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Effect of integrated nutrient management on soil properties and fertility in baby corn (*Zea mays*. L) – Hyacinth bean (*Lablab purpureus* var. *typicus*) cropping system

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Abstract
A field experiment was conducted in a tropical rainy region during *kharif* (July to September) and *rabi* (October to February) seasons of 2015–16 and 2016–17 to study the effect of Integrated Nutrient Management practices on soil properties and soil fertility dynamics in baby corn – hyacinth bean cropping system. The experiment was laid in Randomized Block Design for baby corn during *kharif* 2015 with seven treatments comprised of 100% recommended dose of fertilizers (RDF 150:27:50 N, P and K kg ha^{-1}), 25% N supplemented through farm yard manure (FYM) or vermicompost (VC) +75% RDF with or without bio–fertilizers *Azospirillum* and *Bacillus megaterium*@ 5 kg ha^{-1}each, in addition to control and replicated thrice. Each main treatment was divided into four subplots and the treatments of 100% RDF (20–22 N, P kg ha^{-1}) and 75% RDF with or without *Bradyrhizobium*@500 gha^{-1}(seed treatment) were imposed for hyacinth bean in *Rabi* season and data after *Rabi* 2015–16 and 2016–17 was analyzed in split plot design. The treatments imposed to baby corn during *kharif*, and hyacinth bean during *rabi* didn't show any significant effect on soil bulk density, pH and soil electrical conductivity during both the years (2015–16 and 2016–17). Application of 25% N through FYM or VC and 75% RDF along with biofertilizers to baby corn and 100% RDF along with seed treatment by *Bradyrhizobium* improved the organic carbon content of soil and maintained the soil fertility by increasing the availability of primary nutrients nitrogen, phosphorus and potassium and micro nutrients iron, copper and zinc.

Keywords: Baby corn, fertility dynamics, Hyacinth bean, INM, soil properties

Introduction
Baby corn is a high value and nutrient exhaustive crop. Application of organic manures like farmyard manure and vermicompost proved to be a better alternative to inorganic fertilizers in enhancing growth and yield of the plant (Aleem *et al*., 2014) [3]. Integration of 75% NPK accompanied by 2.25 t ha^{-1}of vermicompost amplified the available N, P and K status of the soil (Dadarwal *et al*., 2009) [12]. Integrated use of vermicompost and RDF of NPK significantly influenced the soil organic carbon. The better physical, chemical and biological environment was observed in organic manure treatments (Kler *et al*., 2002) [19]. The judicious use of fertilizers from different sources to crop will maintain the environmental sustainability for generations without affecting the environmental health (Ranjan *et al*., 2013) [29]. Judicious combination of organic manures (Suri *et al*., 1997) [44], or bio fertilizers *viz*., *Azospirillum* (Rai and Gaur, 1982) [28] and phospo bacteria (Dutta *et al*., 1992) [13] along with in-organic fertilizers not only reduce the quantity of chemical fertilizers but also improve the yield, nutrient uptake (Preetham *et al*., 2020) [27] and quality of crop produce. Substitution of 25% recommended dose of fertilizers through vermicompost or FYM will supply major nutrients as well as micro nutrients ensuring balanced plant nutrition, besides improving soil physical (Anil Kumar *et al.*, 2002) [4], chemical properties (Singh *et al*., 1980) [40] and biological properties (Santhy *et al.*, 1998) [35] of soil resulting in favourable conditions for crop growth and development. Incorporation of the organic manures in the soil results in building up of the available nutrients (macro and micro both) and organic carbon (Banik and Sharma, 2009 [8]; Banik *et al.*, 2006 [9]; Behara 2006 [10]; Swarup and Yaduvanshi, 2006 [45]).
Lablab bean or hyacinth bean is one of the most ancient crops among the cultivated legumes and is grown throughout the tropical regions of Asia, Africa and America. The crop is indigenous to India and grown all over the country. The crop is put to multipurpose uses such as pulse, vegetable and fodder.

The crop is mainly grown for green pods, while the dry seeds are used in the preparation of various vegetarian dishes and is rich in proteins. The foliage of the crop can be used as silage and green manure. Dwarf varieties (determinate bush–type) have a potential for more extensive cultivation of the crop, because the plants require no support system, the pods mature uniformly and the crop is amenable to mechanical harvesting which will reduce cost and labour.

