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RESEARCH PAPER

Integrated nutrient management in pearl millet (*Pennisetum glaucum*) - wheat (*Triticum aestivum*) cropping sequence in semi arid condition of India

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Abstract : A field experiment was conducted at Raja Balwant Singh College Agricultural Research Farm, Agra during 2009 – 2010 to evaluate the effect of different fertility levels on the productivity of pearl millet (*Pennisetum glaucum*) - wheat [*Triticum aestivum* (L.)] cropping sequence under semi arid condition. The combined application of organic manures and fertilizers had significant and positive effects on productivity of the system. The results indicated that the productivity of the wheat and pearl millet crop can be sustained by the application of balanced use of nutrients to the crops through integration of organic manures and fertilizers. The quality of both the crops in respect of protein, nitrogen and phosphorus and potash utilization increased significantly with conjoint use of organic manures and inorganic fertilizers.

Key Words : INM, Pearl millet – wheat cropping sequence, Vermicompost

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INTRODUCTION

Pearl millet - wheat is an important cropping system followed in Agra region. This system is very exhaustive and a crop giving 2.9 t/ha of pearl millet and 4.2 t/ha of wheat may remove 238, 54 and 131 kg N, P and K, respectively. Since, this cropping system is exhaustive for soil nutrients; therefore, replenishment of nutrients on regular basis becomes important aspect of management for sustainability. Research in India has indicated integrated use of organic and inorganic manures for sustaining productivity of soil and crops in an intensive cropping system. The application of FYM in the soil helps in increasing the fertility of the soil as well as the physical condition including its water holding capacity. Availability of nutrients increases and their availability to crop are increased. Organic manures, which were perhaps the major sources of plant nutrients in traditional agriculture, received less emphasized with the advent of high analysis chemical fertilizers. Without detracting from the fact that chemical fertilizer will continue to be main instrument for quickening the pace for agricultural production. The recent researches indicate that a judicious combination of organic manures and fertilizers can better maintain the long-term soil fertility and sustain high levels of productivity. Therefore, use of both organic manures of chemical; fertilizers in appropriate proportion assumes special significance as complementary and supplementary to each other in crop production. Since information pertaining to above aspects is meagre, the present investigation was carried out to study the integrated use of inorganic fertilizers and organic manures on yield, uptake and nutrient use efficiency in wheat-pearlmillet cropping

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sequence.

MATERIAL AND METHODS

Two field experiments were conducted during 2008-09 and 2009-10 at Raja Balwant Singh College Agricultural Research Farm, Bichpuri, Agra in a sandy loam soil low in available nitrogen (170 kg/ha), phosphorus (9.75 kg Pha^{-1}) and potassium (220 kg K/ha). The experiments were laid out in Randomized Block Design having12 treatments with three replications by taking pearl millet (86 M 52) in *Kharif* and wheat (HD 2338) in *Rabi* season. The treatments comprised of T_1 (control), T_2 (100 % recommended dose of N), T_3 (100 % recommended dose of NP), T_4 (100 % recommended dose of NPK), T_5 (100 % recommended dose of N + 25 kg $ZnSO_4$ ha^{-1}), T_6 (100 % recommended dose of N + 10 t FYM ha^{-1}), T_7 (100 % recommended dose of N + 2.5 t vermicompost ha^{-1}), T_8 (100 % recommended dose of N + 25 kg S ha^{-1}), T_9 (10 t FYM ha^{-1}), T_{10} (2.5 t vermicompost ha^{-1}), T_{11} (100 % NPK + 10 t FYM + 25 kg S + 25 kg $ZnSO_4$ ha^{-1}) and T_{12} (150 % recommended dose of NPK). Nitrogen was supplied in the form of urea as per treatments. Single super phosphate and muriate of potash were as sources for P_2O_5 and K_2O, respectively. Recommended dose of NPK for wheat was 120:80:60 and 120:60:60 $kgha^{-1}$ for wheat and pearlmillet, respectively. Full quantity of phosphorus and potash fertilizers was given at the time of sowing. 50 % of Nitrogen was applied as basal dose and rest was given in two splits at first and second irrigation. Sulphur and zinc were applied at the time of sowing through elemental sulphur and zinc sulphate, respectively. Well decomposed FYM (0.6 % N, 2.5% P and 0.55 K) and vermicompost (1.15 % N, 0.86 % P and 0.60 % K) were added to the plots as per treatments 10 days prior to sowing. The seeds of wheat variety HD 2338 were sown in lines at 20 cm apart, using an uniform seed rate of 125 $kgha^{-1}$ in the month of November in both the years. Seeds of pearl millet variety 86 M 52 were sown in lines at 30 cm apart using an uniform seed rate of 5 $kgha^{-1}$ in the month of July during both the years. The lines were opened through pointed spade by human labour and after sowing, planking was done to cover the seed.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect on growth characteristics of pearl millets:

