



# SOIL PROPERTIES AS INFLUENCED BY BULKY MANURES AND CHEMICAL FERTILIZERS IN FRENCHBEAN

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## Abstract

A potculture experiment was conducted during February, 2014 at the Department of Soil Science and Agricultural Chemistry, Annamalai University, Annamalainagar, Tamilnadu, India; to study the integrated use of bulky manures and chemical fertilizers on black soil properties by growing frenchbean as a test crop. The treatments of the study were  $T_1$ – Control,  $T_2$ – 100% RDF,  $T_3$ – 75% RDF + *Sesbania rostrata* @ 5.0 t ha<sup>-1</sup>,  $T_4$ – 75% RDF + *Azartica indica* @ 5.0 t ha<sup>-1</sup>,  $T_5$ – 75% RDF + FYM @ 5.0 t ha<sup>-1</sup>,  $T_6$ – 75% RDF + MSW @ 5.0 t ha<sup>-1</sup> and  $T_7$ – 75% RDF + Vermicompost @ 5.0 t ha<sup>-1</sup>. The initial and post-harvest soils were analysed for their physico-chemical properties by adopting standard procedures. The results of the experiment indicated that control treatment ( $T_1$ ) recorded the bulk density and porespace of 1.50 Mg m<sup>-3</sup> and 54.4 per cent respectively, whereas application of 75% recommend dose of NPK fertilizers and vermicompost @ 5.0 t ha<sup>-1</sup> ( $T_7$ ) registered the bulk density of 1.36 Mg m<sup>-3</sup> and porespace of 62.5 per cent. The same treatment ( $T_7$ ) recorded the post-harvest soil pH, EC and WHC of 8.40, 0.23 dSm<sup>-1</sup> and 50.0 per cent, respectively.

**Key words** : Soil bulk density, particle density, porespace, pH, EC, WHC and frenchbean.

## Introduction

Green undecomposed material used as manure is called green manure. It is usually perform multiple functions that include soil improvement and soil protection. It acts mainly as soil acidifying matter to decrease the alkalinity by generating humic acid and acetic acid. Green manuring is found to increase the soil organic matter content, water holding capacity, improve soil structure and reduce loss of nutrients particularly nitrogen (Bhattacharya and Mandal, 1997).

*Sesbania rostrata* is a stem and root nodulating green manure crop, short-day plant and sensitive to photoperiod. It improves soil structure, increases water holding capacity and decreases soil loss by erosion. A mixture of dung and urine of farm animals along with litter and left over material from roughages (Farm Yard Manure) is commonly used and most popular bulky manure rich in nutrients and improves soil fertility (Patel *et al.*, 2012). Municipal solid waste (MSW) is a waste from houses, streets and public places, shops, offices, hospitals and improves soil properties. Vermicompost is an organic manure produced by earth worm feeding on biological

waste material. It is an odourless, clean, organic material containing adequate quantities of N, P, K and several micronutrients essential for plant growth. For achieving higher productivity and sustaining soil health, adoption of integrated nutrient management practices is necessary. Frenchbean is a shy nodulation legume, requires fairly large quantity of nitrogenous fertilizers. It is unable to fix atmospheric nitrogen symbiotically, hence respond well to manure and fertilizer application.

## Materials and Methods

To find out the effect of different bulky manures and chemical fertilizers on black soil properties, a potculture experiment was carried out at the Department of Soil Science and Agricultural Chemistry, Annamalai University, Annamalainagar (Tamilnadu), India. Frenchbean was grown with seven treatments replicated three times adopting completely randomized design (CRD). The treatments were  $T_1$ – Control,  $T_2$ – 100% RDF,  $T_3$ – 75% RDF + *Sesbania rostrata* @ 5.0 t ha<sup>-1</sup>,  $T_4$ – 75% RDF + *Azartica indica* @ 5.0 t ha<sup>-1</sup>,  $T_5$ – 75% RDF + FYM @ 5.0 t ha<sup>-1</sup>,  $T_6$ – 75% RDF + MSW @ 5.0 t ha<sup>-1</sup> and  $T_7$ – 75% RDF + Vermicompost @ 5.0 t ha<sup>-1</sup>. The initial soil was analysed for their physico-

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**Table 1 :** Effect of bulky manures and NPK fertilizers on BD, PD and Porespace (%) of the post harvest soil of Frenchbean.