The recent energy crisis and hike in prices of inorganic fertilizers also necessitate judicious combination of organic manures and biofertilizers along with chemical fertilizers to improve the yield, economics, food quality and soil health (Suri *et al*., 2011, Kumar *et al*., 2016, Ruxanabi *et al*., 2019, Singh *et al*., 2020) [43, 20, 34, 41].

In view of the above an experiment was conducted to find out the effect of organic manures integrated with microbial cultures and inorganic fertilizers on soil properties and soil fertility dynamics.

Materials and Methods

Experimental site

The experiment was conducted during *kharif* (July to September) and *rabi* (October to February) seasons of 2015–16 and 2016–17 at Horticultural Research Station farm, Adilabad (79° 56' 03" E longitude and 19°08' 09" N latitude).The experimental soil was sandy clay loam in texture, neutral in reaction (pH 7.31), medium in available nitrogen (320 kg ha^{-1}), phosphorous (26.5 kg ha^{-1}), potassium (252 kg ha^{-1}) and belongs to the order Alfisol of shallow to medium depth, non-saline, optimum for arable crop production. The experiment was conducted in a randomized block design for baby corn during *kharif*, 2015 with seven treatments comprising of 25% N supplemented through farm yard manure (FYM) or vermicompost (VC) +75% Recommended dose of fertilizer, (RDF; 150:60:60 N, P_2O_5 and K_2O kg ha^{-1}) with or without soil application of *Azospirillum* and *Bacillus megaterium* @5 kg ha^{-1} each, and unfertilized control, replicated thrice. G–5414 variety of baby corn was used for sowing on 22nd July and 3rd July in 2015 and 2016, respectively. Two seeds were dibbled hill^{-1} at a depth of 3–4 cm with a spacing of 60 cmx15 cm. Gap filling was done on 7th day after sowing and thinning was done on the 14th day after sowing. Manures and fertilizers were applied as per the treatment. FYM @7.5 t ha^{-1} and vermicompost @ 1.875t ha^{-1} were incorporated into the soil before sowing as per the treatment. Nitrogen was applied in three equal splits in the form of urea at (4, 8 and 12 leaf stage) 10, 25 and 40 DAS. Entire P_2O_5 and K_2O were applied as basal dose through single super phosphate and muriate of potash, respectively during both years. *Azospirillum* (nitrogen fixing bacterial formulation) and *Bacillus megaterium* (phosphorus solubilizing bacterial formulation) was applied @5 kg ha^{-1} to baby corn during *kharif* as per the treatments. Need based plant protection measures were taken up. Each of the baby corn treatments was divided into four subplots including treatments of 100% RDF (20:50 N and P_2O_5 kg ha^{-1}) and 75% RDF, with or without seed treatment of *Bradyrhizobium* @ g ha^{-1} during *rabi* season for hyacinth bean in split plot design. *Bradyrhizobium* (nitrogen fixing bacterial formulation) was utilized for seed dressing of hyacinth bean@ 500 g ha^{-1} as per the treatments. Arka Jaya variety was used for sowing on 6th and 10th October of 2015 and 2016, respectively. Two seeds were dibbled hill^{-1} at a depth of 3–4 cm with a spacing of 45 cm x 20 cm, and gap filling was done on 7 DAS and thinning was done on 14 DAS. Pendimethalin 30% EC @ 1.0 kg A.I ha^{-1}was applied at 2 DAS and hand weeding was done at 15 and 30 DAS to maintain weed free condition. Need based plant protection measures were taken up.

Method of data collection

Soil samples were drawn at random from different treatment plots upto 15 cm depth after the harvest of *Rabi* hyacinth bean crop (end of cropping system) during 2015–16 and 2016–17 using screw auger and the treatment wise samples were analyzed for pH, EC, organic carbon, available N, P and K and micronutrient status was studied before *kharif* 2015 and after *Rabi* 2016–17 by adopting standard procedures.

The soil pH was measured by using the glass electrode method as suggested by Jackson (1967) [16]. The electric conductivity was measured using a conductivity bridge as reported by Richards (1954) [30]. The organic carbon was determined by the wet oxidation method as described by Walkley and Black (1934) [46]. The available nitrogen was estimated by the alkaline permanganate oxidation method as outlined by Subbiah and Asija (1956) [42]. The available phosphorus was estimated by Olsen's method as suggested by Olsen *et al*. (1954)[25]. The available potassium was estimated by flame photometry as suggested by Jackson (1973) [17]. The available micro–nutrients iron, copper and zinc were estimated by DTPA extract using atomic absorption spectrophotometer as outlined by Lindsay and Norvell (1978) [22]. The data on observations was analyzed statistically by applying the technique of analysis of variance as outlined by Gomez and Gomez (1984) [14]. Statistical significance was tested by the F test.