The various treatments had a favorable influence on the number of plants/meter, plant height and dry matter accumulation. Conjoint use of 10 t FYM and inorganic fertilizers (100 % NPK + Zn + S ha^{-1}) gave the maximum values of these growth parameters (Table 1). An increase in the effective shoots with chemical (NPK) fertilizers and FYM application has also been reported by Sharma (1983). Application of 2.5 t ha^{-1} vermicompost along with chemical (100 % NPK) fertilizers produced more number of shoots over control treatment. The increase in number of shoots may be attributed to mineralization of FYM, or through solubilization of the nutrients from the native source during the process of decomposition which is very much in

Table 1 : Effect of various nutrient management treatments on growth, yield attributing characters and yield of pearl millet (pooled data of 2 years)

Treatments	No. of shoot/m row length	Plant height (cm)	Dry matter per plant (g)	Grain weight/ ear head (g)	Ear length (cm)	1000-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1 (control)	15.50	195.70	42.70	13.95	16.55	7.35	18.50	206.00
T_2 (100 % N)	19.45	198.35	45.50	8.05	17.75	10.25	20.95	220.45
T_3 (100 % NP)	20.65	200.20	47.25	9.10	19.10	10.95	22.10	224.60
T_4 (100 % NPK)	21.75	202.75	49.10	10.55	20.95	11.60	23.10	227.60
T_5 (100 % N + 25 kg $ZnSo_4$ ha^{-1})	23.15	207.10	50.50	11.05	21.45	11.85	23.75	228.15
T_6 (100 % N + 10 t FYM ha^{-1})	23.35	208.30	53.60	12.90	22.95	12.30	25.30	231.65
T_7 (100 % N + 2.5 t VC ha^{-1})	23.70	206.85	52.85	14.05	24.00	12.50	27.20	234.20
T_8 (100 % N + 25 kg S ha^{-1})	22.60	205.00	50.15	12.20	22.15	11.45	25.50	232.25
T_9 (10 t FYM ha^{-1})	20.30	201.70	44.35	14.45	24.35	11.25	23.30	231.05
T_{10} (2.5 t VC ha^{-1})	20.50	201.40	44.90	14.00	23.95	11.80	24.70	232.90
T_{11} (100 % NPK + 10 t FYM+25 kg S+25 kg $ZnSo_4$ ha^{-1})	26.25	218.55	56.00	15.40	26.40	12.20	28.85	238.50
T_{12} (150 % NPK)	26.90	217.85	55.40	13.35	24.75	12.55	29.35	239.75
S.E.±	1.25	1.85	1.54	0.31	0.84	0.89	0.63	1.95
C.D. (P=0.05)	2.64	3.87	3.24	0.64	1.77	1.55	1.31	4.10

VC, vermicompost; FYM, farm yard manure

agreement with the findings of Gaur (1991). The addition of 10 t FYM along with 100 % NPK and 2.5 t vermicompost enhanced the height of pearl millet plant over 100 % NPK alone treatment in both the years. Similar results were reported by Sharma (1983). Application of inorganic fertilizers (100 % N, 100 % NP and 100 % NPK) increased the dry matter accumulation significantly over control in both the years of study. This improvement in the dry matter accumulation is due to more availability of plant nutrients (NPK) in soil. The dry matter accumulation was further enhanced when 100 % NPK was applied in combination with 10 t ha^{-1} FYM and 2.5 t ha^{-1} vermicompost. This could have due to increased efficiency of applied chemical fertilizers by organic manures. Takchand and Tomar (1992) and Mandai *et al*. (1994) reported similar results.

