

## • Original Research Article

### **Effect of integrated nutrient management (INM) on physico-chemical properties of soils under pearl millet-mustard cropping sequence in Typic ustochrepts**

#### **ABSTRACT**

In northern plains of India, pearl millet-mustard is an efficient, potential and sustainable cropping system (Parihar *et al.*, 2009). There are indications of stagnation or even decline in the productivity of pearl millet-mustard cropping system due to decline in low soil organic matter, soil nutrient deficiency of (secondary and micronutrients) and non-availability of cost effective fertilizers to meet farmers' needs. To ameliorate In amelioration of the soil, it is necessary to use organic manures source like FYM in conjunction combination with inorganic fertilizers to so the soil enriched the soils with all the essential plant nutrients and also to maintain it in good soil health. FYM, not only source of macronutrients but also overcome the requirement of micronutrients. Keeping these points in view (what is the objective of your study or what problem did you want o solve?), The experiments were conducted during 2018-19 using on pearl millet-mustard with sixteen fertilizer treatments which are: Control ( T<sub>1</sub>), 50 % NPK ( T<sub>2</sub>), 75 % NPK ( T<sub>3</sub>), 100 % NPK ( T<sub>4</sub>), 150 % NPK ( T<sub>5</sub>), 100 % NP ( T<sub>6</sub>), 100 % N ( T<sub>7</sub>), 100 % NPK-S ( T<sub>8</sub>), 100 % NPK + 25 Kg ZnSO<sub>4</sub>/ha ( T<sub>9</sub>), 100 % NPK + 50 Kg FeSO<sub>4</sub>/ha ( T<sub>10</sub>), 100 % NPK + 1% FeSO<sub>4</sub> spray at 25 and 45 DAS ( T<sub>11</sub>), 100 % NPK + Azotobacter + PSB ( T<sub>12</sub>), 50 % NPK + FYM ( T<sub>13</sub>), 75 % NPK + FYM ( T<sub>14</sub>), 100 % NPK + FYM ( T<sub>15</sub>), 100 % NPK + FYM + Azotobacter + PSB ( T<sub>16</sub>). (What are the treatments?) in RCBD R. B.D. with three replications. The SOC content in soil increased with the applications of where optimal, super optimal and optimal or sub optimal dose with FYM was given i.e 100% NPK, 150% NPK, 50% NPK + FYM and 75 %NPK + FYM and 100 % NPK + FYM while it whereas decreased in with the application of 50% NPK and 75% NPK, 100%N, 100% NPS-K imbalanced fertility treatments (100%N, 100%NPS-K) and control plot with some exceptions. The optimal dose of fertility (100%NPK) with or without FYM, Azotobacter and PSB and 150% NPK treatment showed build up of all major nutrients (Give names of the nutrients) status at the end of study period, and improved while the soil physical and as well as chemical properties were improved relative to the 50% NPK and 75% NPK, 100%N, 100% NPS-K over the sub-optimal dose fertility

treatments, imbalanced fertilizer treatments and the control. What were the effects of the treatments on the test crop and possible influence of the test crop on the soil properties and your recommendations?

*Keywords: Pearl millet, mustard, FYM, physical, chemical (Arrange alphabetically)*

## 1. Introduction

Integrated nutrient management (INM) practices which involves with the combined use of inorganic and organic nutrient sources of nutrients have had long been advocated to farmers. The usage is with a goal to enhance good soil health and soil ecosystem balance services. Integrated usage application of inorganic fertilizers alongside organic manures has been found to enhance not only the nutrient status of soil but also the soil fitness and soil quality of soils. Integrated nutrient management has been reported to be helpful greatly in increasing soil quality index (Singh 2007) and it has been found that the recycling of organic wastes and use of bio-fertilizers, viz., Rhizobium cultures may play a big vital roles in soil nutrient management of soils.

Soil quality is closely associated with soil organic matter hence; high soil organic matter content means high potential productivity and better soil health of soil. Soil management practices like application of inorganic fertilizers and usage of organic amendments played important roles in maintaining soil quality and improves soil health. Balanced and integrated use of fertilizer with farm yard manure significantly improves soil organic carbon (SOC) contents (Authority?). it also has overall soil quality improvement which are developed by encompasses different physical, chemical and biological properties of the soils (name the physical, chemical and biological aspects improved upon and provide authority/authorities. The C sequestration of C in soils under various cropping systems, manuring and fertilizer practices provide clues to reinforcing soil quality, including soil fertility and productivity through improvements in the soil physical and biological properties of soil.

Soil carbon sequestration is a process that involves may be a process during which the storage of atmospheric CO<sub>2</sub> is far away from the atmosphere and stored within the soil carbon pool This process is primarily mediated by plants through photosynthesis (Authority/Authorities), with carbon stored within the sort of SOC. Carbon sequestration describes long-term storage of CO<sub>2</sub> or other sorts of carbon to either mitigate or deter defer atmospheric heating and avoid overall dangerous global climate change.

Soils comprise the most important pool of organic carbon (OC) within the terrestrial biosphere. Manures used alone or in combination together with inorganic fertilizers are often utilized in agriculture to improve soil fertility in order to increase extend crop production and improve soil fertility. But only a fraction of C added through as organic manure application is sequestered in the soil, while and major a part of it's is converted upon decomposition to CO<sub>2</sub> thereby after decomposition thus returning same the CO<sub>2</sub> fixed by plant back to atmosphere (Authority?).

No review on the test crop and effects of treatments on it growth, production and influence on soil properties and C levels?

Soils comprise the most important pool of organic carbon (OC) within the terrestrial biosphere.