Results and discussion

Effect of INM practices on Yield

Integration of 75% RDF with 25% RDN through vermicompost and biofertilizers (*Azospirillum* and *Bacillus megaterium*) showed significantly higher cob yields without husk during both the years of study (*kharif*, 2015 and 2016) over integration of 75% RDF + 25% N through vermin-compost, integration of 75% RDF + 25% N through FYM with or without biofertilizer, 100% RDF, 100% RDF + bio fertilizer and un-fertilized control (Table 1). Ashish Shivran *et al*. (2015) [6] reported similar results of higher cob yield with application of N through chemical fertilizer and vermin-compost in 75:25 proportions over 100% sole N chemical fertilizer application and 50:50 (chemical fertilizer and vermicompost). Similar results of higher baby corn yields were also reported by Aravinth *et al.*, (2011) [5], Dadarwal *et al.*, (2009) [12], Ashoka *et al.*, (2008) [7] and Prasanna Kumar *et al.*, (2007) [26] due to integration of RDF with vermicompost.

Incorporation of 25% N through FYM integrated with 75% RDF and in conjugation with the biofertilizers, integration of 75% RDF with 25% N through vermicompost and 100% RDF along with the biofertilizers showed on par yields of baby corn during both the years of study (*kharif*, 2015 and 2016) and were significantly superior to 100% RDF alone, integration of 75% RDF with 25% N through FYM and un-fertilized control. Similar results of increased yield were noticed by Lone *et al.*, (2013) [23] with RDF + FYM. Vermicompost was better in improving the yield attributes and yield than FYM. Synergistic effect of vermicompost along with biofertilizer may be attributed to promoting effect of micronutrient and growth regulators present in vermicompost (Ranjan *et al*., 2013) [29].

Application of 100% RDF to hyacinth bean along with seed treatment with *Bradyrhizobium* resulted in significantly higher pod yield (7718 kg ha^{-1} & 7576 kg ha^{-1}) during *Rabi*, 2015-16 and 2016-17, respectively over 100% RDF alone, 75% RDF with or without seed treatment. Application of 75% RDF in conjunction with seed treatment to hyacinth bean resulted in significantly higher pod yields over 75% RDF alone and was at par with 100% RDF alone during both the years of study. Similar results of higher yields with RDF in conjunction with biofertilizer seed treatment were reported by Hunter (1994) [15] in soybean, Ahmed (1998) [2]; Abdallah (2001) [1]; Rughheim and Abdelgani (2009) [32] in faba bean, Rudresh *et al.* (2005) [31] and Bhuiyan *et al.* (2008) [11] in chick pea, Shehata and Khawas (2003) [38] in sunflower.

Effect of INM practices on Post-harvest status of soil properties

Bulk density

Soil bulk density was not significantly influenced due to the effect of INM treatments imposed during *kharif*, 2015 and 2016 and treatments imposed to hyacinth bean crop during *Rabi*, 2015–16 and 2016–17 (Table 2). The use of organic manures (FYM and vermicompost) resulted in slightly lower bulk densities over inorganic treatments and unfertilized control but it was not significant.

Soil pH

During both the years, the soil pH after the harvest of *Rabi* crop did not differ significantly due to the treatments imposed on baby corn during *kharif*, 2015 and 2016 and to hyacinth bean during *Rabi*, 2015–16 and 2016–17 (Table 2), but there was a slight decrease in pH of the soil from the initial value in FYM and vermicompost applied treatments and this could be due to decomposition and mineralization of organic matter.

Soil electrical conductivity

No significant variations were noticed due to the INM treatments imposed on baby corn during *kharif*, 2015 and succeeding hyacinth bean during *Rabi*, 2015–16 on the soil electrical conductivity after the harvest of *Rabi*, 2015–16 crop (Table 2). Similarly no significant variations were noticed due to the effect of INM practices imposed to preceding baby corn during *kharif*, 2016 and INM treatments imposed to hyacinth bean during *Rabi*, 2016–17 on the soil electrical conductivity.

