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**Vanlalmuanpuia Fanai**
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

**RK Kumarjit Singh**
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

**N Surbala Devi**
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

**Correspondence**
**N Surbala Devi**
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

# Effect of organic manures on macronutrient concentration and dry matter yield of chickpea

**Vanlalmuanpuia Fanai, RK Kumarjit Singh and N Surbala Devi**

**Abstract**
A pot experiment was conducted to study the effect of organic manures (*viz.*, FYM, compost, nitrogen enriched compost, phosphorus enriched compost and vermicompost) applied @ 5, 10 and 15 t $ha^{-1}$ on nitrogen, phosphorus and potassium concentration as well as dry matter yield of chickpea (JG-16) grown in a Typic Haploumbrepts soil. Results revealed that comparing among the organic manures applied at different doses no significant effect on nitrogen, phosphorus and potassium content of chickpea was observed during the whole crop growth stage. Nutrient concentration and dry matter yield of chickpea grown in soils amended with organic manures were significantly higher than control at harvest. Comparing among the different organic sources, application of nitrogen enriched compost @ 15 t $ha^{-1}$ resulted higher dry matter yield which was at par with the vermicompost applied at the same dose. Agronomic effectiveness of organic manures was more when applied at higher dose.

**Keywords:** Organic manure, nutrient concentration, dry matter yield, chickpea

## 1. Introduction
In India, chickpea ranks first in terms of area and production among pulse crops. India is the largest chickpea producer as well as consumer in the world. The area under chickpea cultivation is about 9.92 mha and the yield of chickpea in India is about 9.95 t $ha^{-1}$ (FAO, 2014) [14]. Though cultivated area of chickpea occupies an area to a great extent, its productivity is low as compared to its potential yield in the experimental station (Kumar, 1997) [20]. Imbalanced nutrition is an important factor affecting the yield of Bengal gram to a great extent. Use of high analysis chemical fertilizers in imbalanced and indiscriminate manner had developed many problems like decline of soil organic matter, increase in salinity, sodicity, soil pollutant and hazards of pests and diseases (Chakraborti and Singh, 2004) [9]. Balanced use of nutrients through organic sources like farm yard manure, poultry manure, vermicompost, green manuring, neem cake and biofertilizers, are prerequisites for sustaining soil fertility and producing maximal crop yields with optimal input levels (Dahiphale *et al*, 2003) [10].
Besides providing plant nutrients, organic manures improve the structure of the soil and enhance the activities of beneficial soil microbes. Organic manures influence soil productivity through their effect on soil physical, chemical and biological properties (Watson *et al*., 2002) [38]. Organic manures help to maximize soil organic matter, minimize the soil temperature and develop favourable soil structure meanwhile releasing nutrients to the soil in small quantity. The release pattern of nutrients differs with the type of organic manures. The whole nutrient content may not be readily available to the crops when applied to soil. So, it is important to know which type of organic manures contain more available nutrients, along with their release patterns for higher crop productivity. Organic fertilizer applied at varying rates have significant effect on the N, P, and K content of crops (Babu and Seshaiah, 2006; Vimala *et al.*, 2006; Azarmi *et al.*, 2008; Davari *et al.*, 2012; Bairwa and Yadav, 2017) [3, 36, 2, 11, 5]. Organic manures modify the soil physical behaviour and increase the efficiency of applied nutrients (Pandey *et al.* 2007) [25]. Organic manures hold a great promise due to their local availability and ability to improve soil characteristics. Cheap sources of plant nutrients like organic manures can replace organic fertilizers under dryland and rainfed conditions (Badanur *et al.*, 1990) [4].
Uptake of nutrients is enhanced when crops are amended with organic manures (Khankhane and Yadav, 2003; Rajkhowa *et al.*, 2003) [19, 27]. Organic amendments increase the concentration of nutrients and can be seen to enhance the nutritional value and nutrient balance of plant foods (Graham *et al.*, 2000; Beaulah *et al.* 2002) [15, 6].

