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Residual effect of nutrient management of *kharif* groundnut on nutrient content-uptake and soil nutrient-microbial dynamics in subsequent wheat under organic farming

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Abstract
A field experiment entitled, **"**Residual effect of nutrient management of *kharif* groundnut on nutrient content-uptake and soil nutrient-microbial dynamics in subsequent wheat under organic farming**"** was carried out during two consecutive *kharif* and *rabi* seasons of 2021-22 and 2022-23 on loamy sand soil of Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. The nine nutrient management treatments under organic farming applied to groundnut during *kharif* season were laid out in randomized block design and twenty-seven treatment combinations comprising residual effect of preceding nine nutrient management treatments of groundnut followed by three levels of RDN through organic manure along with cow-based bioenhancer to wheat tested in spilt plot design with three replications. Nutrient content and uptake of wheat as well as nutrient status and microbial count in the soil after nutrient management treatments of groundnut remained unaffected due the residual effect of various nutrient management treatments under organic farming. 75% RDN through FYM: castor cake: vermicompost (1:1:1) + *panchgavya* @ 4% spray at 30 and 60 DAS to wheat recorded significantly higher nitrogen content, NPK uptake and available nitrogen status as well as microbial count in the soil after harvest of wheat.

Keywords: Grain, straw, *Panchgavya*, nutrient content and microbial count

Introduction
Wheat (*Triticum aestivum* L.) is the second most important cereal crop next to rice in the world belongs to the family *Poaceae.* It is the leading cereal grain, where 40% of the world population uses as a staple food. Its increasing demand, day by day, is due to increase in the population of India. It is grown on 218.54 million hectares worldwide from the equator to the latitudes of 60°N and 44°S and at altitude ranges from sea level to 3000 m MSL. Wheat is the world's leading cereal crop cultivated over an area 221.11 million hectares with a production of 773.43 million tonnes (Anonymous, 2020) [1] and China is a major wheat producing country and contributed to 10.65 per cent (23.57 million ha) and 17.31 per cent (137.00 million tonnes) of the world total wheat harvest area and yield production in 2021, respectively (Anonymous, 2020) [1].

In Indian agriculture, wheat assumes a special significance on account of its utilization as food, feed and fodder besides several industrial uses. It is cultivated in almost all parts of the country and occupied 31.12 million hectares with the production of 109.58 million tonnes and with an average productivity of 3551 kg/ha (Anonymous, 2020) [1]. The major wheat producing states are Uttar Pradesh, Madhya Pradesh, Punjab, Rajasthan, Haryana and Bihar which occupies 9.85, 6.08, 3.53, 3.00, 2.56 and 2.22 million hectares area with the production of 35.50, 18.18, 17.18, 11.03, 12.39 and 6.14 million tonnes of total wheat cultivation in the country, respectively.

Its popularity comes from the versatility of its use in the production of a wide range of food products, such as *Injera*, breads, cakes, pastas, cookies etc. (Pena, 2002) [8]. In addition, it has high nutritive value (>10% protein, 2.4% lipid, and 79% carbohydrates) and it accounts for about 20 of the caloric intake of the human diet (Gooding and Davies, 1997) [2].

There is a keen awareness worldwide in recent years on the excess use of inorganic fertilizers and other chemicals leading to environmental pollution and pest outbreaks. Sustained production strategies often involve application of organic sources. Sustainable farming depends upon the successful management of resources for agricultural production and to satisfy the human needs while maintaining or enhancing the quality of environment and conserving natural resources.

Principle of organic farming is to allow Mother Nature to provide us food the nature intended. The soil is of central importance. Organic farming nourishes the soil and its micro universe of life forms rather than force feeding the plant to grow unnaturally fast. Conservation and efficient use of natural resources are the means to achieve sustainable high yields, food, nutritional security and environmental safety. Organic farming is thought to be one of the ways for achieving these goals on a long term. Organic system relay on a modern and synthetic understanding of ecology and soil science, while also integrating traditional agricultural knowledge.