Soil organic carbon

No significant differences were noticed due to the INM treatments imposed on baby corn during *kharif*, 2015 and to succeeding hyacinth bean during *Rabi*, 2015–16 on the soil organic carbon after the harvest of *Rabi*, 2015–16. Significant variations were noticed on the soil organic carbon after the harvest of *Rabi*, 2016–17 (Table 2). Significantly higher soil organic carbon (%) values were recorded in organic treatments (25% N through FYM or vermicompost integrated with 75% RDF and biofertilizers, 25% N through FYM integrated with 75% RDF) over 100% RDF with or without biofertilizers and unfertilized control. The soil organic carbon increased from 0.63% before *kharif*, 2015 to 0.65% due to integration of 25% N through FYM or VC and biofertilizers after *Rabi*, 2016–17. Sarwar *et al*. (2012) [36] also reported that the replacement of 25% N with organic manures increased the organic carbon content of the soil after the harvest of maize.

Effect of INM on Post harvest soil fertility dynamics

Available Nitrogen (kg ha^{-1})

All the organic treatments (FYM & vermicompost integrated with 75% RDF) with or without biofertilizers improved the available nitrogen content of the soil after two years of experimentation. Application of 100% RDF along with biofertilizers also showed a slight increase in the available nitrogen content of the soil (Table 3). Nitrogen balance in the soil after completion of the experiment was higher in different treatment combinations compared to initial nitrogen content except under unfertilized control and 100% RDF. The highest available nitrogen in the soil was found with organic treatments (FYM and VC) along with biofertilizers. Kamalakumari and Singaram (1996) [18] also reported similar results of higher soil available nitrogen with the combined use of FYM and inorganic fertilizers in maize, Kumar (2002) [21] in maize–wheat cropping system.

Available Phosphorus (kg ha^{-1})

Maximum available phosphorus was observed in the combined application of 25% N through FYM and 75% RDF along with biofertilizers treatment after the harvest of hyacinth bean crop during *Rabi*, 2016–17 and was at par with the rest of the organic treatments and significantly superior over 100% RDF with or without fertilizers and un–fertilized control (Table 3). Phosphorus content showed increasing values with all treatment combinations compared to initial status except unfertilized control. Higher phosphorus content recorded with FYM and VC treatments could be attributed to enhanced activity of phosphorus solubilizing microbes in soil with the appreciable quantity of organic matter in the soil (Ocampo *et al*., 1975) [24]. The lowest and negative phosphorus balance with unfertilized control could be attributed to the non–availability of nutrients. These results are also in close agreement with those of Sharma and Banik (2012) [37] for baby corn.

Available potassium (kg ha^{-1})

Maximum available potassium was observed in the combined application of 25% N through FYM and 75% RDF with biofertilizers treatment after the harvest of hyacinth bean crop 2016–17 and was at par with the rest of the organic treatments and 100% RDF with biofertilizers and significantly superior over 100% RDF alone and un–fertilized control (Table 3). The investigation revealed a marginal increase in the available potassium of soil with organic treatments when used along with biofertilizers compared to the rest of the treatments. An increase in the potassium status in the soil after application of potash fertilizers along with organic manures has been also reported by Singh *et al.* (1996) [39].

Available Iron (mg kg^{-1})

All the organic treatments (FYM & vermicompost integrated with 75% RDF) with or without biofertilizers improved the available iron content of the soil after two years of experimentation and were significantly superior over 100% RDF with or without biofertilizers and unfertilized control. Application of 100% RDF along with biofertilizers also showed a slight increase in the available iron content of the soil (Table 3).

Available Copper (mg kg^{-1})

Maximum available copper was observed in the combined application of 25% N through FYM and 75% RDF along with biofertilizers treatment after the harvest of hyacinth bean crop during *Rabi*, 2016–17, was at par with the integration of 25% N through FYM and 75% RDF and significantly superior over rest of the treatments of integration of 25% N through vermicompost and 75% RDF with or without biofertilizers, 100% RDF with or without microbes and un–fertilized control (Table 3).