Treatment no.	Treatment details	Physical properties		
		BD	PD	Porespace
T <sub>1</sub>	Control	1.50	2.40	62.5
T <sub>2</sub>	100% RDF	1.40	2.72	51.4
T <sub>3</sub>	75% RDF + <i>Sesbania rostrata</i> @ 5.0 t ha <sup>-1</sup>	1.37	2.51	54.6
T <sub>4</sub>	75% RDF + <i>Azartica indica</i> @ 5.0 t ha <sup>-1</sup>	1.25	2.14	58.4
T <sub>5</sub>	75% RDF + FYM @ 5.0 t ha <sup>-1</sup>	1.46	2.07	69.5
T <sub>6</sub>	75% RDF + MSW @ 5.0 t ha <sup>-1</sup>	1.43	2.22	64.4
T <sub>7</sub>	75% RDF + Vermicompost @ 5.0 t ha <sup>-1</sup>	1.36	2.50	54.4
	S.Ed	0.10	0.08	0.23
	C.D.(p=0.05)	NS	NS	NS

**Table 2 :** Effect of bulky manures and NPK fertilizers on pH, EC and WHC of the post harvest soil of Frenchbean.

Treatment no.	Treatment details	Chemical properties		
		pH	EC (dSm <sup>-1</sup> )	WHC (%)
T <sub>1</sub>	Control	8.67	0.52	45.0
T <sub>2</sub>	100% RDF	8.65	0.46	45.6
T <sub>3</sub>	75% RDF + <i>Sesbania rostrata</i> @ 5.0 t ha <sup>-1</sup>	8.42	0.36	48.1
T <sub>4</sub>	75% RDF + <i>Azartica indica</i> @ 5.0 t ha <sup>-1</sup>	8.46	0.42	46.8
T <sub>5</sub>	75% RDF + FYM @ 5.0 t ha <sup>-1</sup>	8.58	0.41	47.2
T <sub>6</sub>	75% RDF + MSW @ 5.0 t ha <sup>-1</sup>	8.51	0.27	48.5
T <sub>7</sub>	75% RDF + Vermicompost @ 5.0 t ha <sup>-1</sup>	8.40	0.23	50.0
	S.Ed	0.07	0.03	2.91
	C.D. (p=0.05)	NS	0.06	NS

chemical properties by adopting standard procedures. After harvesting of frenchbean, post harvest soil samples from various treatments in each replication were also collected. The samples were air dried in shade, powdered with wooden mallet, passed through 2 mm sieve and chemically analyzed for their BD, PD, porespace, pH, EC & WHC. The soil analytical data was subjected to statistical scrutiny by the procedure outlined by Gomez and Gomez (1984).

## Results and Discussion

The results of the initial and post-harvest soil properties in a pot experiment with frenchbean were given hereunder. Before application of manures and fertilizers an initial soil was analysed for their pH, EC and OC were 8.6, 0.31 dSm<sup>-1</sup> and 5.2 g kg<sup>-1</sup>, respectively. The soil used in this experiment belongs to black soil, clay loam in

texture, Kondal series, Vertisols in order with the taxonomic classification of *Typic Haplusterts*.

### 1. Physical properties of post-harvest soil of Frenchbean

Perusal of the data indicated that there was no significant influence in bulk density by treatments. Control (T<sub>1</sub>) recorded the bulk density of 1.50 Mg m<sup>-3</sup>, whereas application of 75% recommend dose of NPK fertilizers and vermicompost @ 5.0 t ha<sup>-1</sup> (T<sub>7</sub>) registered the bulk density of 1.36 Mg m<sup>-3</sup>.

Highest particle density of 2.72 Mg m<sup>-3</sup> was recorded with the application of 100% RDF (T<sub>2</sub>). It might be due to higher application of inorganic fertilizers, which deteriorates soil structure. Whereas, low particle density of 2.07 Mg<sup>-3</sup> was recorded with 75% recommend dose of NPK fertilizers and FYM @ 5.0 t ha<sup>-1</sup> (T<sub>5</sub>). It might

be due to high organic carbon content resulting in soil aggregation.

It was found that there was no significant increase in soil pore space due to various treatments. The treatment which received 75% recommend dose of NPK fertilizers and Vermicompost @ 5.0 t ha<sup>-1</sup> (T<sub>7</sub>) recorded soil pore space (54.4%) and the control registered the lowest value (62.50 %). These findings are in conformity with the results of Kumar *et al.* (2004).

## 2. Chemical properties of post-harvest soil of Frenchbean

The data on post harvest soil pH, EC and WHC are given in table 2. All the treatments non significantly influenced soil pH, EC and WHC. Among the treatments, control registered the highest soil pH of 8.67 (T<sub>1</sub>) and lowest soil pH of 8.40 recorded in the treatment (T<sub>7</sub>), which was received inorganic fertilizers (75% RDF) + Vermicompost @ 5.0 t ha<sup>-1</sup>. The electrical conductivity values of the post harvest soil after harvest of frenchbean under various treatments varied from 0.23 to 0.52. The soil incorporated with 75% RDF + vermicompost @ 5.0 t ha<sup>-1</sup> recorded the highest WHC (50.0) (T<sub>7</sub>). This was due to the release of organic acids during microbial decomposition of vermicompost and increased enzymatic activity in soil. This could be attributed to addition of vermicompost and also due to better root growth and their subsequent decomposition and their influence on

physico-chemical characteristics of the soil (Shakuntala *et al.*, 2012).

Based on the results of the pot experiment, it is concluded that soil application of 75% RDF + Vermicompost @ 5.0 t ha<sup>-1</sup> may be recommended as an effective package of practice to boost yield of French bean with sustaining soil health.

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