India is predominantly an agricultural country and green revolution has brought a significant change in Indian agriculture. The achievements were mainly due to use of high yielding varieties, fertilizer responsive crop cultivars and increased fertilizer use. However over emphasis on chemical farming has led to deterioration of soil health resulted in decline in productivity, besides causing soil and water pollution problems and health hazards (Pandey *et al.*, 2008) [6]. In India, most of the farming communities are small and marginal farmers having holdings less than one hectare land and now a day's chemical fertilizers are becoming a scarce commodity and due to its escalation in costs, farmers are finding difficult for its procurement. Though chemical fertilizers and pesticides helps in getting substantial yields, its indiscriminate use and continuous cropping has resulted in deterioration of soil health, which in turn resulted in poor crop productivity. Many experts in the field of agriculture have said that any more efforts to persist with the model of chemical agriculture will only prove counterproductive in the long run and cause irreparable damage to soil health and environment.

Material and Methods

A field experiment was conducted at Organic Unit, Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during the *kharif* and *rabi* seasons of 2021-22 and 2022-23, entitled with "Residual effect of nutrient management of *kharif* groundnut on nutrient content-uptake and soil nutrient-microbial dynamics in subsequent wheat under organic farming." The treatments consisted of nutrient management under organic farming *viz.*, G_1: 100% RDN through FYM, G_2: 100% RDN through castor cake, G_3: 100% RDN through vermicompost, G_4: 100% RDN through FYM + *Panchagavya* @ 4% spray at 30 and 60 DAS, G_5: 100% RDN through castor cake + *Panchagavya* @ 4% spray at 30 and 60 DAS, G_6: 100% RDN through vermicompost + *Panchagavya* @ 4% spray at 30 and 60 DAS, G_7: 100% RDN through FYM + *Bijamrut* (Seed treatment 200 ml/kg seed) + *Jivamrut* @ 500 lit/ha at 30 and 60 DAS, G_8: 100% RDN through castor cake + *Bijamrut* (Seed treatment 200 ml/kg seed) + *Jivamrut* @ 500 lit/ha at 30 and 60 DAS and G_9: 100% RDN through vermicompost + *Bijamrut* (Seed treatment 200 ml/kg seed) + *Jivamrut* @ 500 lit/ha at 30 and 60 DAS to groundnut in *kharif* season as main plot treatments and replicated three times in Randomized Block Design. During *rabi* season each main plot treatment was spited in to three sub-plot treatments with three levels of nutrient management *viz.*, W_1: *Panchgavya* @ 4% spray at 30 and 60 DAS, W_2: 50% RDN through FYM: Castor cake: Vermicompost (1:1:1) + *Panchgavya* @ 4% spray at 30 and 60 DAS and W_3: 75% RDN through FYM: Castor cake: Vermicompost (1:1:1) + *Panchgavya* @ 4% spray at 30 and 60 DAS to wheat resulting in twenty-seven treatment combinations replicated three times in Split Plot Design. The experiment was conducted on the same site without changing the randomization of the treatments for the successive year to assess the residual effects. Organic manure *viz.*, farm yard manure, vermicompost and castor cake (in 1:1:1 ratio) were applied to groundnut crop 15 days before sowing as per the treatments and uniformly mixed with soil at the time of bed preparation as per the treatment. The foliar application of *panchagavya* @ 4% applied after the 30 and 60 DAS of wheat. Before sowing, seeds were treated with *Azotobactor* and PSB biofertilizers @10 ml/kg seed during both the years. The seeds were sown manually at 22.5 cm row apart by maintaining the seed rate of 100 kg/ha and the seeds were sown in previously opened furrow at the depth of 2 to 3 cm and seeds were properly covered with soil and light irrigation was applied in each plot immediately after sowing. The plant samples were analyzed for N, P and K content as per the standard methods. The concentration of nutrients in grain and straw were used to calculate the uptake of nutrients by wheat. The protein content of wheat was worked out by multiplying nitrogen content with 5.70 (Hulse *et al.*, 1977) [3], to express as percentage on dry weight basis for each treatment. The soil samples were collected from each net plot after harvest of wheat crop at 0-15 cm depth. Available N and P_2O_5 and K_2O status of soil were analyzed by alkaline permanganate, olsen's method and flame photometric method, respectively. The soil samples for total bacterial count, *rhizobium*, PSB, KSB and *azotobacter* were collected from 0-15 cm depth from different spots of each net plot before sowing and after harvest of wheat. The data were statistically analyzed for various characters as described by (Panse and Sukhatme, 1967) [7].

