International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(3): 639-642

Received: 08-03-2018
Accepted: 10-04-2018

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# Effect of different soil amendments on Physico-chemical properties of soil under brinjal-fenugreek cropping sequence

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**Abstract**
Based on a cropping system, the different soil amendments were used to study its effect on physico-chemical properties of soil. The aim was to explore the effects of different soil amendments on improvement of soil properties and at the same time determine the appropriate application of organic manures and inorganic fertilizers for improved sustainable yields of a cropping system. The study was carried out at the Division of Vegetable Science, SKUAST-Kashmir for two consecutive years without changing the site of experiment. The treatment combinations comprised of thirteen nutrient management practices through different sources viz. organic manures (FYM, poultry manure, vermicompost, sheep manure, dal weed) and inorganic fertilizers (N, P & K), applied alone or in various combinations. After the harvest of last residual crop the soil was analysed for various Physico-chemical properties and it was found that by applying mixture of different organic manures ($T_6$), pH of the soil was lowered significantly as compared to other treatments and recorded a pH of 6.45. Among integration of organic manures with inorganic fertilizers, treatment $T_9$ (50% RFD + 50% PM) recorded a soil pH of 6.59 which was significantly lower than rest of the integrated treatments. The same organic treatment $T_6$ (integration of all organic manures) resulted in improvement of electrical conductivity (EC) and organic carbon (OC) content of the soil recording an EC and OC of 0.33 $dsm^{-1}$ and 2.98 percent, respectively and was found significantly higher than rest of the treatments. The extent of increase in soil EC and OC due to treatment $T_6$ over initial soil status was 55.45 % and 18.33 % and over treatment T12 (recommended fertilizers dose) was 21.47 % and 15.43 %, respectively. The treatment $T_{12}$ (RFD) receiving no organic inputs showed least increase in Electrical conductivity and organic carbon content of soil

**Keywords:** Brinjal, cropping sequence, fenugreek, Physico-chemical properties, soil amendments

## Introduction
The growth in agricultural production has to be sustainable. This becomes possible only when soil is in good health. The primary factor having influence on the soil health is the organic matter content of the soil. The organic fraction of cultivated soils is under constant threat of nutrient depletion due to environmental factors and inadequate replenishment. Growing of high yielding varieties of different crops on irrigated lands under increased use of chemical fertilizers has resulted in progressive rise in multi-nutrient deficiencies, nutrient imbalances, deterioration of soil health and productivity with time. As such, the excessive reliance on the energy intensive chemicals without recourse to the replenishment of soil organic matter is an unsound farming practice. On the other hand, use of organic manures alone suffers from drawback of low content of plant nutrients and its slow release characteristics. Therefore, neither organic manures nor chemical fertilizers alone can help in achieving the yield sustainable under highly intensive farming when the nutrient turnover in soil plant system is much larger. Considering the beneficial effect of organic manures on soil health and the environmental problems associated with the excessive and continuous use of inorganic fertilizers, the concept of integrated nutrient management (INM) involving conjunctive use of organic manures and inorganic sources of nutrients assume greater significance. Therefore, an attempt was initiated to study the effect of conjunctive application of organic manures and inorganic fertilizers on Physico-chemical properties of soil under brinjal-fenugreek cropping sequence.

## Material and Methods

Field experiment on brinjal-fenugreek cropping system was carried out at Experimental Field of the Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar. The experimental field (site) is situated at 34.1° North latitude and 74.89° East longitude with an altitude of 1587 meters above mean sea level. The climate of the experimental site is temperate type with moderately hot summers and very cold winters. The valley mostly remains covered with snow during the winter months. The average annual precipitation is 816.3 mm (average of past 30 years) most of which is received in the form of snow and rains from December to April. The soil is clay loam in texture, neutral in soil reaction, low in organic carbon and medium in phosphorus and potassium. The initial soil test values of the experimental field are presented in Table 1.Nutrient contents of the organic manure used in the experiment are shown in Table-2.