## 2. Material and Methods

The experiment was carried out during *kharif* 2017 to *rabi* 2019 in research farm of the Department of Soil Science and Agricultural Chemistry, College of Agriculture, R.V.S.K.V.V., Gwalior, situated in Grid zone at the at latitude of 26° 13'N; and longitude 76° 10'E with an on altitude of 197 meters from mean sea level (MSL). The soil of the experimental field was alluvial, sandy clay loam in texture and classified as Typic Ustochrepts at sub group level (Authoity?). The Soil samples were collected from various depths (at 0-15, 15-30, 30-60 and 60-100 cm) of soil profile with the help of screw and tube auger to study the impact of various fertilizer treatments on the soil properties of within the soil profile of experimental site. The experiment was laid out with

under randomized complete block design (RCBD) with three replications comprising of 16 treatments. The treatments include the details are as follows. Control ( T<sub>1</sub>), 50 % NPK ( T<sub>2</sub>), 75 % NPK ( T<sub>3</sub>), 100 % NPK ( T<sub>4</sub>), 150 % NPK ( T<sub>5</sub>), 100 % NP ( T<sub>6</sub>), 100 % N ( T<sub>7</sub>), 100 % NPK-S ( T<sub>8</sub>), 100 % NPK + 25 Kg ZnSO<sub>4</sub>/ha ( T<sub>9</sub>), 100 % NPK + 50 Kg FeSO<sub>4</sub>/ha ( T<sub>10</sub>), 100 % NPK + 1% FeSO<sub>4</sub> spray at 25 and 45 DAS ( T<sub>11</sub>), 100 % NPK + Azotobacter + PSB ( T<sub>12</sub>), 50 % NPK + FYM ( T<sub>13</sub>), 75 % NPK + FYM ( T<sub>14</sub>), 100 % NPK + FYM ( T<sub>15</sub>), 100 % NPK + FYM + Azotobacter + PSB ( T<sub>16</sub>).

The recommended fertilizer doses for pearl millet and mustard as per the treatments were applied (80:40:20 and 100:60:40 of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O kg ha<sup>-1</sup>, respectively ) in the form of as urea, single superphosphate and muriate of potash, applied at 5 cm away from the seed line and 5 cm deep in the soil. In all, 50% per cent of the N nitrogen and entire dose of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were applied at the time of sowing and while the remaining 50% N as per cent of nitrogen was top dressing in the form of urea for pearl millet at 30 days after sowing. and For mustard, fertilizer application was carried out after first irrigation. In treatment with 100 % NPK-S, P was added through DAP to make it S free treatment, while As per treatment FYM was added @ at 10 tonnes ha<sup>-1</sup> yr<sup>-1</sup> before the sowing of kharif crop. The seeds were inoculated with Azotobacter (AZO) and phosphate solubilising bacteria (PSB) both @ at 10 g Kg<sup>-1</sup> seed. The pearl millet (Cv. JBV-3) and mustard (Cv. Pusa bold) @ at 5 kg ha<sup>-1</sup> were sown by driving about 3 cm deep in furrows. Chemical fertilizers were applied below the seed in furrows before the seed sowing and seeds were covered with soil to level the opened furrows. The inter row Row to row distance between in pearl millet and mustard maintained was 45 cm and 30 cm respectively, with Plant to plant distance 10 cm inter plant spacing was maintained under both crops.

### 3. Results and Discussion

#### 3.1 Effect of integrated nutrient management on soil physical properties

### 3.1.1 Soil bulk density ( $\text{Mg m}^{-3}$ )

The perusal of data indicates that the bulk density of the soils varied from 1.10 - 1.57  $\text{Mg m}^{-3}$  at 0-15 cm soil depth at the end of study period (Table 1). The maximum highest bulk density was obtained for reported in the treatment  $T_7$  and followed by  $T_1$  and  $T_6$  where full dose of NPK or FYM was not applied. The increased bulk density was been attributed to the deterioration of the soil structure due to with N-fertilizer used when applied alone or as imbalanced fertilization (Walia *et al.*, 2010). The plots treatments receiving 100% NPK alone or in combination with Azotobactor and or PSB and 150% NPK showed had the decreasing trend of bulk density value over the sub optimal fertility dose (plots treated with 50% and 75% NPK), which could be attributed probably to increased biomass production with consequent increased in the soil organic matter content of soil (Selvi *et al.*, 2005). However, no A definite trend in the soil bulk density was observed not noticed at the end of study period but the and decreased values obtained with respect to treatments may be ascribed to continuous application of inorganic fertilizer under long term fertilizer experiment. Decrease of bulk density in the treatments of integrated use of chemical fertilizers and FYM may be mainly attributed to higher organic matter content of the soil which results increase of porosity in the manure treated plots. The FYM treated plots ( $T_{13}$ ,  $T_{14}$ ,  $T_{15}$  and  $T_{16}$ ) in combination with various levels of NPK observed had lower value of bulk density. Decrease in BD of soil which may be due to the higher organic carbon content of soils resulting to more pore spaces and better soil aggregation. Similarly trends had been were also reported by Thakur *et al.* (2011) when they studied the impact of continuous use of inorganic fertilizers and organic manures on soil properties under soybean-wheat intensive cropping on a Vertisol in which location?.

