also reported that enhanced utilization of K is brought about through the effect of N and P on root proliferation ratio, extent and distribution of K in soil.

Table 5a: Effect of organic and inorganic plant nutrient sources on grain and straw nitrogen content (%) in wheat

Treatments	Content of N (%)					
	In grain			In straw		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
T1	1.02	1.07	1.05	0.30	0.35	0.33
T2	1.56	1.70	1.63	0.43	0.47	0.45
T3	1.59	1.73	1.66	0.45	0.54	0.50
T4	1.66	1.80	1.73	0.51	0.56	0.54
T5	1.60	1.74	1.67	0.49	0.53	0.51
T6	1.63	1.76	1.70	0.46	0.52	0.49
T7	1.66	1.80	1.73	0.53	0.58	0.56
T8	1.60	1.73	1.67	0.50	0.54	0.52
T9	1.62	1.75	1.69	0.51	0.55	0.53
T10	1.59	1.72	1.66	0.49	0.53	0.51
T11	1.60	1.73	1.67	0.48	0.52	0.50
T12	1.65	1.77	1.71	0.49	0.53	0.51
SEm±	0.014	0.016	0.015	0.010	0.012	0.011
CD(P=0.05)	0.029	0.033	0.031	0.021	0.025	0.023

Table 5b: Effect of organic and inorganic plant nutrient sources on grain and straw nitrogen uptake (mg pot⁻¹) in wheat

Treatments	Uptake of N (mg pot ⁻¹)								
	By grain			By straw			Total		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
T1	54.37	74.90	64.63	48.00	60.66	54.33	102.37	135.56	118.96
T2	163.80	198.39	181.10	81.70	101.05	91.38	245.50	299.44	272.47
T3	200.02	233.55	216.79	95.40	128.68	112.04	295.42	362.23	328.83
T4	211.65	247.14	229.40	109.24	133.95	121.60	320.89	381.09	350.99
T5	200.80	234.90	217.85	103.73	125.24	114.49	304.53	360.14	332.34
T6	197.23	228.45	212.84	97.43	120.59	109.01	294.66	349.04	321.85
T7	207.50	242.10	224.80	112.31	137.23	124.78	319.81	379.33	349.57
T8	163.68	189.78	176.73	85.50	106.81	96.16	249.18	296.60	272.89
T9	167.99	194.25	181.12	88.23	109.56	98.90	256.22	303.81	280.02
T10	159.48	187.82	173.65	83.79	104.52	94.15	243.28	292.34	267.80
T11	144.32	176.46	160.39	78.48	101.56	90.02	222.80	278.02	250.41
T12	164.16	192.05	178.11	83.94	104.52	94.23	248.11	296.56	272.34
SEm±	0.100	0.087	0.094	0.028	0.048	0.038	0.129	0.135	0.132
CD(P=0.05)	0.432	0.369	0.401	0.122	0.208	0.165	0.554	0.577	0.566

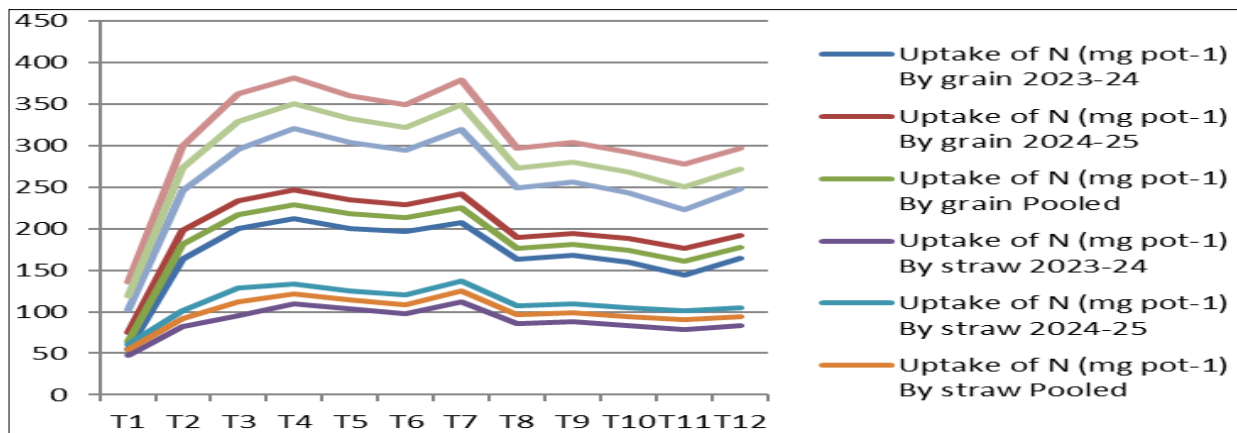


Fig 1: Effect of organic and inorganic plant nutrient sources on grain and straw nitrogen uptake (mg pot⁻¹) in wheat