**Table 1:** Initial nutrient status of the experimental field.

| Chemical characteristics | Value |
|---|---|
| pH | 7.10 |
| Organic carbon (%) | 2.34 |
| Electrical conductivity (d $Sm^{-1}$) | 0.147 |
| Available N (kg $ha^{-1}$) | 290.50 |
| Available P (kg $ha^{-1}$) | 23.50 |
| Available K (kg $ha^{-1}$) | 195.40 |

**Table 2:** Nutrient status of the organic manures used in the experimental field.

| Name of the manure | Nutrient composition (%) | | |
|---|---|---|---|
| | N | $P_2O_5$ | $K_2O$ |
| Farm Yard Manure (FYM) | 0.4 | 0.20 | 0.20 |
| Vermicompost (VC) | 2.0 | 1.0 | 1.0 |
| Poultry manure (PM) | 2.2 | 1.2 | 1.2 |
| Sheep Manure (SM) | 0.60 | 0.3 | 0.03 |
| Dal weed (DW) | 0.36 | 0.19 | 0.14 |

The experiment was conducted in Randomized Complete Block Design with three replications for two consecutive years without changing the site of the experiment for studying the residual effect of fertilizers applied. The treatment combinations comprised of thirteen nutrient management practices through different sources (Table-3).

The brinjal was taken as main crop and all the nutrients, organic as well inorganic were applied to it. The fenugreek was raised as residual crop to study the carry over effect of applied fertilizers. The well decomposed farm yard manure (FYM), vermicompost (VC), poultry manure (PM), sheep manure (SM) and dal weed (DW) were applied two weeks before sowing and incorporated in soil as per treatments either alone or in combination with other organic as well as inorganic sources of nitrogen. Brinjal cv. Local Long was transplanted at the spacing of 60 cm x 45 cm during 2012 and 2013. The residual crop fenugreek cv. Early Bunching was sown in rows 30 cm apart on 20 and 22 November during 2012 and 2013, respectively. Other management practices were adopted as per recommendations for crops under irrigated conditions. The soil was analyzed after harvesting of the crop to find out the change in available nutrient (N, P and K) status. The nutrient uptake by the crop was obtained as the product of concentration of nutrient and yield. Data obtained from consecutive two years were statistically analyzed by using the F-test as per the procedure given by Gomez and Gomez (1984) [8]. LSD at P=0.05 were used to determine the significance differences between treatment means.

**Table 3:** Treatment combination for brinjal-fenugreek cropping system.

| Symbol | Structure | Quantity |
|---|---|---|
| $T_1$ | Farmyard manure (FYM) | 38 t $ha^{-1}$ |
| $T_2$ | Vermicompost (VC) | 8 t $ha^{-1}$ |
| $T_3$ | Poultry manure (PM) | 8 t $ha^{-1}$ |
| $T_4$ | Sheep manure (SM) | 25 t $ha^{-1}$ |
| $T_5$ | Dal weed (DW) | 20 t $ha^{-1}$ |
| $T_6$ | Integration of all organic manures | 7.5 t FYM+ 1.5 t VC $ha^{-1}$+ 1.5 t PM h $ha^{-1}$+ 5 t SM $ha^{-1}$+ 4 t DW $ha^{-1}$ |
| $T_7$ | 50% RFD + 50% FYM | 75:60:60 N:$P_2O_5$:$K_2O$ kg $ha^{-1}$ + 19 t $ha^{-1}$ |
| $T_8$ | 50% RFD + 50% VC | 75:60:60 N: $P_2O_5$:$K_2O$ kg $ha^{-1}$ + 4 t $ha^{-1}$ |
| $T_9$ | 50% RFD + 50% PM | 75:60:60 N: $P_2O_5$:$K_2O$ kg $ha^{-1}$ + 4 t $ha^{-1}$ |
| $T_{10}$ | 50% RFD + 50% SM | 75:60:60 N: $P_2O_5$:$K_2O$ kg $ha^{-1}$ + 12.5 t $ha^{-1}$ |
| $T_{11}$ | 50% RFD + 50% DW | 75:60:60 N: $P_2O_5$:$K_2O$ kg $ha^{-1}$ + 10 t $ha^{-1}$ |
| $T_{12}$ | RFD | 150:120:120 N: $P_2O_5$:$K_2O$ kg $ha^{-1}$ |
| $T_{13}$ | Control | No chemical fertilizers/organic manures |

## Methods of chemical analysis

Soil pH was measured by digital pH meter using soil: water ratio of 1:2.5 (Jackson, 1973) [9]. Organic carbon was determined by wet oxidation method as described by Walkley and Black (1934) [13]. Electrical conductivity was estimated by solubridge conductivity meter (Jackson, 1973) [9]. Available nitrogen was determined by alkaline potassium permanganate method as described by Subbiah and Asija (1956) [12]. Available phosphorus was determined by Olsen method (Olsen *et al.,* 1954) [11] and available potassium was determined by extracting it with neutral normal ammonium acetate (Merwin and Peech, 1950) [10] and determined by flame photometer as outlined by Jackson (1973) [9]. The total nutrient in manure samples were determined by digesting with concentrated nitric and perchloric acid mixture (Yoshida *et al*, 1976) [14].