Results and Discussion

1. Effect on nutrient content

The nitrogen, phosphorus and potassium content in grain and straw of wheat crop as influenced by different treatments is tabulated in Table 1.

Residual effect of nutrient management of groundnut

It was observed from the data summarized in Table 1 revealed that nitrogen, phosphorus and potassium content in grain and straw of wheat was non-significantly influenced due to different treatments applied to groundnut crop in pooled study.

Effect of nutrient management in wheat

The data presented in Table 1 further indicated that significantly the highest values of nitrogen, phosphorus and potassium content in grain and straw were recorded with the treatment W_3 (75% RDN through FYM: castor cake: vermicompost 1:1:1 ratio + *panchgavya* @ 4% spray at 30 and 60 DAS) in wheat during pooled study. The lower values of nitrogen, phosphorus and potassium content in grain and straw were recorded in the treatment W_1 (*Panchgavya* @ 4% spray at 30 and 60 DAS) during pooled study. These might be due to more availability of NPK to plant which was translocated to straw and grain. It might also be due to the addition of organic manure along with liquid organic manure enhances microbial population in soil and released organic acids favor more nutrient in plant so, nutrient

concentration in plant has increased. Similar results were also reported by Singh *et al.* (2020) [11] in wheat.

Interaction effect

It is evident from the data (Table 1) that combined effect of different treatment applied to groundnut and wheat crop failed to manifest their significant effect on nitrogen, phosphorus and potassium content in grain and straw of wheat (G × W) in pooled study.

2. Effect on nutrient uptake

Data on nitrogen, phosphorus and potassium uptake by grain and straw as well as total uptake by wheat plant is presented in Table 2.

Residual effect of nutrient management of groundnut

An examination of data given in Table 2 revealed that nitrogen, phosphorus and potassium uptake by grain, straw and total uptake by plant were non-significantly affected due to different nutrient management treatments applied to the preceding groundnut crop during pooled study.

Effect of nutrient management in wheat

The data presented in Table 2 indicated that higher values of nitrogen, phosphorus and potassium uptake by grain, straw and total uptake by wheat plant were recorded significantly highest with the treatment W_3 (75% RDN through FYM: castor cake: vermicompost in 1:1:1 ratio + *panchgavya* @ 4% spray at 30 and 60 DAS) in pooled study. The lower values of nitrogen, phosphorus and potassium uptake by grain, straw and total uptake by wheat plant were noted in the treatment W_1 (*Panchgavya* @ 4% spray at 30 and 60 DAS) during pooled study. This might be due to adequate amount of NPK nutrient in the rhizosphere which increased root and shoot growth as well as absorption of nutrient from deeper soil layers leading to enhanced translocation to reproductive structure such as seeds and other parts of plant. Availability of adequate amount of nutrient increases the cation exchange capacity of roots there by enabling them to absorb more nutrients from the soil. This might be due to adequate amount of NPK nutrient in the rhizosphere which increased root and shoot growth as well as absorption of nutrient from deeper soil layers leading to enhanced translocation to reproductive structure such as seeds and other parts of plant. Availability of adequate amount of nitrogen increases the cation exchange capacity of roots thereby enabling them to absorb more nutrients from the soil. Meena *et al*. (2018) [4] reported that uptake of nutrients by grain and straw increased due to higher availability of nutrients resulting higher yield of grain and straw.

Interaction effect

Interaction effect between different treatment imposed to groundnut and wheat crop (G × W) was not found any significant effect on nitrogen, phosphorus and potassium uptake by grain, straw as well as total uptake by wheat plant during pooled study.