Yield attributes and yields of pearl millet:

Data on yield attributing characters *viz*., ear length, number of ear heads/running meter, weight of grains/ ear head and 1000-grain weight were recorded at harvest and summarized in Table 1. The differences in these yield attributing characters due to various treatments were quite visible at harvest. Lower values of these characters were recorded in T_1 (control) treatment during both the years. Application of 100 % N, 100 % NP and 100 % NPK enhanced the values of these characters significantly over control. Both the levels of NPK fertilizers differ significantly from each other in respect of these yield attributes. Yield attributes were further improved when 100 % NPK fertilizers were added in combination with 10 t ha^{-1} FYM and 100 % NPK + 2.5 t ha^{-1} vermicompost. The maximum values of these yield attributes were recorded in T_{11} (100 % NPK + 10 t FYM + 25 kg S + 25 kg $ZnSO_4$ ha^{-1}) treatment in both seasons.

Grain and stover yield of pearl millet significantly increased with 100 % N, 100 % NP and 100 % NPK treatments over control in both crop seasons. Among these treatments 100 % NPK proved superior in respect of grain and stover production. The yield of pearl millet increased significantly with 10 t FYM ha^{-1} and 2.5 t vermicompost ha^{-1} applications over control, which may be ascribed to increased availability of nutrients in soil. The yield of pearl millet crop improved significantly when 100 % NPK was applied with 2.5 t ha^{-1} vermicompost over 100 % NPK alone. The beneficial effect of FYM and vermicompost may be due to its contribution in supplying additional plant nutrients, improvement of soil physical and biological processes in soil. Similar results were also reported by Gangwar and Singh (1992). Treatment T_{11} (NPK 100 % + 10 t FYM ha^{-1} + 10 kg S + 10 kg $ZnSO_4$ ha^{-1}) out yielded all the treatments in both crop seasons. The highest yield of pearl millet under this treatment may be due to beneficial effect of FYM on soil properties and fertility status of soils.

Effect on growth characters of wheat:

Application of NPK levels showed a positive effect on the number of tillers, plant height and dry matter production at all the stages of growth (Table 2). Application of FYM and vermicompost along with inorganic fertilizers increased plant growth at each stage over the control. The increase in number of tillers may be attributed to increase availability of nutrients in soil due to addition of FYM. Similar results were reported by Gaur (1991) and Singh *et al.* (1994). Application 100% NPK in conjunction with $ZnSO_4$ and S produced more number of tillers and dry matter over control. Application

Table 2 : Effect of various nutrient management treatments on growth, yield attributing characters and yield of wheat (pooled data of 2 years)

Treatments	No. of effective tillers per running m	Plant height (cm)	Dry matter per plant (g)	Grain weight/ ear head (g)	No. of grains/ ear head	1000-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1 (control)	74.0	71.08	47.61	3.14	41.85	30.03	28.73	39.87
T_2 (100 % N)	93.4	78.04	52.22	3.18	47.80	31.98	36.27	49.87
T_3 (100 % NP)	97.9	78.79	55.05	3.20	50.10	32.72	37.74	51.93
T_4 (100 % NPK)	105.9	81.05	56.21	3.25	54.30	34.02	40.50	55.77
T_5 (100 % N + 25 kg $ZnSO_4$ ha^{-1})	107.6	81.58	57.22	3.31	55.05	33.63	43.43	59.37
T_6 (100 % N + 10 t FYM ha^{-1})	118.7	82.80	59.92	3.31	59.60	34.79	47.58	66.54
T_7 (100 % N + 2.5 t VC ha^{-1})	123.4	84.31	50.40	3.25	60.15	37.29	47.50	66.44
T_8 (100 % N + 25 kg S ha^{-1})	117.1	82.88	56.96	3.21	55.80	37.05	44.44	59.77
T_9 (10 t FYM ha^{-1})	119.4	83.61	50.67	2.73	54.15	32.69	36.78	49.08
T_{10} (2.5 t VC ha^{-1})	118.9	82.41	49.62	3.24	54.80	32.72	36.27	48.40
T_{11} (100 % NPK + 10 t FYM + 25 kg S + 25 kg $ZnSo_4$ ha^{-1})	130.7	86.55	56.35	3.36	66.50	38.05	52.14	72.23
T_{12} (150 % NPK)	131.5	85.98	59.74	3.35	66.65	37.85	50.50	70.20
S.E.±	1.5	1.57	1.53	0.06	0.18	0.17	0.57	1.59
C.D. (P=0.05)	3.1	3.18	3.09	0.12	0.74	0.35	1.15	3.21

VC, vermicompost; FYM, farm yard manure

of 100 % NPK + 10 t FYM ha^{-1} recorded the greater plant height at all the growth stages in both the cropping season. Increase in plant height may be attributed due to greater availability of nutrients in soil with combined application of chemical fertilizer and FYM. These results are in close conformity with the findings of Sharma (1983).