Chemical fertilizers and manures are very costly, thus efficient nutrient management not only help in increasing the present agricultural production level but also sustain the production and protect the environment from different types of hazards occurring due to mismanagement of costly fertilizers. The application of chemical fertilizers with organic sources resulted in increased N, P, and K concentration as well as uptake by chickpea (Naidu *et al.*, 2008; Mohammadi *et al.*, 2010; Singh and Sharma, 2011; Deshpande *et al.*, 2015) [24, 23, 33, 13]. The soil application of organic manures significantly enhanced the growth and yield parameters of crops (Reddy *et al.*, 2008; Patil *et al.*, 2012; Singh *et al.*, 2012) [28, 26, 32]. Jat and Ahlawat (2006); Shah and Kumar (2014); Sahu *et al.*, (2015) [17, 31, 29] revealed that the integrated use of organic and inorganic sources resulted in an increased dry matter accumulation. Keeping the above points in view the present investigation was undertaken to study the effect of organic manures on nitrogen, phosphorus and potassium concentration as well as dry matter yield of chickpea.

## 2. Materials and Methods

Composite soil samples (0 - 15 cm depth) were collected from the Central Agricultural University Research farm, Andro, Imphal East, Manipur, India following the standard procedure as described by Jackson (1973) [16]. The soil belongs to Typic Haploumbrepts having the general characteristic presented in Table 3. The composite soil samples were air dried at room temperature in shade and passed through a 2 mm sieve.

Five organic manures *viz*., FYM, compost, nitrogen enriched compost, phosphorus enriched compost and vermicompost were prepared by using paddy straw as raw material (Table 1). For preparing FYM, mixture of 4-5 cm long cut urine-soaked paddy straw and cow dung slurry was put in the box, plastered with mud and left for 135 days. 4 kg of partially decomposed cut paddy straw were placed layer by layer with cow dung slurry alternately in a thermocol box and vermiworm was added @ 4-5 matured worm kg$^{-1}$ substrate for vermicompost preparation. Same process was followed without vermiworm for making compost. For preparing N-enriched compost urea was added @ 20g kg$^{-1}$ raw material. P-enriched compost was prepared by adding rock phosphate @ 20g kg$^{-1}$ raw material. Turning was done at 15 days interval. Compost, vermicompost, N-enriched compost and P-enriched compost were fully matured at 110 days.

**Table 1:** Chemical composition of the organic manures used in the experiment

| Organic manures | Total N (%) | Total P (%) | Total K (%) |
|---|---|---|---|
| FYM | 0.56 | 0.25 | 0.61 |
| Compost | 0.85 | 0.31 | 0.78 |
| Nitrogen enriched compost | 1.55 | 0.34 | 0.82 |
| Phosphorus enriched compost | 0.85 | 0.59 | 0.92 |
| Vermicompost | 1.22 | 0.50 | 1.38 |

Four kg soils were filled in 306 plastic pots. Recommended dose of fertilizer @ 20:40:20 kg NPK were applied as basal in the form of urea, DAP and MOP. The organic manures (@ 5, 10 and 15 t ha$^{-1}$) and fertilizers were mixed properly to the soil one week before sowing seed (Table 2). Five seeds were sown in each pot and thinned out after 15 days of germination maintaining 3 plants per pot. The whole plants were uprooted on 20$^{th}$, 40$^{th}$, 60$^{th}$, 80$^{th}$ days after sowing and at harvest by destructive sampling to estimate nutrient concentration and dry matter yield. The experiment was carried out under RBD and consisted of 17 treatments with 3 replications.