3. Effect on available nutrients status in soil

The data on available N, P_2O_5 and K_2O in soil after harvest of wheat as influenced by different treatments during pooled study are presented in Table 3.

Residual effect of nutrient management of groundnut

The scrutiny of data presented in Table 3 indicated that the available N, P_2O_5 and K_2O in soil after harvest of wheat showed non-significant effect due to nutrient management treatments applied to preceding groundnut crop during pooled study.

Effect of nutrient management in wheat

Treatment W_3 (75% RDN through FYM: castor cake: vermicompost in 1:1:1 ratio + *panchgavya* @ 4% spray at 30 and 60 DAS) resulted in significantly highest available N, P_2O_5 and K_2O in soil in pooled study. The lower available N, P_2O_5 and K_2O in soil were recorded in the treatment W_1 (*panchgavya* @ 4% spray at 30 and 60 DAS) during pooled study. It might be due to accumulation of residual nitrogen through FYM, castor cake and vermicompost and increase C: N ratio in the soil. The primary effect of N-organic sources is to increase vegetative production, which ultimately added in the soil in the form of leaves and roots for recycling back in the soil system. Significant increase in available NPK of soil was due to the increased mineralization of organic nutrient by active microorganisms and the regular dynamics of biomass carbon. The long-term application of organic sources and relatively slow release of nutrient from applied organic sources induces a residual effect on soil nutrient status and succeeding crop which resulted improved nutrient status of soil and higher crop yield ensuring long-term sustainability of organic farming system. Similar results had also reported by Samant and Patra (2016) in rice.

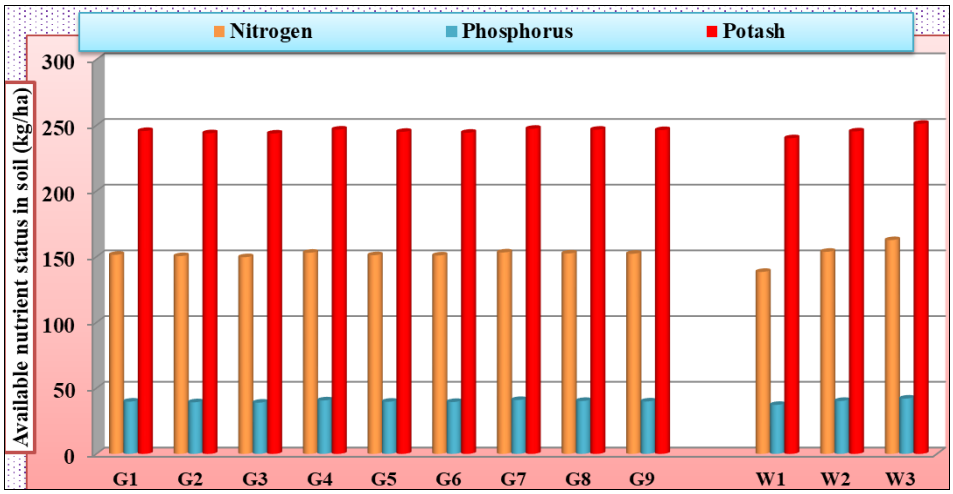

Fig 1: Available nitrogen, phosphorus and potash in soil after of wheat as influenced by nutrient management under organic farming (Pooled of two years)

Interaction effect
Interaction effect between different treatment applied to groundnut and wheat (G × W) did not show positive effect on available N, P_2O_5 and K_2O status of soil after harvest of wheat during pooled study.

4. Microbial population
The data on total microbial, PSB, *azotobacter*, KSB and *rhizobium* count in soil after harvest of wheat as influenced by different treatments are presented in Table 4.

Residual effect of nutrient management of groundnut
The data narrated in Table 4 revealed that the different treatments of nutrient management applied to preceding groundnut crop failed to exert any significant effect on the total microbial, PSB, *azotobacter*, KSB and *rhizobium* count in soil after harvest of wheat during pooled study.