The application of 100 % NPK along with 2.5 t ha^{-1} vermicompost produced taller plants over 100 % NPK alone but the magnitude of increase in this parameter was more or less similar to FYM. It may be seen from the data that the accumulation of dry matter took place at slow rate up to maximum tillering stages in wheat. The dry matter was accumulated continuously and almost linearly up to maturity of the crops irrespective of the treatment effect. During early growth period roots are not well established and the leaves are not able to produce enough food materials, thus, the initial rate of dry matter accumulation was very slow. The differences in dry matter accumulation in wheat due to various treatments were quite visible after maximum tillering stages. Application of inorganic fertilizers (100 % N, 100 % NP and 100 % NPK) increased dry matter content in both the years of study. This improvement in the dry matter accumulation is due to more availability of plant nutrients (NPK) in soil. The dry matter accumulation was further enhanced when 100 % NPK was applied in combination with 10 t FYM ha^{-1} in both the crop seasons. This could have due to increased efficiency of applied chemical fertilizers through application of FYM. The increase in dry matter production with the application of fertilizers and FYM has also been indicated earlier by Takchand and Tomar (1992). The application of 2.5 t ha^{-1} vermicompost along with 100 % NPK also enhanced the dry matter production of wheat over 100 % NPK and also improved the dry matter accumulation in wheat which may be ascribed to increased availability of S to plants. Application of 10 t ha^{-1} FYM and 2.5 t ha^{-1} vermicompost alone increased the dry matter production favorably from an early stage and these differences further enlarged at successive latter stages. The increase in dry matter accumulation in wheat as a result of organic manure application is due to more availability of essential plant nutrient to plant and improvement in physiochemical properties of the soil. The increase in dry matter accumulation with FYM application has also been reported by Negi *et al.* (1988) and Singh *et al.* (1994).

Yield attributes and yields of wheat:

In general, application of both the levels of NPK fertilizers enhanced the values of these characters but the effect of higher level of NPK was more pronounced. Application of $ZnSO_4$ and sulphur along with 100% NPK improved the yield attributes over control. Integrated use of fertilizers with FYM and vermicompost proved more beneficial in respect of yield attributing characters. The maximum impact on yield attributes was recorded under plots receiving 150% NPK. Application of NPK fertilizers alone improved the grain and straw yields significantly over control. Application of FYM (10tha^{-1}) and vermicompost (2.5tha^{-1}) alone significantly improved the grain and straw production of wheat over control. Combined use of inorganic fertilizers, FYM and vermicompost produced higher grain and straw yields of wheat. The mean increases in grain production due to 10 t ha^{-1} FYM and 2.5 t ha^{-1} vermicompost over control were 28.0 and 26.2 per cent, respectively. Combined application of NPK fertilizers, $ZnSo_4$ and sulphur proved markedly beneficial in improving the wheat production. Treatment T_{11} (100% NPK + FYM +Zn) and T_{12} (150 % NPK) produced similar yield. Similar influence of integrated use of FYM and chemical fertilizers on productivity of agricultural crops like rice, wheat and maize were reported by Gaur (1991). Mandai *et al.* (1994) observed that presence of easily decomposable organic residues helps in re-mineralization of immobilized inorganic nitrogen, which is subsequently made available to the plants for a longer period. Similar synergetic influences of manures and inorganic fertilizers on the crop yield have been reported by Verma (1996) and Singh *et al.* (1996).

Studies on qualitative parameter studies:

From quality point of view, T_{11} treatment appears to be the best. Application of N, NP and NPK alone or in combination with FYM and vermicompost enhanced the protein yield (Table 3 and 4). Integrated use of nutrients (100 % NPK + $ZnSO_4$ or sulphur) increased the protein yield synergistically. The maximum protein yield of wheat crop was recorded under T_{11} treatment in both crop seasons.