### 3.1.2 Soil porosity

The soil porosity as a result of the various fertilizer treatments ranged from 47.33 to 56.58 % at the end of study period (Table 1) and indicating that the different fertilizer treatments nutrient management practices had significant influences on porosity of the soils. The maximum soil porosity of soil was recorded under treatment 100% NPK+FYM at @ 10  $\text{t ha}^{-1}\text{yr}^{-1}$ + Azotobactor +PSB which increased and showed the build up by 19.0 %, 11.2 % and 10.7 % compared to over the control, 11.2 % over 100%NPK, and 10.7

% over 150% NPK treated plots respectively. The plots treatments receiving various levels of NPK treatments in combination with FYM at @ 10 t ha<sup>-1</sup> yr<sup>-1</sup> (T<sub>13</sub>, T<sub>14</sub>, T<sub>15</sub>, and T<sub>16</sub>) produced the had higher soil porosity compared to same levels of sole NPK treated plots (T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub>) without FYM. It is pertinent to note that the continuous addition of organic manure usage not only influenced the bulk density but also brought about a favourable change in the soil total porosity of soil which in turn also influenced the and other soil physical properties. Selvi *et al.*, (2005) in long term field experiment found the reported significantly higher soil porosity (58.9%) with the application of when 100% NPK + FYM at @ 10 t ha<sup>-1</sup> compared to the than absolute control (50.2%) in on a Vertic Haplustep soil.

### 3.1.2 Infiltration rate (cm hr<sup>-1</sup>)

The soil terminal infiltration rate due to the treatments recorded under the plots receiving different fertility levels varied from 1.83 - 2.61 cm hr<sup>-1</sup> (Table 1) and this may considered good for well drained soils. The infiltration rate was observed to be highest with value of 2.6 cm hr<sup>-1</sup> in plots treated with 100% NPK+FYM at @10 t ha<sup>-1</sup>yr<sup>-1</sup> +Azotobactor+PSB (2.6 cm hr<sup>-1</sup>) and was followed by 2.59 cm hr<sup>-1</sup> with 100% NPK +FYM at @10t ha<sup>-1</sup>yr<sup>-1</sup> (2.59 cm hr<sup>-1</sup>). The values which were significantly higher over the compared to other treatments (Fig. 2.c). The sole use of treatment receiving 100% N resulted to alone showed the lowest infiltration rate (1.83 cm hr<sup>-1</sup>) as compared to the all fertility treatments and control (1.87cm hr<sup>-1</sup>). There was only narrow difference in infiltration rates but found statistically significant. The plots with FYM in combination with chemical fertilizers as treatments plots (T<sub>13</sub>, T<sub>14</sub>, T<sub>15</sub> and T<sub>16</sub>) recorded had relatively higher infiltration rates over the plots receiving than the no treatment (control) or only and sole chemical fertilizers (T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>). The continuous addition of organic manure not only influences any single physical properties but also brought about a favourable change in all the physical properties. Similar trend had been findings were reported by Bajpai *et al.* (2006) when they studied the integrated nutrient management on Inceptisols of Chhattisgarh as it affects the on soil physico-chemical properties and the productivity of rice-wheat system.

NOTE: You have not compared trends for each year and then at the end of the experiments and trends down the soil profile.

**Table : 1 Soil physical properties as affected by integrated nutrient management (2017-2019)**

Treatments	BD (Mg m <sup>-3</sup> ) (0-15cm)			Porosity (%) (0-15cm)			Infiltration rate (cm hr <sup>-1</sup> )
	Initial (2017)	Final (2019)	B/D	Initial (2017)	Final (2019)	B/D	
T <sub>1</sub> -CONTROL	1.55	1.57	0.02	47.85	47.33	-0.5	1.73
T <sub>2</sub> -50%NPK	1.44	1.44	0.00	48.44	48.41	0.0	1.87
T <sub>3</sub> -75%NPK	1.40	1.40	0.00	48.86	48.83	0.0	1.99
T <sub>4</sub> -100%NPK	1.35	1.37	0.02	50.21	50.53	0.3	2.13
T <sub>5</sub> -150%NPK	1.32	1.34	0.02	50.38	50.73	0.4	2.22
T <sub>6</sub> -100%NP	1.37	1.38	0.01	48.93	49.31	0.2	1.93
T <sub>7</sub> -100%N	1.40	1.43	0.03	46.88	46.55	-0.3	1.81
T <sub>8</sub> -100%NPK-S	1.38	1.40	0.02	49.12	49.47	0.3	2.13
T <sub>9</sub> -100%NPK+25 Kg/ha ZnSO <sub>4</sub>	1.37	1.39	0.02	49.34	49.64	0.3	1.96
T <sub>10</sub> -100%NPK+50 Kg/ha FeSO <sub>4</sub>	1.36	1.38	0.02	48.16	48.45	0.3	1.98
T <sub>11</sub> -100%NPK+1% spray at 25 and 45 DAS	1.38	1.40	0.02	51.09	51.39	0.3	1.99
T <sub>12</sub> -100%NPK+AZO+PSB	1.35	1.32	-0.03	51.23	51.64	0.4	2.26
T <sub>13</sub> -50%NPK+FYM	1.32	1.30	-0.02	51.55	51.86	0.3	2.57
T <sub>14</sub> -75%NPK+FYM	1.25	1.22	-0.03	52.36	52.89	0.5	2.61
T <sub>15</sub> -100%NPK+FYM	1.19	1.16	-0.03	53.56	54.23	0.7	2.64
T <sub>16</sub> -100%NPK+FYM+AZO+PSB	1.15	1.10	-0.05	55.64	56.58	0.9	2.69
<b>SEm±</b>	<b>0.07</b>	<b>0.04</b>		<b>3.09</b>	<b>3.29</b>		<b>0.09</b>
<b>CD(P=0.05)</b>	<b>NS</b>	<b>0.10</b>		<b>NS</b>	<b>NS</b>		<b>0.26</b>