Effect of nutrient management in wheat
Application of 75% RDN through FYM: castor cake: vermicompost (1:1:1) + *panchgavya* @ 4% spray at 30 and 60 DAS (W_3) resulted in significantly highest total microbial, PSB and *azotobacter* count in soil after harvest of wheat during pooled study. The *rhizobium* and KSB count in soil after harvest of wheat was found to be non-significant due to application of different nutrient management practices during pooled study. This result reflects that microbial population was higher in soil due to the higher availability of organic matter in soil as well as good source of food of microbes and *jivamrut* itself contains large number of microbes which was applied during preceding groundnut crop as well as bio-enhancer *i.e. panchgavya* and easily available food *i.e.* sugar, which is important for faster multiplication of microorganisms. The results are akin to those reported earlier by Rajanna *et al.* (2011) [9] and Shubha *et al.* (2014) [10].

Interaction effect
Interaction effect between different treatment applied to groundnut and wheat (G × W) was found non-significant effect on total microbial, PSB, *azotobacter*, KSB and *rhizobium* count of soil after harvest of wheat in pooled study.

Table 1: Nitrogen, phosphorus and potassium content in grain and straw of wheat as influenced by nutrient management under organic farming (Pooled of 2 year)

Treatments	Nitrogen content (%)		Phosphorus content (%)		Potassium content (%)	
	Grain	Straw	Grain	Straw	Grain	Straw
Main plot: Residual effect of nutrient management of groundnut						
G_1	1.640	0.509	0.322	0.212	0.442	1.223
G_2	1.611	0.501	0.318	0.208	0.438	1.219
G_3	1.600	0.499	0.314	0.207	0.438	1.218
G_4	1.657	0.512	0.325	0.218	0.448	1.227
G_5	1.636	0.506	0.321	0.210	0.440	1.222
G_6	1.615	0.502	0.320	0.209	0.439	1.221
G_7	1.668	0.513	0.328	0.220	0.449	1.228
G_8	1.654	0.511	0.324	0.215	0.445	1.226
G_9	1.651	0.510	0.323	0.213	0.444	1.224
S. Em. ±	0.022	0.008	0.004	0.003	0.007	0.019
C. D. (P=0.05)	NS	NS	NS	NS	NS	NS
C. V.%	5.64	6.64	5.59	6.55	6.32	6.58
Sub plot: Nutrient management in wheat						
W_1	1.581	0.486	0.307	0.200	0.427	1.206
W_2	1.632	0.511	0.323	0.215	0.445	1.224
W_3	1.698	0.524	0.336	0.223	0.456	1.240
S. Em. ±	0.006	0.002	0.002	0.002	0.004	0.005
C. D. (P=0.05)	0.017	0.007	0.006	0.005	0.010	0.014
Significant interactions	-	-	-	-	-	-
C. V.%	2.78	3.54	4.63	5.67	5.87	2.92

G_1: 100% RDN through FYM, G_2: 100% RDN through castor cake, G_3: 100% RDN through vermicompost, G_4: 100% RDN through FYM + *Panchgavya* 4% spray at 30 and 60 DAS, G_5: 100% RDN through castor cake +*Panchgavya* 4% spray at 30 and 60 DAS, G_6: 100% RDN through vermicompost + *Panchgavya* 4% spray at 30 and 60 DAS, G_7: 100% RDN through FYM +*Bijamrut* (seed treatment 200 ml/kg seed) + *Jivamrut*@ 500 lit/ha at 30 and 60 DAS, G_8: 100% RDN through castor cake + *Bijamrut* (seed treatment 200 ml/kg seed) + *Jivamrut*@ 500 lit/ha at 30 and 60 DAS, G_9: 100% RDN through vermicompost + *Bijamrut* (seed treatment 200 ml/kg seed) + *Jivamrut*@ 500 lit/ha at 30 and 60 DAS, W_1: *Panchgavya* 4% spray at 30 and 60 DAS, W_2: 50% RDN through FYM: Castor cake: Vermicompost (1:1:1) +*Panchgavya* 4% spray at 30 and 60 DAS, W_3:75% RDN through FYM: Castor cake: Vermicompost (1:1:1)+*Panchgavya* 4% spray at 30 and 60 DAS