Table 6a: Effect of organic and inorganic plant nutrient sources on grain and straw P- content (%) in wheat

Treatments	Content of P (%)					
	In grain			In straw		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
T1	0.40	0.45	0.425	0.12	0.16	0.14
T2	0.47	0.52	0.495	0.15	0.19	0.17
T3	0.52	0.55	0.535	0.21	0.25	0.23
T4	0.54	0.56	0.550	0.22	0.26	0.24
T5	0.49	0.54	0.515	0.20	0.24	0.22
T6	0.50	0.53	0.515	0.19	0.23	0.21
T7	0.52	0.54	0.530	0.20	0.24	0.22
T8	0.50	0.51	0.505	0.17	0.21	0.19
T9	0.47	0.52	0.495	0.19	0.23	0.21
T10	0.45	0.50	0.475	0.18	0.22	0.20
T11	0.44	0.49	0.465	0.16	0.20	0.18
T12	0.48	0.50	0.490	0.18	0.22	0.20
SEm±	0.013	0.016	0.0145	0.005	0.007	0.006
CD(P=0.05)	0.027	0.033	0.031	0.0103	0.0144	0.0124

Table 6b: Effect of organic and inorganic plant nutrient sources on grain and straw P- uptake (mg pot⁻¹) in wheat

Treatments	Uptake of P (mg pot ⁻¹)								
	By grain			By straw			Total		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
T1	21.32	31.50	26.41	19.20	27.73	23.46	40.52	59.23	49.87
T2	49.35	60.68	55.02	28.50	40.85	34.68	77.85	101.53	89.69
T3	65.42	74.25	69.83	44.52	59.58	52.047	109.94	133.83	121.88
T4	68.85	76.89	72.87	47.12	62.19	54.66	115.97	139.08	127.52
T5	61.50	72.90	67.20	42.34	56.71	49.53	103.84	129.61	116.73
T6	60.50	68.79	64.65	40.24	53.34	46.79	100.74	122.13	111.44
T7	65.00	72.63	68.82	42.38	56.78	49.58	107.38	129.41	118.41

T8	51.15	55.95	53.55	29.07	41.54	35.30	80.22	97.49	88.85
T9	48.74	57.72	53.23	32.87	45.82	39.34	81.61	103.54	92.57
T10	45.14	54.60	49.87	30.78	43.38	37.08	75.92	97.98	86.95
T11	39.69	49.98	44.83	26.16	39.06	32.61	65.85	89.04	77.44
T12	47.76	54.25	51.01	30.83	43.38	37.11	78.59	97.63	88.11
SEm±	0.094	0.087	0.090	0.014	0.028	0.021	0.108	0.115	0.111
CD(P=0.05)	0.402	0.369	0.386	0.058	0.116	0.087	0.460	0.486	0.473