Note: AZO: *Azotobactor*, PSB phosphate solubilizing bacteria, FYM: farmyard manure, D/B: decrease or buildup

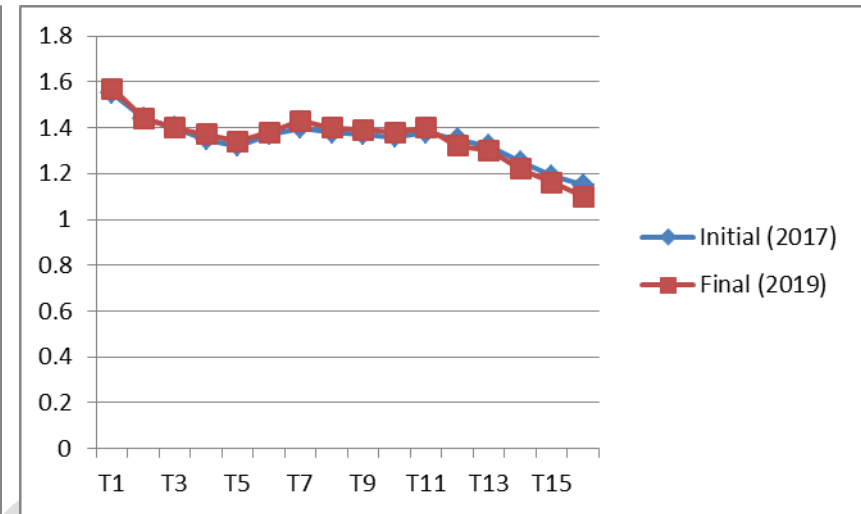
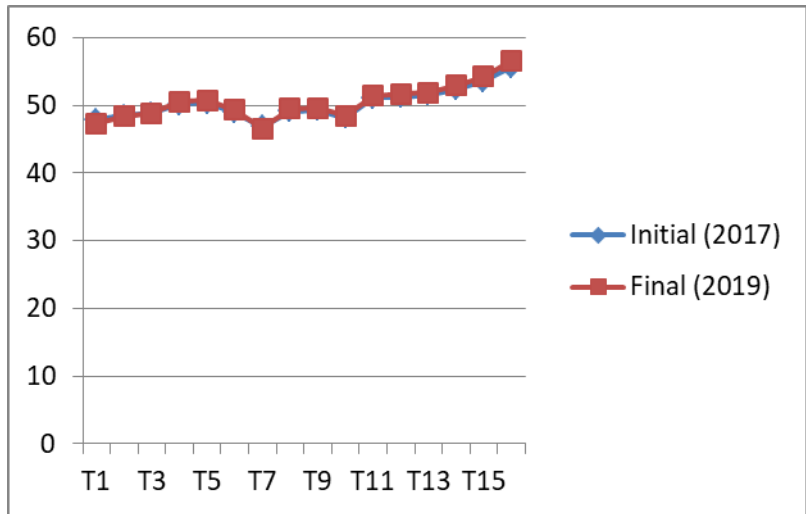
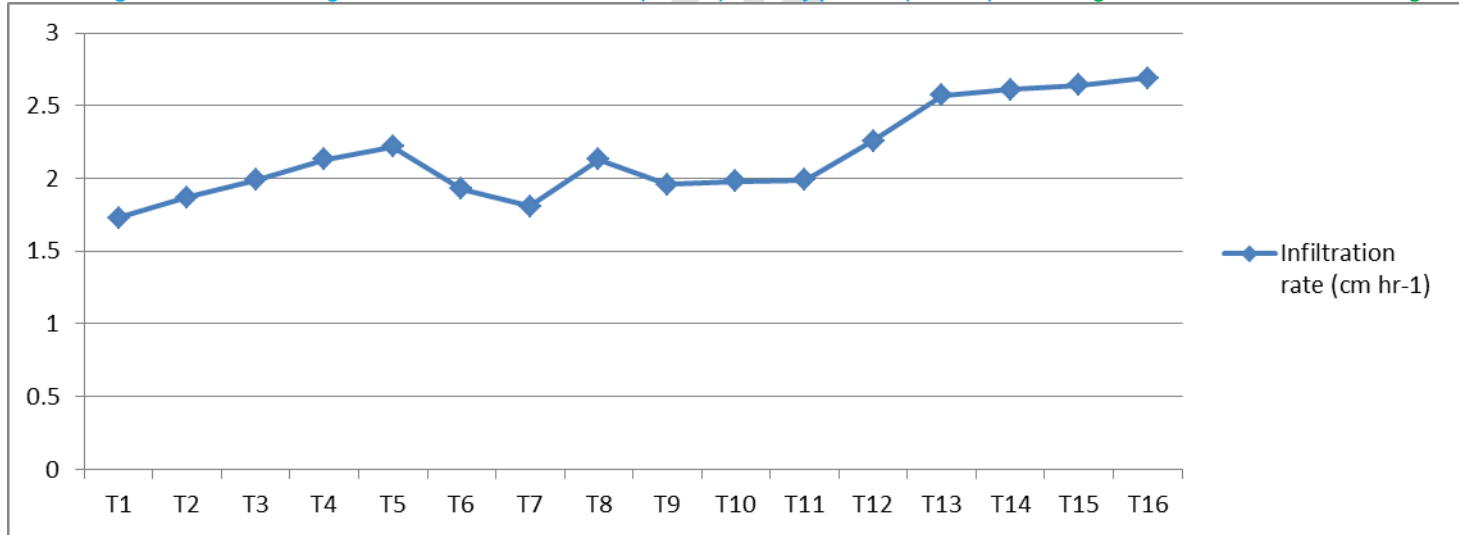