## Results and Discussion

All the Physico-chemical properties of the soil were assessed initially before the start of experiment and after two years i.e.

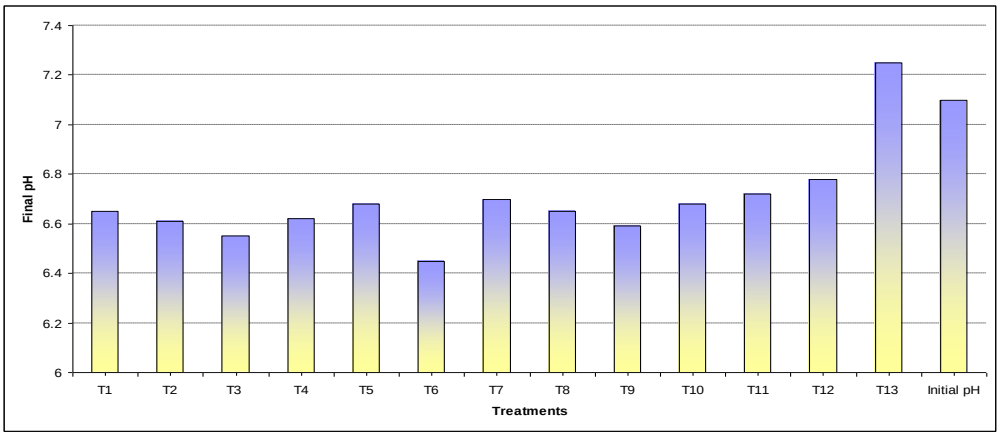
after the harvest of 4th crop in sequence. Data presented in Table 1 and fig 1, 2 & 3 revealed significant variation for soil pH, electrical conductivity and organic carbon due to various treatments under study.

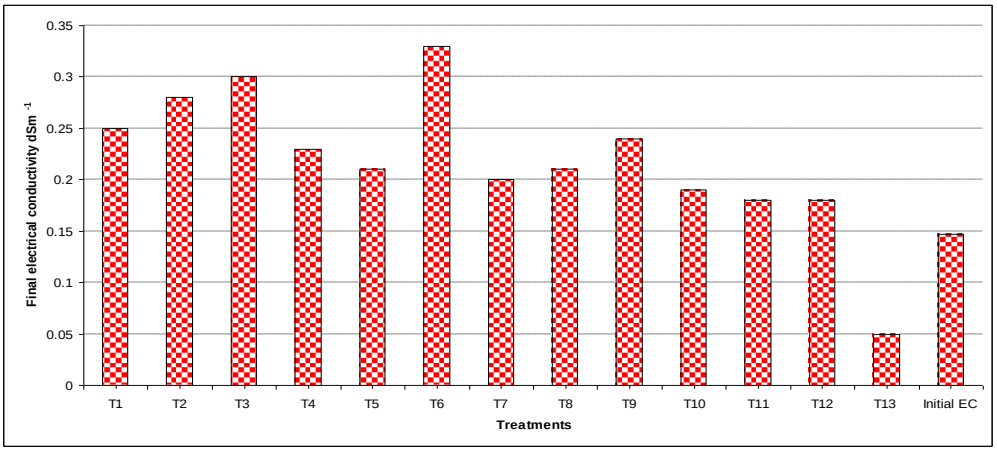
**Treatment effect on soil pH, EC (electrical conductivity) and OC (organic carbon)**

Data reveals that after the harvest of *rabi* residual crop the Physico-chemical properties of the soil were significantly influenced by various treatments under study. The treatment $T_6$ (integration of organic manures) recorded a pH of 6.45 which was significantly lower than rest of the treatments but exhibited at par results with $T_2$ & $T_3$. The extent of decrease in soil pH due to treatment $T_6$ was 9.15 and 4.86 percent over initial status (7.10) and $T_{12}$ (6.78). Among integration of organic manures with inorganic fertilizers, treatment $T_9$ (50% RFD + 50% PM) recorded a soil pH of 6.59 which was significantly lower than rest of the integrated treatments but exhibited at par results with $T_7$ (50% RFD + 50% FYM) and $T_8$ (50% RFD + 50% VC). The extent of decrease in soil pH due to treatment $T_9$ was 7.18 and 2.80 percent over initial status (7.10) and $T_{12}$ (6.78). The decrease in soil pH in the treatments receiving either full or a part of nutrients through organic manures is due to release of various organic acids, especially carbonic acid during the decomposition process which might have resulted in lowering of pH. These results are in close conformity with Thornsbury *et al.* (2000) [7], Tarun *et al.* (2006) [6] and Chattoo (2006) [2].