**Table 2:** Details of the treatments

| Notation | Treatment | Equivalent weight per pot |
|---|---|---|
| $T_1$ | Control | Nil |
| $T_2$ | RDF (Recommended dose of fertilizer) [20:40:20 NPK] | 0.017g urea, 0.154g DAP, 0.059g MOP |
| $T_3$ | 5 t ha$^{-1}$ FYM (Farm Yard Manure) | 8.93g |
| $T_4$ | 5 t ha$^{-1}$ C (Compost) | 8.93g |
| $T_5$ | 5 t ha$^{-1}$ NEC (Nitrogen enriched compost) | 8.93g |
| $T_6$ | 5 t ha$^{-1}$ PEC (Phosphorus enriched compost) | 8.93g |
| $T_7$ | 5 t ha$^{-1}$ VC (Vermicompost) | 8.93g |
| $T_8$ | 10 t ha$^{-1}$ FYM | 17.86g |
| $T_9$ | 10 t ha$^{-1}$ C | 17.86g |
| $T_{10}$ | 10 t ha$^{-1}$ NEC | 17.86g |
| $T_{11}$ | 10 t ha$^{-1}$ PEC | 17.86g |
| $T_{12}$ | 10 t ha$^{-1}$ VC | 17.86g |
| $T_{13}$ | 15 t ha$^{-1}$ FYM | 26.79g |
| $T_{14}$ | 15 t ha$^{-1}$ C | 26.79g |
| $T_{15}$ | 15 t ha$^{-1}$ NEC | 26.79g |
| $T_{16}$ | 15 t ha$^{-1}$ PEC | 26.79g |
| $T_{17}$ | 15 t ha$^{-1}$ VC | 26.79g |

Soil parameters like soil texture (hydrometer method), pH (1:2.5 soil: water suspension using glass electrode systronic pH meter), EC (1:2.5 soil: water suspension using systronic direct reading conductivity meter) and available K (flame photometer) were analysed as described by Jackson (1973) [16]. Organic carbon (Walkley and Black`s rapid titration method), Cation exchange capacity (leaching with 1N $NH_4OAc$), available N (alkaline potassium permanganate) and P were determined following the standard procedures of Walkley and Black (1934) [37], Borah *et. al.*, (1987) [7], Subbiah and Asija (1956) [34] and Bray and Kurtz No.1 (1945) [8], respectively. Plant total nitrogen content was estimated using the Modified Microkjeldahl method as described by Jackson (1973) [16]. Di-acid ($HNO_3$: $HClO_4$) extracts of plant samples were subjected to analysis of P using the Vanadomolybdo Phosphoric Acid Yellow colour (ammonium molybdate + ammonium metavanadate) method as described by Jackson (1973) [16]. Total potassium was determined flame photometrically after extraction from the plant with di-acid ($HNO_3$: $HClO_4$) as described by Jackson (1973) [16].

**Table 3:** General characteristics of the soil used in the experiment

| Parameters | Results |
|---|---|
| Textural class | Clay |
| Sand (%) | 5.78 |
| Silt (%) | 22.56 |
| Clay (%) | 72.79 |
| pH (1:2.5 soil: water ratio) | 5.26 |
| EC (1:2.5 soil: water ratio; $dsm^{-1}$) | 0.15 |
| CEC [cmol ($p^+$) $kg^{-1}$] | 9.40 |
| Organic carbon (%) | 1.53 |
| Available nitrogen (kg $ha^{-1}$) | 238.34 |
| Available phosphorus (kg $ha^{-1}$) | 15.44 |
| Available potassium (kg $ha^{-1}$) | 355.71 |

## 3. Results and Discussion

### 3.1 Effect of organic manures on total nitrogen content in chickpea

Data on total nitrogen concentration in chickpea are presented in Table 4. Result from the observation revealed that irrespective of different treatments the amount of total nitrogen concentration in plant increased up to 40$^{th}$ day after sowing and then gradually decreased till harvest. The application of organic manures at different doses had no significant effect on the total nitrogen content of chickpea at different stages of crop growth. The organic manure applied at 10 t $ha^{-1}$ and 15 t $ha^{-1}$ had significant effect on the total nitrogen content of chickpea as compared to control on 60$^{th}$ and 80$^{th}$ day.

At harvest, irrespective of dose, the application of manures significantly enhanced plant nitrogen concentration over control. Similar reports on increased plant nitrogen content due to organic manure application are also presented by (Arancon *et al.*, 2003; Khadija *et al.*, 2004; Defline *et al.*, 2005; Vimala *et al.*,2006; Sultana *et al.*, 2015; Mohajerani *et al.*, 2016; Bairwa and Yadav, 2017) [1, 18, 12, 36, 35, 22, 5]. At harvest, comparing the soil amended with organic manures, the highest nitrogen content was recorded in $T_{15}$ (2.48 %) which is at par with $T_{12}$ (2.46 %) and the lowest was in $T_{14}$ (2.33 %) and $T_{16}$ (2.38 %).