Fig.: 1.(a) Bulk density ( $\text{Mg m}^{-3}$ ) at initial and final study periods (2017-19)

Fig.: 1.(b) Porosity (%) (0-15cm) at initial and final study periods (2017-19)

Fig 1.(c): Effect of integrated nutrient management on soil Infiltration rate ( $\text{cm ha}^{-1}$ ) at study periods (2017-19) NOTE: Fig. Title it should be below the Figure



## 3.2 Effect of integrated nutrient management on soil chemical properties

### 3.2.1 Soil reaction (pH)

The soil value of pH varied from 7.63 -7.83 under various treatments at the surface soil and there was some which increased with respect to increase in soil depth. This was in trend with Sawarkar *et al.* (2013) who reported that the soil pH increased with depth. The control treatment has highest value of pH and it was fall very low due to application of urea and maximum decline takes place where was least when N alone was applied. This is probably due to acid producing nature of these nitrogenous fertilizers (Prasad *et al.* 2010, Yaduvanshi *et al.* 2013)

It was seen that The FYM at @10 t ha<sup>-1</sup>yr<sup>-1</sup> applied in conjunction with various in combination with chemical fertilizers levels (T<sub>13</sub>, T<sub>14</sub>, T<sub>15</sub> and T<sub>16</sub>) resulted to insignificantly decreased soil pH as compared to the same level of sole use of chemical fertilizers alone, which may be attributed to the production of organic acids during decomposition of organic manure mediated by microbial organisms in the soil (Gupta *et al.*, 2000) reported reduction in soil pH, as a result of microbial decomposition of organic manures.

It is observed from the results that soil pH was influenced non-significantly by long term integrated nutrient management. Though there was no significant variations seen but there were numerical changes in soil pH values.

### 3.2.2 Electrical conductivity (dSm<sup>-1</sup>)

The soil electrical conductivity (EC) of soil under various treatments ranged from 0.108-0.244 dSm<sup>-1</sup> at 0-15 cm for surface soil at the end of experiment and decreased with soil depth. The EC electrical conductivity of soil was not significantly affected by different levels of NPK and FYM. However, but there was slight increase under the various fertilizer different treatments over the control. The electrical conductivity indicated that of various treatments data indicated that the changes were only theoretical and there was no threat since the values were within as it was always well in safe limits, which was in tren with findings of Babu *et al.* (2007).. The electrical conductivity of soil was not significantly affected by different levels of NPK and FYM, but there was slight increase under different treatments over control. It may be due to

application of inorganic fertilizer. These results supports the findings of Babu *et al.* (2007).