As far as electrical conductivity and organic carbon content of the soil is concerned, treatment $T_6$ (integration of organic manures) recorded maximum EC and OC of 0.33 $dSm^{-1}$ and 2.98 percent, respectively which was significantly higher than rest of the treatments but exhibited at par results with $T_3$. Integration of organics exhibited an increase in soil EC over the sole organic and integrated combinations. The extent of increase in soil EC and OC due to treatment $T_6$ was 55.45, 18.33 percent and 21.47, 15.43 percent, respectively over initial status(0.147) and $T_{12}$ (0.18). Among integration of organic manures with inorganic fertilizers, treatment $T_9$ (50% RFD + 50% PM) recorded an EC and OC of 0.24 $dSm^{-1}$ and 2.75 percent, respectively which was significantly higher than rest of the integrated treatments but exhibited at par results with treatment $T_8$ (50% RFD + 50% VC). The treatment $T_{12}$ (RFD) receiving no organic inputs showed least increase in Electrical conductivity and organic carbon content of soil. The increase in electrical conductivity is because of the fact that the decomposition of organic manures induces an acidic condition in soil which results in more solubility of salts. Thus the salts present in soil become more mobile and conducts more electric current which results in increase in electrical conductivity. These results corroborate with Thornsbury *et al.* (2000) [7], Sharma *et al.* (2003) [5] and Chattoo (2006) [2].

The continuous application of chemical fertilizers results in drastic reduction of organic carbon content whereas addition of organic manure helps in maintaining organic matter status in soil. The enzymatic activities (urease and alkaline phosphates activities) are also enhanced. With the result, a number of mineral compounds present in the soil are solubilized and made available to plants. Further, the addition of organic manure results in modification of soil texture and the biological activity of the soil also get enhanced. The decomposition rate is hastened due to higher biological activity which results in improvement of organic matter content of soil. These results are in close conformity with Reza and Jafa (2007) [4], Frankenberger and Dick (1983) [3] and Choudhary *et al.* (2011) [1].



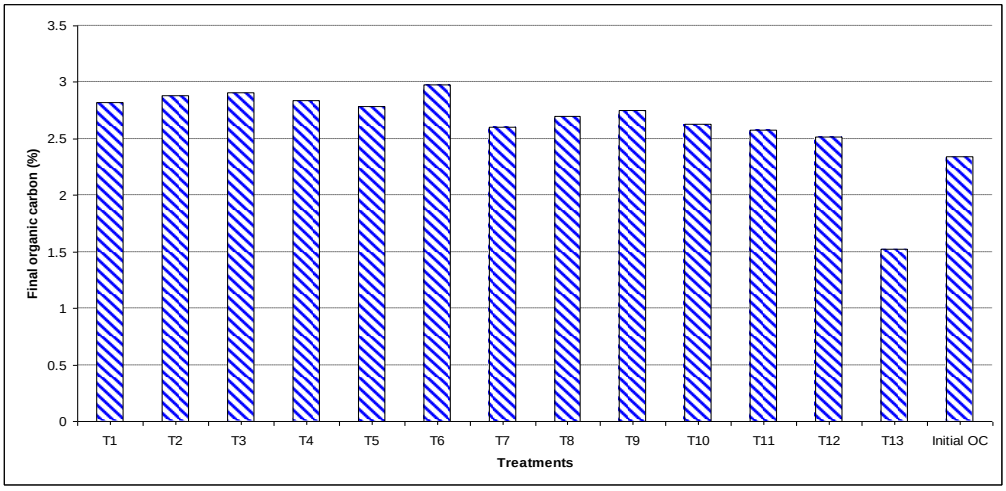



**Fig 1, 2, 3:** Diagrams showing the Influence of organic manures and inorganic fertilizers on mean soil pH, organic carbon (%) and electrical conductivity ($dSm^{-1}$)

