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Effect of Integrated Nutrient Management on Particle Size Distribution of Calcareous Soil

Amit Kumar Pandey, Ashutosh Singh* and Umesh Singh
Mandan Bharti Agriculture College, Agwanpur, Saharsa-852201, Bihar, India
***Corresponding AuthorEmail :**dr.ashusingh1984@gmail.com*

Abstract

To assess the impact of organics and chemical fertilizer on particle size distribution in calcareous soil, a field experiment was conducted at Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar. The experiment was laid out in split plot design with three replication. Four level of NPK fertilizer and four level of organics were taken as main plot treatment and sub-plot treatment, respectively. Soil samples were taken from 0-15 cm, processed and analyzed for its sand, silt and clay percentages. Integrated use of compost, crop residue either alone or in combination with chemical fertilizer improved the soil structure by adding organic matter. Since, soil texture is the permanent property of soil, therefore addition of organic and inorganic fertilizer had not any effect of soil particle size distribution and the textural class of the experimental soilremainsas sandy loam.

***Key words :** INM, sand, silt, clay, calcareous soil.*

Introduction

Soil texture is composition of size of soil particles i.e. sand, silt and clay. Soil physical properties are influenced by textural classes. Density of soil, porosity, water holding capacity, organic matter content susceptibility to erosion are controlled by soil texture (1, 2) with these factors texture become a most important factors for crop selection and crop growth. Soil texture determines the rate at which water drains through a saturated soil. Soil texture also influences how much water is available to plant. Differences in soil texture also impacts organic matter levels and organic matter breakdown. The cation exchange capacity of soil increases with percent clay and organic matter. Selection of crops as per texture of soil, is of prime importance for sustenance of soil as well as sustainability of agriculture (3). To improve soil tilth, nutrient status, biological communities, aeration and structure, organic matter should be added regularly, adding organic matter does not change the texture of soil but it does change the physical properties related to the soil texture (4). Sound soil management for sustainable agricultural production depends to a large extent to the texture of soil.

Intensive cultivation of rice-wheat system and imbalanced fertilizer application resulted multinutrient deficiencies and depletion of organic matter from the soil (5, 6). Sustainable agriculture aims at meeting the need of present generation without endangering the resource base for positivity. Unfortunately unsustainable productivity, yield decline, environmental pollution, decreasing organic matter storage, decreasing factor productivity under high intensity agriculture in the post green revolution era has been a matter of greatconcern (7, 8). Maintaining soil health/ quality is indispensable for sustaining the agricultural productivity at higher level. It is high time to appreciate the fact unless the soil physical environment is maintain at its optimum level, the yield potential of a crop cannot be realized. Application of organic manure *viz.*, compost, farmyard manure, green manure, crop residue improve soil physical properties through improvement of soil organic matter. The increased plant biomass produced by fertilizer results in increased of organic material to soil in the form of decaying roots, litter and crop residue. This mineral fertilizers indirectly influence soil organic matter content by increasing crop productivity and thereby increasing the amount of organic matter (9). Therefore, the objective of the present investigation was to recognized the impact of integrated use of compost, crop residue and NPK fertilizer either alone or incombination on the percentage of sand, silt and clay in soil.

Materials and Methods

A field experiment was conducted during 1988-89 on eight textured highly calcareous soil at Research farm of Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar. The experimental soil located at 25°59'' north latitude and 85°48'' east longitude with an attitude of 52.92 meter sea mean level. The climate of the experimental area is sub-tropical with a mean annual temperature of 25.3 °C. The experiment was laid out in a split plot design with three replication and plot size was 4.0 m x 2.5 m. four levels of fertilizer *viz.*, No NPK, 50% NPK, 100% NPK and 150% NPKrecommended were applied as treatments in main plot. The main plot was divided into four sub-plots in which treatment *viz.*, no manure, compost @ 10 t ha^{-1}, crop residue and compost plus crop residue

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Table-1 : General properties of initial experimental soil.