Available Zinc (mg kg^{-1})

Maximum available zinc was observed in the combined application of 25% N through FYM and 75% RDF with or without biofertilizers treatment after the harvest of hyacinth bean crop 2016–17 and was at par with the rest of the organic treatments and significantly superior to 100% RDF with or without biofertilizers and unfertilized control (Table 3). Rutkowska *et al.* (2014) [33] also reported significantly a higher concentration of micro nutrients (zinc and iron) in soil solution under farm yard manure application over only chemical fertilizer.

Table 1: Effect of integrated nutrient management practices on yield of baby corn and hyacinth bean in baby corn–hyacinth bean cropping system

Treatments	Baby Corn		Hyacinth Bean	
	Cob yield Without husk (kg ha^{-1})		Pod Yield (kg ha^{-1})	
	2015	2016	2015-16	2016-17
Main treatments- (*Kharif*-Baby corn)				
T_1	1602	1495	7859	7772
T_2	1803	1596	8082	7889
T_3	1801	1601	7732	7632
T_4	2049	1890	7838	7747
T_5	1542	1471	6685	6346
T_6	1807	1553	6960	6619
T_7	823	749	5995	5893
S.E.M±	64	16	115	96
C.D. (p = 0.05)	198	49	355	296
Sub-treatments– (*Rabi*- hyacinth bean)				
S_1-100% RDF		1546	7445	7282
S_2-75% RDF		1369	6822	6629
S_3-100% RDF + *Bradyrhizobium* @ 500 g ha^{-1}Seed treatment		1590	7718	7576
S_4-75% RDF + *Bradyrhizobium* @ 500 g ha^{-1} Seed treatment		1411	7244	7026
S.Em±		16	74	97
C.D. (p = 0.05)		45	210	277
Interaction between				
Bean treatment means at same level of baby corn INM treatments				
S.E.M±		41	195	257
C.D. (P=0.05)		NS	NS	NS
INM treatment means of baby corn at same or different level of bean treatments				
S.E.M±		39	204	242
C.D. (p = 0.05)		NS	NS	NS

T_1– 25% N through FYM + 75% RDF; T_2– 25% N through FYM + 75% RDF + *Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_3– 25% N through VC + 75% RDF; T_4– 25% N through VC + 75% RDF + *Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_5– 100% RDF T_6– 100% RDF–+–*Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_7– Control (No fertilizer application)

Table 2: Effect of integrated nutrient management practices on bulk density (Mg m^{-3}), pH, electrical conductivity (dS m^{-1}) and Organic Carbon (%) of soil in baby corn–hyacinth bean cropping system

Treatments	Bulk Density (Mg m^{-3})		pH		Electrical Conductivity (dS m^{-1})		Organic Carbon (%)	
	After harvest of *Rabi* crop		After harvest of *Rabi* crop		After harvest of *Rabi* crop		After harvest of *Rabi* crop	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
Main treatments– (*Kharif*–Baby corn)								
T_1	1.47	1.48	7.28	7.26	0.046	0.051	0.65	0.65
T_2	1.46	1.47	7.29	7.25	0.048	0.053	0.65	0.65
T_3	1.48	1.46	7.31	7.30	0.043	0.048	0.64	0.64
T_4	1.47	1.46	7.30	7.29	0.048	0.054	0.65	0.65
T_5	1.48	1.50	7.35	7.36	0.047	0.053	0.64	0.63
T_6	1.49	1.48	7.34	7.34	0.043	0.048	0.64	0.63
T_7	1.49	1.48	7.37	7.36	0.048	0.053	0.64	0.63
S.E.M±	0.01	0.01	0.03	0.01	0.001	0.001	0.005	0.005
C.D. (p = 0.05)	NS	NS	NS	NS	NS	NS	NS	0.01
Sub–treatments– (*Rabi*– hyacinth bean)								
S_1–100% RDF	1.48	1.47	7.32	7.51	0.045	0.050	0.65	0.64
S_2–75% RDF	1.47	1.47	7.33	7.53	0.046	0.052	0.65	0.64
S_3–100% RDF + *Bradyrhizobium* @ 500	1.47	1.47	7.33	7.45	0.046	0.052	0.65	0.64

g ha^{-1}Seed treatment								
S_4–75% RDF + *Bradyrhizobium* @ 500 g ha^{-1} Seed treatment	1.48	1.48	7.31	7.43	0.046	0.052	0.64	0.64
S.E.M$\pm$	0.01	0.01	0.01	0.01	0.001	0.001	0.004	0.004
C.D. (p = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Interaction between								
Bean treatment means at the same level of baby corn INM treatments								
S.E.M$\pm$	0.02	0.02	0.19	0.20	0.003	0.003	0.01	0.01
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS
INM treatment means of baby corn at a same or different level of bean treatments								
S.E.M$\pm$	0.02	0.02	0.19	0.20	0.003	0.003	0.01	0.01
C.D. (p = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Initial value	1.49		7.31		0.03		0.63	