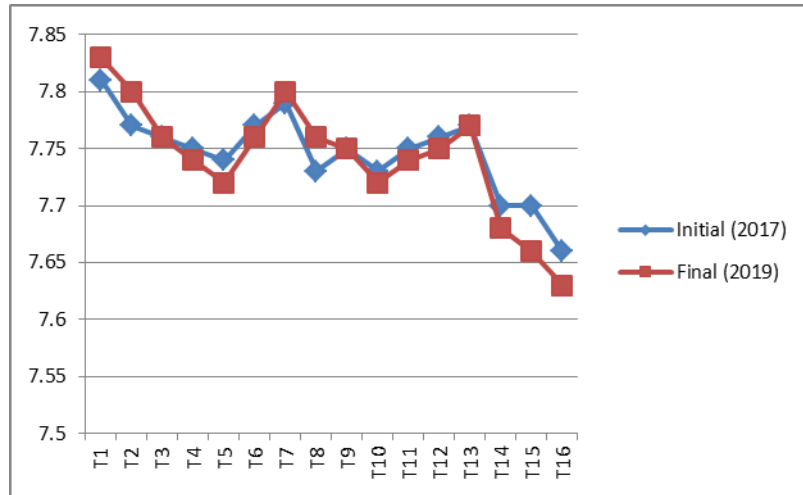
UNDER PEER REVIEW

**Table : 2 Soil reaction (pH) as affected by nutrient management practices under a long term study**

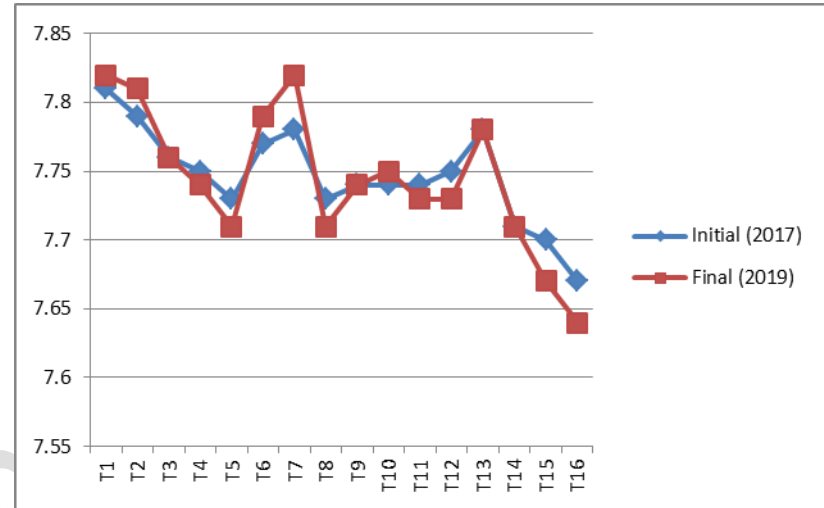
Treatments/ Depth (m)	Initial (2017)				Final (2019)				D/B			
	0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100
T <sub>1</sub> -CONTROL	7.81	7.81	7.81	7.82	7.83	7.82	7.81	7.82	0.02	0.01	0.00	0.00
T <sub>2</sub> -50%NPK	7.77	7.79	7.78	7.81	7.80	7.81	7.78	7.81	0.03	0.02	0.00	0.00
T <sub>3</sub> -75%NPK	7.76	7.76	7.77	7.78	7.76	7.76	7.77	7.78	0.00	0.00	0.00	0.00
T <sub>4</sub> -100%NPK	7.75	7.75	7.76	7.75	7.74	7.74	7.76	7.75	-0.01	-0.01	0.00	0.00
T <sub>5</sub> -150%NPK	7.74	7.73	7.74	7.75	7.72	7.71	7.74	7.75	-0.02	-0.02	0.00	0.00
T <sub>6</sub> -100%NP	7.77	7.77	7.77	7.76	7.76	7.79	7.77	7.76	-0.01	0.02	0.00	0.00
T <sub>7</sub> -100%N	7.79	7.78	7.78	7.80	7.80	7.82	7.78	7.80	0.01	0.04	0.00	0.00
T <sub>8</sub> -100%NPK-S	7.73	7.73	7.74	7.74	7.76	7.71	7.75	7.74	0.03	-0.02	0.01	0.00
T <sub>9</sub> -100%NPK+25 Kg/ha ZnSO <sub>4</sub>	7.75	7.74	7.72	7.73	7.75	7.74	7.72	7.73	0.00	0.00	0.00	0.00
T <sub>10</sub> -100%NPK+50 Kg/ha FeSO <sub>4</sub>	7.73	7.74	7.73	7.73	7.72	7.75	7.73	7.73	-0.01	0.01	0.00	0.00
T <sub>11</sub> -100%NPK+1% spray at 25 and 45 DAS	7.75	7.74	7.74	7.76	7.74	7.73	7.74	7.76	-0.01	-0.01	0.00	0.00
T <sub>12</sub> -100%NPK+AZO+PSB	7.76	7.75	7.74	7.75	7.75	7.73	7.73	7.75	-0.01	-0.02	-0.01	0.00
T <sub>13</sub> -50%NPK+FYM	7.77	7.78	7.74	7.77	7.77	7.78	7.74	7.77	0.00	0.00	0.00	0.00
T <sub>14</sub> -75%NPK+FYM	7.70	7.71	7.71	7.72	7.68	7.71	7.71	7.72	-0.02	0.00	0.00	0.00
T <sub>15</sub> -100%NPK+FYM	7.70	7.70	7.72	7.71	7.66	7.67	7.71	7.71	-0.04	-0.03	-0.02	0.00
T <sub>16</sub> -100%NPK+FYM+AZO+PSB	7.66	7.67	7.68	7.69	7.63	7.64	7.65	7.66	-0.05	-0.04	-0.03	0.00
<b>SEm±</b>	<b>0.04</b>	<b>0.06</b>	<b>0.04</b>	<b>0.07</b>	<b>0.03</b>	<b>0.06</b>	<b>0.06</b>	<b>0.08</b>				
<b>CD(P=0.05)</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>0.09</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>				

Note: AZO: *Azotobactor*, PSB phosphate solubilizing bacteria, FYM: farmyard manure, D/B: decrease or buildup

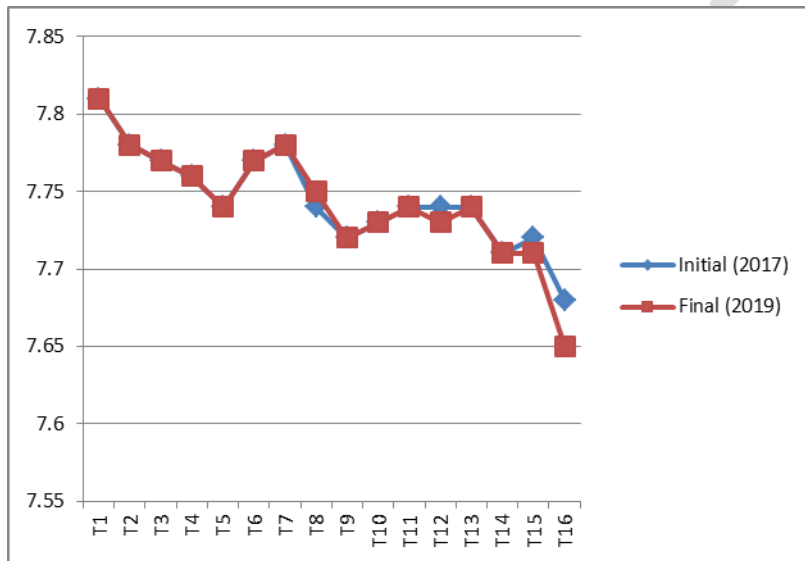
**Fig 2: Effect of integrated nutrient management on Soil reaction (pH) at initial and final study periods (2017-19)**