Parameter	Value
Sand (%)	46.85
Silt (%)	41.35
Clay (%)	11.80
Bulk density (Mg m^{-3})	1.44
Pore space (%)	48.76
Water holding capacity (%)	31.22
pH (1:2 soil : water)	8.4
Electrical conductivity (dSm^{-1})	0.37
Cation Exchange Capacity [Cmol(P^+)kg^{-1}]	9.82
Free calcium carbonate (%)	34.34
Organic carbon (g kg^{-1})	5.0
Available N (Kg ha^{-1})	23.70
Available P_2O_5 (Kg ha^{-1})	19.90
Available K_2O (Kg ha^{-1})	10.00
Available S (Kg ha^{-1})	10.27
Available Zn (mg kg^{-1})	0.79
Available B (mg kg^{-1})	0.52
Total bacteria (x 10^6 cfu g^{-1})	28
Total fungi (x 10^4 cfu g^{-1})	16
Total actinomycetes (x 10^5 cfu g^{-1})	7

were superimposed over NPK levels. The recommended dose of NPK (120:60:40) were applied to each crop of rice and wheat as urea, single superphosphate and muriate of potash. Half dose of nitrogen and entire dose of P and K were applied at the time of transplanting of rice and sowing of wheat and remaining nitrogen fertilizer was applied in the equal splits at tillering and flower initiation stage. Rice and wheat crop were grown continuously under rice-wheat cropping system. Rice *cv*. Rajshree was 37^{th} and 39^{th} test crop and wheat *cv*. HD2733 as $38^{th}$and 40^{th} test crop during the reported period of 2007-08 and 2008-09. Soil samples from each plot of the field experiment were collected at the harvest of wheat rotation. Soil samples were dried under shade, grinded with wooden hammer and sieved through 2 mm sieve. The texture of soil samples were determined by (10). The general properties of initial experimental soil has been presented in Table-1.

Results and Discussion

Application of inorganic fertilizer or organic manure either alone or incombination has been presented in Table-2. Percentage of sand varies from 58.25% to 60.85% under different treatment combination and maximum sand percentage was recorded under no manure and 100% NPK whereas minimum (58.25%) was recorded in the treatment no manure and no NPK fertilizer. Silt percentage varied from 26.81% to 29.0% under different treatment combination and maximum value 29.0% was recorded under the treatment no manure and no NPK whereas minimum value (26.81%) was recorded in the treatment receiving crop residue and 50% NPK. Similarly, clay percentage varied from 14.07% to 15.37% under. The treatment receiving crop residue and 100% NPK registered maximum value (15.07%) whereas the minimum value (14.07%) was recorded in the treatment no organic manure and no compost. The soil texture is a permanent property of soil and it will not change with the incorporation of organic and inorganic fertilizer. Therefore, the textural class of the soil remains sandy loam during the course of investigation. Similar observation was also reported by (11).

Table-2 : Effect of compost, crop residue and inorganic fertilizer on textural classes of calcareous soil.

Treatments	Sand (%)	Silt (%)	Clay (%)	Textural class
No manure, no NPK	58.25	28	13.75	Sandy loam
No manure and 50% NPK	59.55	26.81	13.64	Sandy loam
No manure and 100% NPK	60.85	26	13.15	Sandy loam
No manure and 150% NPK	58.5	27.41	14.09	Sandy loam
Compost @ 10 t ha^{-1} and no NPK	58.59	26.59	14.82	Sandy loam
Compost @ 10 t ha^{-1} and 50% NPK	59.47	26.48	14.05	Sandy loam
Compost @ 10 t ha^{-1} and 100% NPK	60.35	25.96	13.69	Sandy loam
Compost @ 10 t ha^{-1} and 150% NPK	58.4	28	13.6	Sandy loam
Crop residue + no NPK	60.51	25.92	13.57	Sandy loam
Crop residue + 50% NPK	60.12	25.81	14.07	Sandy loam
Crop residue + 100% NPK	59.67	26.22	14.11	Sandy loam
Crop residue + 150% NPK	59.18	26.99	13.83	Sandy loam
Compost @ 10 t ha^{-1} + crop residue and no NPK	59.03	26.96	14.01	Sandy loam
Compost @ 10 t ha^{-1} + crop residue and 50% NPK	59.85	26.21	13.94	Sandy loam
Compost @ 10 t ha^{-1} + crop residue and 100% NPK	59.96	27.49	12.55	Sandy loam
Compost @ 10 t ha^{-1} + crop residue and 150% NPK	60.26	25.91	13.83	Sandy loam

Conclusions

On the basis of these observations it was concluded that addition of compost, crop residue either alone or in combination with chemical fertilizer has no any remarkable influence on particle size distribution of the experimental soil, and the soil remains as sandy loam soil.

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