Table 2: Nitrogen, phosphorus and potassium uptake by grain and straw as well as total uptake by plant of wheat as influenced by nutrient management under organic farming (Pooled of 2 year)

Treatments	Nitrogen uptake (kg/ha)			Phosphorus uptake (kg/ha)			Potassium uptake (kg/ha)		
	Grain	Straw	Total N	Grain	Straw	Total N	Grain	Straw	Total N
Main plot: Residual effect of nutrient management of groundnut									
G_1	35.96	16.24	52.20	7.08	6.78	13.86	9.71	38.87	48.58
G_2	34.22	15.63	49.85	6.77	6.52	13.29	9.30	37.91	47.21
G_3	33.54	15.40	48.93	6.61	6.40	13.02	9.19	37.36	46.55
G_4	37.99	17.12	55.11	7.46	7.31	14.77	10.26	40.96	51.21
G_5	35.58	15.94	51.52	7.00	6.64	13.65	9.59	38.36	47.95
G_6	34.81	15.80	50.61	6.91	6.56	13.47	9.48	38.09	47.57

G_7	38.78	17.24	56.02	7.62	7.42	15.03	10.42	41.06	51.48
G_8	36.94	16.75	53.68	7.26	7.06	14.32	9.96	40.06	50.02
G_9	36.52	16.38	52.90	7.15	6.85	14.00	9.80	39.07	48.87
S. Em.(±)	1.19	0.64	1.54	0.22	0.24	0.38	0.39	1.38	1.53
C. D. (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
C. V. (%)	13.96	16.66	12.51	13.34	14.96	11.50	16.90	15.02	13.30
Sub plot: Nutrient management in wheat									
W_1	24.72	11.47	36.19	4.80	4.72	9.52	6.68	28.49	35.18
W_2	36.22	16.76	52.99	7.17	7.04	14.20	9.87	40.13	49.99
W_3	47.17	20.60	67.77	9.33	8.75	18.08	12.68	48.63	61.31
S. Em.(±)	0.55	0.27	0.66	0.12	0.12	0.17	0.17	0.61	0.67
C. D. (P = 0.05)	1.54	0.77	1.87	0.33	0.33	0.49	0.47	1.72	1.89
Significant interactions	-	-	-	-	-	-	-	-	-
C. V. (%)	11.15	12.26	9.31	12.23	12.47	9.08	12.59	11.45	10.10

G_1: 100% RDN through FYM, G_2: 100% RDN through castor cake, G_3: 100% RDN through vermicompost, G_4: 100% RDN through FYM + *Panchgavya* @ 4% spray at 30 and 60 DAS, G_5: 100% RDN through castor cake +*Panchgavya* @ 4% spray at 30 and 60 DAS, G_6: 100% RDN through vermicompost + *Panchgavya* @ 4% spray at 30 and 60 DAS, G_7: 100% RDN through FYM +*Bijamrut* (seed treatment 200 ml/kg seed) + *Jivamrut*@ 500 lit/ha at 30 and 60 DAS, G_8: 100% RDN through castor cake + *Bijamrut* (seed treatment 200 ml/kg seed) + *Jivamrut*@ 500 lit/ha at 30 and 60 DAS, G_9: 100% RDN through vermicompost + *Bijamrut* (seed treatment 200 ml/kg seed) + *Jivamrut* @ 500 lit/ha at 30 and 60 DAS, W_1: *Panchgavya* @ 4% spray at 30 and 60 DAS, W_2: 50% RDN through FYM: Castor cake: Vermicompost (1:1:1) +*Panchgavya* @ 4% spray at 30 and 60 DAS, W_3:75% RDN through FYM: Castor cake: Vermicompost (1:1:1)+*Panchgavya* @ 4% spray at 30 and 60 DAS