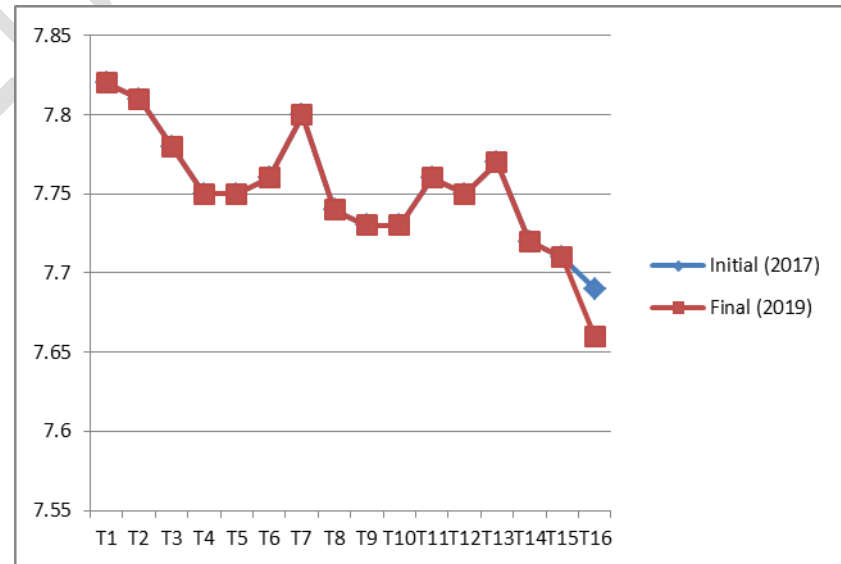
**Fig.: 2.(a) Soil reaction (pH) at 0-15cm soil depth.**



**Fig.: 2.(b) Soil reaction (pH) at 15-30cm soil depth**



**Fig.: 2 (c) Soil reaction (pH) at 30-60 cm soil depth.**



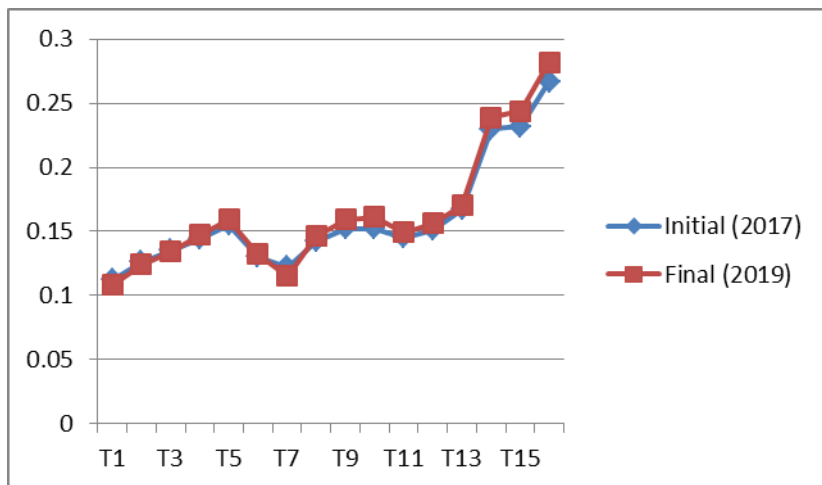
**Fig.: 2.(d) Soil reaction (pH) at 60-100cm soil depth**

**Table : 3 Electrical conductivity (dSm<sup>-1</sup>) affected by integrated nutrient management (2017-2019)**

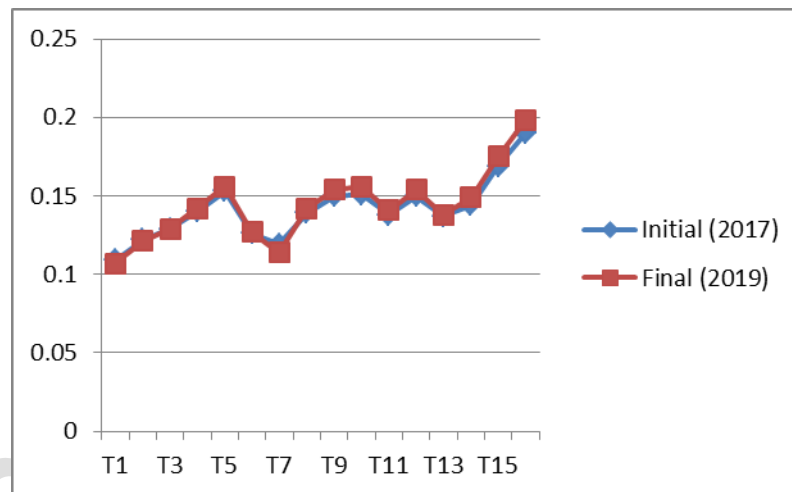
Treatments/ Depth (m)	Initial (2017)				Final (2019)				D/B			
	0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100
T <sub>1</sub> -CONTROL	0.112	0.109	0.101	0.096	0.108	0.107	0.099	0.095	-0.004	-0.002	-0.002	-0.002
T <sub>2</sub> -50%NPK	0.126	0.122	0.105	0.102	0.124	0.121	0.104	0.102	-0.002	-0.001	-0.001	0.000
T <sub>3</sub> -75%NPK	0.135	0.129	0.109	0.105	0.134	0.129	0.109	0.105	-0.001	0.000	0.000	0.000
T <sub>4</sub> -100%NPK	0.144	0.140	0.114	0.106	0.147	0.142	0.116	0.107	0.003	0.002	0.002	0.001
T <sub>5</sub> -150%NPK	0.155	0.153	0.125	0.108	0.159	0.156	0.127	0.110	0.004	0.003	0.002	0.002
T <sub>6</sub> -100%NP	0.130	0.126	0.105	0.103	0.132	0.127	0.105	0.103	0.002	0.001	0.000	0.000
T <sub>7</sub> -100%N	0.122	0.119	0.101	0.101	0.115	0.114	0.099	0.101	-0.007	-0.005	-0.002	0.000
T <sub>8</sub> -100%NPK-S	0.142	0.139	0.111	0.102	0.146	0.142	0.113	0.103	0.004	0.003	0.002	0.001
T <sub>9</sub> -100%NPK+25 Kg/ha ZnSO <sub>4</sub>	0.152	0.150	0.115	0.116	0.159	0.154	0.118	0.116	0.007	0.004	0.003	0.000
T <sub>10</sub> -100%NPK+50 Kg/ha FeSO <sub>4</sub>	0.152	0.151	0.116	0.122	0.161	0.156	0.120	0.123	0.010	0.005	0.004	0.001
T <sub>11</sub> -100%NPK+1% spray at 25 and 45 DAS	0.145	0.138	0.117	0.112	0.149	0.141	0.118	0.113	0.004	0.003	0.001	0.001
T <sub>12</sub> -100%NPK+AZO+PSB	0.151	0.150	0.121	0.109	0.156	0.154	0.124	0.110	0.005	0.004	0.003	0.001
T <sub>13</sub> -50%NPK+FYM	0.167	0.137	0.111	0.106	0.170	0.138	0.111	0.106	0.003	0.001	0.001	0.000
T <sub>14</sub> -75%NPK+FYM	0.230	0.144	0.116	0.108	0.239	0.149	0.118	0.109	0.009	0.005	0.002	0.001
T <sub>15</sub> -100%NPK+FYM	0.232	0.169	0.125	0.114	0.244	0.175	0.129	0.117	0.013	0.006	0.003	0.003
T <sub>16</sub> -100%NPK+FYM+AZO+PSB	0.267	0.190	0.137	0.123	0.282	0.198	0.142	0.126	0.015	0.009	0.005	0.003
<b>SEm±</b>	<b>0.022</b>	<b>0.033</b>	<b>0.021</b>	<b>0.015</b>	<b>0.025</b>	<b>0.024</b>	<b>0.028</b>	<b>0.020</b>				
<b>CD(P=0.05)</b>	<b>0.063</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>0.072</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>				