The protein yield increased significantly with addition of NPK fertilizers. Application of 150 % NPK showed more values of protein yield over 100 % NPK treatment in both crop seasons. The yield of protein was maximum at 100 % NPK and 10 t FYM ha^{-1} + 25 kg $ZnSo_4$ + 25 kg Sulphur ha^{-1}. This increase in protein yield may be attributed to greater production of crop and improvement in protein percentage. Gangwar and Singh (1992) observed that inorganic fertilizer (NPK) influenced the crude protein.

Application of 100 % N, 100 % NP and 100 % NPK improved the utilization of N and P by the crop over control. Application of FYM and vermicompost alone or in combination with 100 % NPK also enhanced the uptake of N and P significantly over control. Similarly, 100 % NPK + 25 kg S ha^{-1} improved the utilization of these nutrients by the crop. This increase in nitrogen uptake may be ascribed to higher grain production with organic matter addition. Similar results were also reported by Dahiya *et al.* (1998) and Singh *et al.* (1994). The uptake of nitrogen increased significantly over control with increasing levels of NPK fertilizers in both the years. Addition of organic matter (10

t FYM ha^{-1}) increased the uptake of phosphorus which may be ascribed to an increased production and improvement in phosphorus content of the crop. Similar results were also reported by Singh *et al*. (1994). Combined application of 100 % NPK (50 and 75 %) fertilizers increased the uptake of phosphorus by the pearl millet crop. These results are in close conformity with the findings of Tekchand and Tomar (1992), Jana and Ghosh (1996), Singh *et al.* (1996) and Santhy *et al.* (1998). The maximum uptake values were recorded under 150 % NPK treatment. The uptake of K improved significantly by all the fertilizers treatments over control. Combined application of 100 % NPK with 10 t FYM or 2.5 t vermicompost or 25 kg $ZnSO_4$ or 25 kg S ha^{-1} increased the uptake of K by the crops significantly over 100 % NPK alone. The higher uptake is due to higher yields of crop in the treated plots. The organic manures besides being a source of major nutrients supply micronutrients as well. Similar results were also reported by Singh and Tomar (1991). The maximum values of K were recorded under T_{11} treatment.

The grain portion of the wheat consumed more nitrogen and phosphorus than straw. Application of 100 % N, 100 % NP and 100 % NPK enhanced the nitrogen and phosphorus uptake over control but the magnitude of increase was greater with 100 % NPK (Table 4). Combined application of NPK + Zn and NPK + sulphur also improved the utilization of

Table 3 : Protein synthesis, nitrogen, phosphorus and potassium uptake by pearl millet under different nutrient management treatments (pooled data of 2 years)

Treatments	Protein synthesis ($kgha^{-1}$)	Total uptake by grain (kg/ha)			Total uptake by straw (kg/ha)		
		N	P	K	N	P	K
T_1 (control)	144.90	23.19	3.62	12.52	110.23	23.70	346.11
T_2 (100 % N)	193.80	31.02	4.38	15.91	134.81	28.73	378.99
T_3 (100 % NP)	206.18	33.01	5.21	15.95	146.02	32.57	390.88
T_4 (100 % NPK)	226.17	36.19	5.91	18.10	152.51	35.33	407.46
T_5 (100 % N + 25 kg $ZnSo_4$ ha^{-1})	231.56	37.06	5.84	17.40	156.94	35.25	398.04
T_6 (100 % N + 10 t FYM ha^{-1})	278.60	44.58	8.22	23.27	166.81	42.30	467.52
T_7 (100 % N + 2.5 t VC ha^{-1})	281.88	45.11	8.54	23.68	168.87	39.88	471.41
T_8 (100 % N + 25 kg S ha^{-1})	235.75	37.73	6.13	17.67	152.82	37.92	407.90
T_9 (10 t FYM ha^{-1})	215.30	34.46	5.59	16.54	141.44	32.81	397.17
T_{10} (2.5 t VC ha^{-1})	220.14	35.24	5.91	17.02	144.09	35.17	399.36
T_{11} (100 % NPK + 10 t FYM + 25 kg S + 25 kg $ZnSO_4$ ha^{-1})	305.32	48.86	8.76	26.28	174.89	44.32	487.53
T_{12} (150 % NPK)	303.63	48.59	9.20	26.26	176.72	45.37	495.52
S.E.±	8.00	1.47	0.31	0.84	3.83	0.58	2.73
C.D. (P=0.05)	16.65	3.09	0.65	1.77	8.42	1.21	5.73