**Table 4:** Influence of organic manures and inorganic fertilizers on mean soil pH, organic carbon (%) and electrical conductivity ($dSm^{-1}$)

| Treatment code | Treatment | pH | Electrical conductivity ($dSm^{-1}$) | Organic carbon (%) |
|---|---|---|---|---|
| $T_1$ | Farmyard manure (FYM) | 6.65 | 0.25 | 2.82 |
| $T_2$ | Vermicompost (VC) | 6.61 | 0.28 | 2.88 |
| $T_3$ | Poultry manure (PM) | 6.55 | 0.30 | 2.91 |
| $T_4$ | Sheep manure (SM) | 6.62 | 0.23 | 2.84 |
| $T_5$ | Dal weed (DW) | 6.68 | 0.21 | 2.79 |
| $T_6$ | Integration (all organic manures) | 6.45 | 0.33 | 2.98 |
| $T_7$ | 50% RFD + 50% FYM | 6.70 | 0.20 | 2.60 |
| $T_8$ | 50% RFD + 50% VC | 6.65 | 0.21 | 2.70 |
| $T_9$ | 50% RFD + 50% PM | 6.59 | 0.24 | 2.75 |
| $T_{10}$ | 50% RFD + 50% SM | 6.68 | 0.19 | 2.63 |
| $T_{11}$ | 50% RFD + 50% DW | 6.72 | 0.18 | 2.58 |
| $T_{12}$ | RFD | 6.78 | 0.18 | 2.52 |
| $T_{13}$ | Control | 7.25 | 0.05 | 1.52 |
| | $C.D_{(p\leq 0.05)}$ | 0.12 | 0.035 | 0.075 |
| | C.V | 2.48 | 5.22 | 4.94 |
| | Initial soil status | 7.10 | 0.147 | 2.34 |

## References


1. Choudhary BR, Gupta AK, Parihar CM, Jat SL, Singh DK. Effect of integrated nutrient management on fenugreek (*Trigonella foenum-graecum* L.) and its residual effect on fodder pearl millet (*Pennisetum glaucum*). Indian Journal of Agronomy. 2011; 56:189-195.
2. Chattoo MA. Influence of organic manures and inorganic fertilizers on growth, yield and quality of okra. Ph D (Agri.) Thesis submitted to Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar India, 2006.
3. Frankenberger J, Dick W. Relationships between enzyme activities and microbial growth and activity indices in soil. Soil Science Society of America Journal. 1983; 47:945-951.
4. Reza MT, Jafar K. Influence of organic and chemical fertilizers on growth and yield of tomato (*Lycopersicon esculentum* L.) and soil chemical properties. Annual Report. Tehran, Iran: Shahid Beheshti University, 2007.
5. Sharma RP, Datt N, Sharma P. Combined application of nitrogen, phosphorus, potassium and farmyard manure in onion under high hills, dry temperature conditions of North Western Himalayas. Indian Journal of Agricultural Science. 2003; 73:225-227.
6. Tarun A, Singh S, Sachan RS. Influence of integrated management of bio-fertilizers and chemical fertilizers on post-harvest soil fertility status in fenugreek on a mollisol. Environment and Ecology. 2006; 24:796-802.
7. Thornsbury SD, Stoffela PJ, Minten TM. Economics of organic waste compost utilization in commercial tomato production system. Acta Horticulturae. 2000; 536:93-99.
8. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd *edition.* John Wiley and Sons, Inc. New York, 1984.
9. Jackson ML. Soil chemical analysis. Prentice Hall of India, Pvt. Ltd., New Delhi, 1973.
10. Merwin DH, Peech M. Exchangeable soil potassium in the sand, silt and clay fractions as influenced by the nature of complementary exchangeable cations. Soil Science Society of American Journal. 1950; 15:125-128.
11. Olsen SR, Coleman CW, Watnabe FS, Dean LA. Estimation of available phosphorus with sodium bicarbonate. United States Department of Agriculture Circular. 1954; 939:19.
12. Subbiah BV, Asija JS. A rapid procedure for the estimation of available nitrogen in the soil. Current Science. 1956; 25:259-260.
13. Walkley A, Black JA. An estimation of the method for determining soil organic carbon and proposed modification of the chemical acid titration method. Soil Science. 1934; 37:29-39.
14. Yoshida SD, Forno A, Cock JH, Gomez KA. Laboratory manual for physiological studies of rice. Third Edition. IRRI, Manila, Philippine, 1976.