Note: AZO: *Azotobacter* , PSB phosphate solubilizing bacteria, FYM: farmyard manure, D/B: decrease or buildup

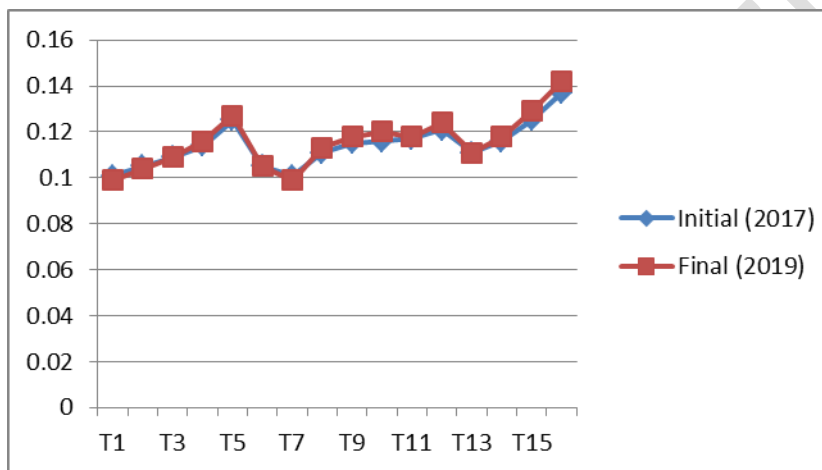
**Fig 3 : Effect of integrated nutrient management on Electrical conductivity ( $\text{dSm}^{-1}$ ) at initial and final study periods (2017-19)**



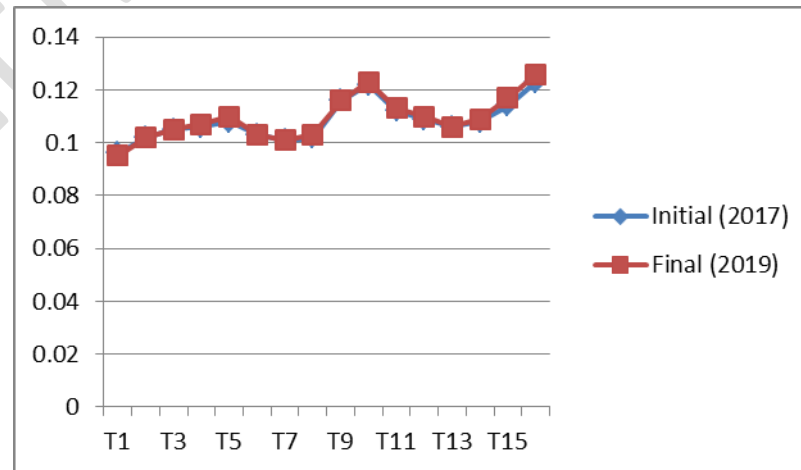
**Fig.: 3.(a) Electrical conductivity ( $\text{dSm}^{-1}$ ) at 0-15cm soil depth.**



**Fig.: 3.(b) Electrical conductivity ( $\text{dSm}^{-1}$ ) at 15-30cm soil depth**



**Fig.: 3.(c) Electrical conductivity ( $\text{dSm}^{-1}$ ) at 30-60 cm soil depth.**



**Fig.: 3.(d) Electrical conductivity ( $\text{dSm}^{-1}$ ) at 60-100cm soil depth.**

## Conclusion

The results indicated that, the management practices such as application of fertilizer and organic amendments together plays an important role in maintaining soil physico-chemical properties and total carbon sequestration (you did not discuss anything on Carbon sequestration in your report?) under the pearl millet - mustard cropping sequence.

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