Table 3: Available nutrient status in soil, total microbial count, PSB and *Azotobacter*, *rhizobium* and KSB count after harvest wheat as influenced by nutrient management under organic farming (Pooled of 2 year)

Treatments	Available nutrient status in soil (kg/ha)			Total microbial count (CFU × 10^5/g soil)	PSB count (CFU × 10^5/g soil)	*Azotobacter* count (CFU × 10^5/g soil)	*Rhizobium* count (CFU × 10^5/g soil)	KSB count (CFU × 10^2/g soil)
	N	P_2O_5	K_2O					
Main plot: Residual effect of nutrient management of groundnut								
G_1	151.5	39.8	245.7	222.67	197.31	190.33	155.24	38.87
G_2	150.5	39.3	244.0	218.76	192.20	188.00	153.46	37.91
G_3	149.7	39.0	243.8	217.33	189.04	187.27	151.85	37.36
G_4	153.1	40.7	246.8	225.70	201.07	197.28	156.10	40.96
G_5	151.2	39.7	245.1	221.57	195.41	189.63	154.80	38.36
G_6	151.0	39.5	244.4	220.59	193.76	188.58	154.03	38.09
G_7	153.3	41.0	247.4	231.32	204.00	197.86	156.50	41.06
G_8	152.5	40.3	246.7	224.51	199.61	195.66	155.75	40.06
G_9	152.3	39.9	246.4	223.48	198.45	191.26	155.56	39.07
S. Em.(±)	2.3	0.5	4.0	3.59	3.14	3.59	2.71	1.38
C. D. (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS
C. V. (%)	6.43	5.81	6.87	6.84	6.77	7.94	7.42	15.02
Sub plot: Nutrient management in wheat								
W_1	138.5	37.3	240.2	189.57	174.07	165.73	152.27	28.49
W_2	153.8	40.3	245.4	223.88	189.89	190.63	154.94	40.13
W_3	162.7	42.1	251.2	255.20	226.32	218.93	157.23	48.63
S. Em.(±)	1.0	0.3	1.8	1.48	1.58	1.14	1.41	0.61
C. D. (P = 0.05)	2.8	0.7	5.2	4.18	4.46	3.22	NS	1.72
Significant interactions	-	-	-	-	-	-	-	-
C. V. (%)	4.88	4.89	5.53	4.88	5.91	4.38	6.68	11.45

G_1: 100% RDN through FYM, G_2: 100% RDN through castor cake, G_3: 100% RDN through vermicompost, G_4: 100% RDN through FYM + *Panchgavya* @ 4% spray at 30 and 60 DAS, G_5: 100% RDN through castor cake +*Panchgavya* @ 4% spray at 30 and 60 DAS, G_6: 100% RDN through vermicompost + *Panchgavya* @ 4% spray at 30 and 60 DAS, G_7: 100% RDN through FYM +*Bijamrut* (seed treatment 200 ml/kg seed) + *Jivamrut*@ 500 lit/ha at 30 and 60 DAS, G_8: 100% RDN through castor cake + *Bijamrut* (seed treatment 200 ml/kg seed) + *Jivamrut*@ 500 lit/ha at 30 and 60 DAS, G_9: 100% RDN through vermicompost + *Bijamrut* (seed treatment 200 ml/kg seed) + *Jivamrut* @ 500 lit/ha at 30 and 60 DAS, W_1: *Panchgavya* @ 4% spray at 30 and 60 DAS, W_2: 50% RDN through FYM: Castor cake: Vermicompost (1:1:1) +*Panchgavya* @ 4% spray at 30 and 60 DAS, W_3:75% RDN through FYM: Castor cake: Vermicompost (1:1:1)+*Panchgavya* @ 4% spray at 30 and 60 DAS

Conclusion

Based on the findings of two years of experimentation, it is concluded that application of 75% RDN (90 kg N) through FYM: castor cake: vermicompost (1:1:1) along with *panchgavya* @ 4% spray at 30 and 60 DAS increased nutrient content, uptake, microbial count and available nutrient after harvest of wheat under organic farming.

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