T_1– 25% N through FYM + 75% RDF; T_2– 25% N through FYM + 75% RDF + *Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_3– 25% N through VC + 75% RDF; T_4– 25% N through VC + 75% RDF + *Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_5– 100% RDF T_6– 100% RDF–+–*Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_7– Control (No fertilizer application)

Table 3: Effect of integrated nutrient management practices on available nutrients (N, P_2O_5 and K_2O kg ha^{-1}) and Iron, copper and zinc in baby corn–hyacinth bean cropping system

Treatments	After harvest of *Rabi* crop 2015–16			After harvest of *Rabi* crop 2016–17			After harvest of *Rabi* crop 2016–17		
	N (kg ha^{-1})	P_2O_5 (kg ha^{-1})	K_2O (kg ha^{-1})	N (kg ha^{-1})	P_2O_5 (kg ha^{-1})	K_2O (kg ha^{-1})	Iron (mg kg^{-1})	Copper (mg kg^{-1})	Zinc (mg kg^{-1})
Main treatments– (*Kharif*–Baby corn)									
T_1	325.2	30.6	235.8	340.2	32.1	252.5	5.58	0.67	2.7
T_2	340.4	32.5	245.6	341.2	32.5	258.5	5.59	0.67	2.7
T_3	307.9	26.5	232.5	334.6	31.5	240.5	5.48	0.63	2.6
T_4	321.6	29.5	240.6	338.5	31.6	250.8	5.58	0.64	2.6
T_5	270.4	27.6	230.1	318.2	28.2	240.2	5.29	0.60	2.3
T_6	299.2	28.5	232.0	320.9	29.6	242.0	5.35	0.62	2.4
T_7	245.1	21.1	212.2	200.6	20.8	198.0	5.00	0.57	2.2
S.Em$\pm$	7.1	0.5	6.2	7.4	0.6	6.5	0.04	0.01	0.03
C.D. (P=0.05)	21.2	1.3	17.6	22.3	1.5	18.1	0.12	0.02	0.1
Sub–treatments– (*Rabi*– hyacinth bean)									
S_1–100% RDF	303.1	28.7	236.5	317.5	30.6	243.0	5.42	0.64	2.56
S_2–75% RDF	305.6	26.4	223.3	305.7	26.8	232.8	5.35	0.63	2.47
S_3–100% RDF + *Bradyrhizobium* @ 500 g ha^{-1} Seed treatment	295.8	29.3	240.2	320.8	30.9	249.8	5.44	0.63	2.49
S_4–75% RDF + *Bradyrhizobium* @ 500 g ha^{-1} Seed treatment	301.1	27.6	230.8	316.0	29.7	236.0	5.39	0.62	2.50
S.Em$\pm$	5.1	0.4	4.8	5.3	0.5	5.0	0.04	0.00	0.02
C.D. (P=0.05)	13.6	1.1	12.9	14.0	1.3	13.6	0.10	0.01	0.07
Initial value	320	26.5	252				5.4	0.62	2.5

T_1– 25% N through FYM + 75% RDF; T_2– 25% N through FYM+75% RDF + *Azospirillum* and *Bacillus megaterium* @ 5 kg ha^{-1} each; T_3– 25% N through VC + 75% RDF; T_4– 25% N through VC+75% RDF + *Azospirillum* and *Bacillus megaterium*@5 kg ha^{-1} each; T_5– 100% RDF T_6– 100% RDF + *Azospirillum* and *Bacillus megaterium*@5kg ha^{-1} each; T_7– Control (No fertilizer application)

Conclusion

Application of 25% N through farm yard manure or the vermicompost and 75% recommended dose of fertilizer along with biofertilizers to baby corn and 100% recommended dose of fertilizer along with seed treatment by *Bradyrhizobium* improves the organic carbon content of soil and maintains the soil fertility by way of increasing the availability of primary nutrients nitrogen, phosphorus and potassium and micro–nutrients iron, copper and zinc.

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