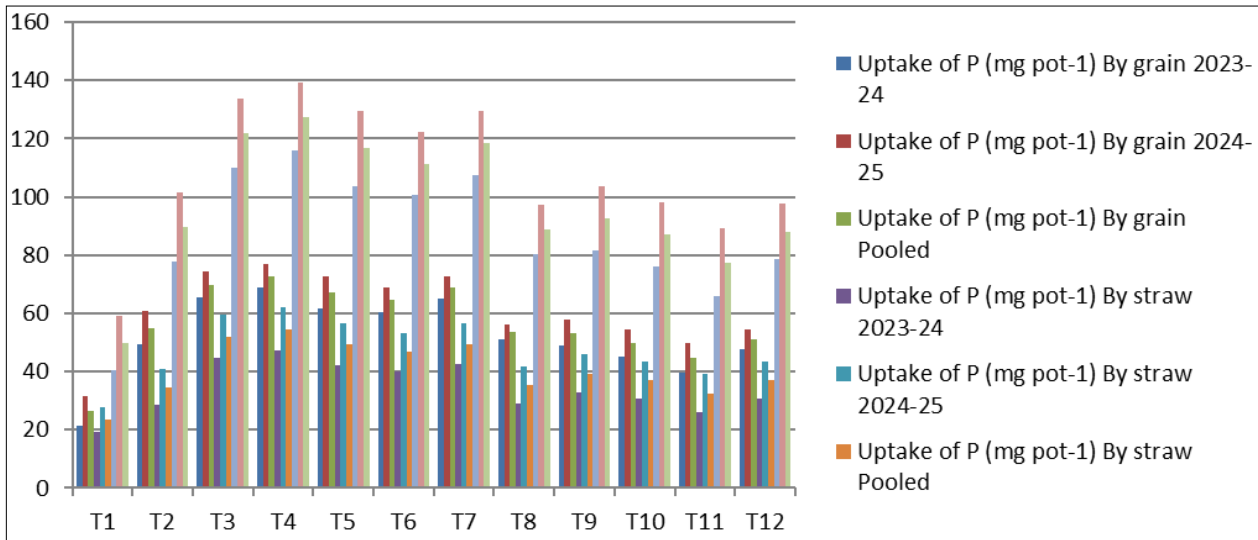


Fig 2: Effect of organic and inorganic plant nutrient sources on grain and straw P- uptake (mg pot⁻¹) in wheat

Table 7a: Effect of organic and inorganic plant nutrient sources on grain and straw K- content (%) in wheat

Treatments	Content of K (%)					
	In grain			In straw		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
T1	0.413	0.434	0.424	1.30	1.41	1.355
T2	0.417	0.438	0.428	1.35	1.46	1.405
T3	0.422	0.443	0.433	1.38	1.49	1.435
T4	0.428	0.449	0.439	1.41	1.52	1.465
T5	0.421	0.442	0.432	1.37	1.48	1.425
T6	0.419	0.440	0.429	1.36	1.47	1.415
T7	0.420	0.441	0.430	1.37	1.48	1.425
T8	0.418	0.439	0.429	1.34	1.45	1.395
T9	0.419	0.440	0.430	1.35	1.46	1.405
T10	0.418	0.439	0.429	1.33	1.44	1.385
T11	0.417	0.438	0.428	1.34	1.45	1.395
T12	0.418	0.439	0.429	1.33	1.44	1.385
SEm±	0.012	0.014	0.013	0.016	0.018	0.017
CD(P=0.05)	NS	NS	NS	0.033	0.037	0.035

Table 7b: Effect of organic and inorganic plant nutrient sources on grain and straw K- uptake (mg pot⁻¹) in wheat.

Treatments	Uptake of K (mg pot ⁻¹)								
	By grain			By straw			Total		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
T1	22.01	30.38	26.20	208.00	244.35	226.18	230.01	274.73	252.37
T2	43.78	51.11	47.45	256.50	313.90	285.20	300.28	365.02	332.69
T3	53.09	59.80	56.45	292.56	355.07	323.81	345.65	414.87	380.26
T4	54.57	61.65	58.11	302.02	363.58	332.80	356.59	425.23	390.92
T5	52.84	59.67	56.25	290.03	349.72	319.88	342.86	409.39	376.13
T6	50.70	57.11	53.91	288.05	340.89	314.47	338.75	398.01	368.38
T7	52.50	59.32	55.91	290.30	350.17	320.24	342.80	409.48	376.14
T8	42.76	48.16	45.46	229.14	286.81	257.98	271.90	334.97	303.43
T9	43.45	48.84	46.15	233.55	290.83	262.19	277.00	339.67	308.34
T10	41.93	47.94	44.93	227.43	283.97	255.70	269.36	331.91	300.63
T11	37.61	44.67	41.14	219.09	283.19	251.14	256.70	327.86	292.28
T12	41.59	47.63	44.61	227.83	283.97	255.90	269.42	331.60	300.51
SEm±	0.086	0.076	0.081	0.045	0.072	0.058	0.131	0.148	0.139
CD(P=0.05)	0.373	0.325	0.349	0.191	0.307	0.249	0.564	0.632	0.598