VC=Vermicompost; FYM-Farm yard manure

Table 4 : Protein synthesis, nitrogen, phosphorus and potassium uptake by wheat under different nutrient management treatments (pooled data of 2 years)

Treatments	Protein synthesis ($kgha^{-1}$)	Total uptake by grain (kg/ha)			Total uptake by straw (kg/ha)		
		N	P	K	N	P	K
T_1 (control)	313.30	42.39	5.89	14.09	24.53	4.59	82.54
T_2 (100 % N)	500.20	58.53	7.80	18.14	34.41	6.24	103.98
T_3 (100 % NP)	524.95	62.52	9.07	18.87	36.89	7.53	109.07
T_4 (100 % NPK)	566.10	67.00	9.73	21.47	40.16	8.09	119.34
T_5 (100 % N + 25 kg $ZnSo_4$ ha^{-1})	621.25	73.10	9.13	21.29	43.95	7.42	122.91
T_6 (100 % N + 10 t FYM ha^{-1})	690.85	82.78	12.61	26.41	51.25	10.66	144.08
T_7 (100 % N + 2.5 t VC ha^{-1})	697.65	83.65	12.59	26.61	51.83	10.97	144.52
T_8 (100 % N + 25 kg S ha^{-1})	627.65	74.90	10.45	22.68	44.84	8.08	124.94
T_9 (10 t FYM ha^{-1})	507.80	58.75	7.73	27.56	33.86	6.62	103.06
T_{10} (2.5 t VC ha^{-1})	505.25	58.33	7.99	18.32	33.40	7.02	101.15
T_{11} (100 % NPK + 10 t FYM + 25 kg S + 25 kg $ZnSO_4$ ha^{-1})	763.45	90.94	13.82	29.98	56.35	11.92	158.19
T_{12} (150 % NPK)	739.75	88.14	13.64	30.05	55.46	11.59	155.14
S.E.±	9.03	2.69	0.80	1.61	2.75	0.72	4.43
C.D. (P=0.05)	18.96	5.65	1.68	3.38	5.78	1.50	9.29

VC, vermicompost; FYM, farm yard manure

nitrogen and phosphorus but the effect was non-significant. Application of FYM and vermicompost alone or in combination with 100 % NPK also enhanced the N and P uptake by the wheat crop significantly over NPK alone. Higher values of nitrogen uptake with addition of FYM and vermicompost are apparently the result of favorable effect of FYM on absorption coupled with greater fields. Higher uptake of N under these treatments with FYM indicates that mineralized N from FYM and vermicompost could sufficiently meet the nutritional requirement of the crop. Similar results were also reported by Dahiya *et al*. (1980) and Singh *et al*. (1994). The maximum values of N and P uptake were recorded with 150 % NPK in both crop seasons. Application of NPK along with FYM and vermicompost also enhanced the uptake of P by wheat crop in both crop seasons. Similar results were also reported by Tekchand and Tomar (1992) and Singh *et al*. (1996). This increase in P uptake with addition of 10 t FYM ha^{-1} was significantly higher over control. This may be due to more availability of P from applied FYM and to the solubility action of organic acids produced during degradation of organic material thus, resulting in more release of the native and applied P in soil. Dahiya *et al*. (1980) reported that the addition of organic manures increased the P uptake in grain.

Addition of chemical fertilizers proved beneficial for improving the K uptake by wheat crop. The higher yields of grain and straw under 100 % NPK coupled with 10 t ha^{-1} FYM and 2.5 t ha^{-1} vermicompost absorbed large quantities of K from the soil thus depleting the soil in K consequently showing its higher uptake in plants. These results are in close conformity with the findings of Singh and Tomar (1991).

In this light of the results summarized above, it may be concluded that the combined application of organic manures and fertilizers had significant and positive effects on productivity of crops and soil fertility. The results indicate that the productivity of the wheat and pearl millet crop can be sustained by supplying balanced use of nutrients to the crops and integrated use of organic manures and fertilizers. Supply of organic manures significantly improved the fertility status. The quality of both the crops in respect of protein, nitrogen, phosphorus and potash utilization of these nutrients were increased significantly with conjoint use of organic manures and inorganic fertilizers. Since, cereal – cereal cropping sequence has high nutrient requirements; the integrated nutrient management approach will restore and sustain soil health and productivity besides meeting the nutritional deficiency.

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