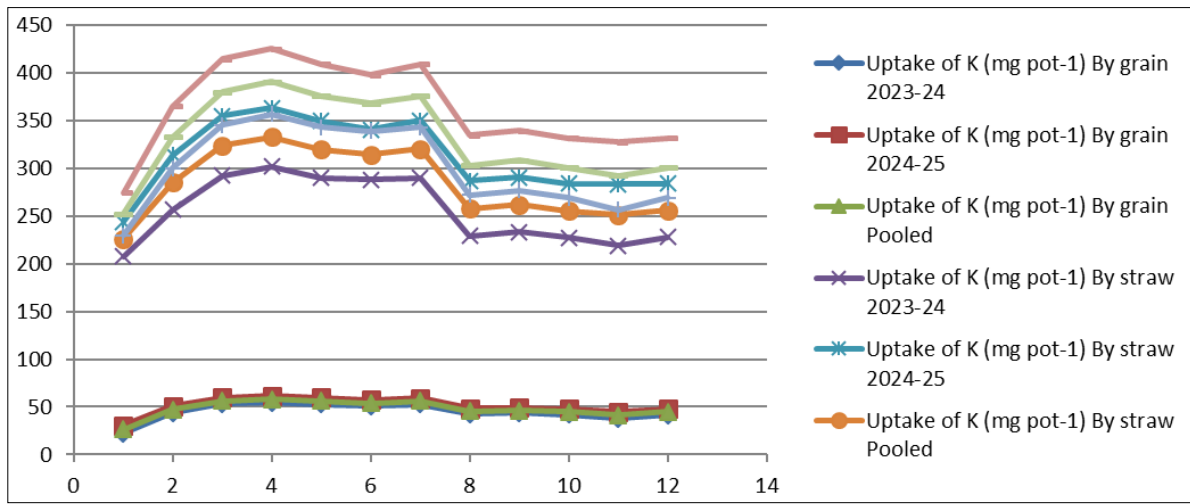


Fig 3: Effect of organic and inorganic plant nutrient sources on grain and straw K- uptake (mg pot^{-1}) in wheat

Summary: Application of N through 130 kg ha^{-1} by urea and 30 kg ha^{-1} through different organic sources (T_3 to T_7) increase the N, P and K contents significantly (except K in grain) in grain and straw at harvest in addition to their increased uptake by the crop over no fertilizer / manure (T_1). Among various treatment, N application through combination of poultry manure (T_7) resulted in higher N content in grain and straw; however, the uptake was maximum in grain as carpet waste (T_4) and in the straw as poultry manure (T_7) but total uptake of N was maximum and minimum recorded in the treatment of $100\% \text{ NPK} + 30 \text{ kg N ha}^{-1}$ through C.W. (T_4) and control (T_1) respectively. Whereas, P and K content and their uptake were maximum observed in the treatment of T_4 in grain and straw. The results of N content in the treatments T_3 to T_7 were at par; most of the similar trends were found in the case of P and K content.

Conclusion

Application of organic manures / wastes alone treatments (organic farming) was found to be favourable for pot experiment of wheat. Application of 100 per cent nitrogen through urea along with 30 kg N ha^{-1} through organic sources (integrated nutrient management) was found to be highly effective for achieving maximum yield of wheat in both years with other parameters of wheat. The application of recommended doses of N through farm yard manure, poultry manure, press mud and carpet waste were also found suitable for nutrient acquisition to wheat as organic sources. Application of N through 120 kg ha^{-1} by urea and 10 kg ha^{-1} through different organic sources (T_3 to T_7) increase the N, P and K contents significantly (except K in grain) in grain and straw at harvest in addition to their increased uptake by the crop over no fertilizer / manure (T_1). Among various treatment, N application through combination of poultry manure (T_7) resulted in higher N content in grain and straw; however, the uptake was maximum in grain as carpet waste (T_4) and in the straw as poultry manure (T_7) but total uptake of N was maximum and minimum recorded in the treatment of $100\% \text{ NPK} + 10 \text{ kg N ha}^{-1}$ through C.W. (T_4) and control (T_1) respectively. Whereas, P and K content and their uptake were maximum observed in the treatment of T_4 in grain and straw. The results of N content in the treatments T_3 to T_7 were at par; most of the similar trends were found in the case of P and K content.

Recommendations: On the basis of two years of pot experimentation, final recommendation for the farmers will not be justified. Nevertheless, the findings indicate that if recommended dose of N is to be applied through the organics (FYM, CW, PM, DS and PyM), there is a possibility of reduction in yield in comparison to recommended doses of chemical fertilizer along with 30 kg N ha^{-1} additional nitrogen through organic sources of nutrients and alone treatment of inorganic sources. However, the indications are that lower yield of wheat in case of organic farming (T_8 - T_{12}) and natural farming (T_1 -without nutrient sources).

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