**Table 4:** Effect of organic manures on total nitrogen content (%) in chickpea

| Treatments | Days after sowing seeds | | | | |
|---|---|---|---|---|---|
| | 20 | 40 | 60 | 80 | Harvest |
| $T_1$ | 1.30 | 2.91 | 2.59 | 2.33 | 2.24 |
| $T_2$ | 1.47 | 3.20 | 2.95 | 2.52 | 2.41 |
| $T_3$ | 1.36 | 2.98 | 2.68 | 2.49 | 2.38 |
| $T_4$ | 1.39 | 2.99 | 2.69 | 2.51 | 2.35 |
| $T_5$ | 1.38 | 3.18 | 2.88 | 2.52 | 2.44 |
| $T_6$ | 1.44 | 3.13 | 2.76 | 2.41 | 2.33 |
| $T_7$ | 1.38 | 3.06 | 2.77 | 2.49 | 2.41 |
| $T_8$ | 1.39 | 3.10 | 2.73 | 2.52 | 2.38 |
| $T_9$ | 1.33 | 2.99 | 2.84 | 2.49 | 2.38 |
| $T_{10}$ | 1.39 | 3.20 | 2.87 | 2.51 | 2.41 |
| $T_{11}$ | 1.38 | 2.93 | 2.84 | 2.48 | 2.37 |
| $T_{12}$ | 1.43 | 3.20 | 2.93 | 2.57 | 2.46 |
| $T_{13}$ | 1.35 | 2.96 | 2.79 | 2.48 | 2.37 |
| $T_{14}$ | 1.38 | 3.01 | 2.80 | 2.49 | 2.33 |
| $T_{15}$ | 1.41 | 3.20 | 2.98 | 2.54 | 2.48 |
| $T_{16}$ | 1.44 | 3.07 | 2.84 | 2.55 | 2.38 |
| $T_{17}$ | 1.39 | 3.15 | 2.95 | 2.55 | 2.44 |
| S.E.d(±) | 0.07 | 0.05 | 0.07 | 0.05 | 0.03 |
| $CD_{0.05}$ | NS | 0.11 | 0.14 | 0.11 | 0.05 |

### 3.2 Effect of organic manures on total phosphorus content in chickpea

Data pertaining to total phosphorus concentration in chickpea are presented in Table 5. Results revealed that the amount of total phosphorus concentration in plant increased up to 40$^{th}$ day after sowing seeds and then gradually declined till harvest. Exhibition of P decline with crop age was also reported by Setia and Sharma (2007) [30].

Comparing among the organic manures applied at different doses no significant effect on the total phosphorus content of chickpea was observed during the whole crop growth stage. However, the organic manure application to soil had significant effect on the total phosphorus content of chickpea as compared to control only at 80$^{th}$ day and at harvest. Report on effectiveness of organic manures in promoting plant phosphorus accumulation were given earlier by Babu and Seshaiah (2006) [3], Lungmuana *et al.* (2013) [21], Sultana *et al.* (2015) [35], Bairwa and Yadav (2017) [5]. At harvest, the highest phosphorus content was recorded in $T_{16}$ (0.39 %) which is at par with $T_{11}$ (0.37 %) and the lowest was in $T_4$ (0.32 %).

**Table 5:** Effect of organic manures on total phosphorus content (%) in chickpea

| Treatment | Days after sowing seeds | | | | |
|---|---|---|---|---|---|
| | 20 | 40 | 60 | 80 | Harvest |
| $T_1$ | 0.32 | 0.40 | 0.37 | 0.32 | 0.29 |
| $T_2$ | 0.35 | 0.44 | 0.41 | 0.39 | 0.35 |
| $T_3$ | 0.33 | 0.42 | 0.39 | 0.36 | 0.33 |
| $T_4$ | 0.33 | 0.42 | 0.39 | 0.36 | 0.32 |
| $T_5$ | 0.33 | 0.45 | 0.43 | 0.40 | 0.35 |
| $T_6$ | 0.34 | 0.45 | 0.43 | 0.39 | 0.36 |
| $T_7$ | 0.33 | 0.45 | 0.43 | 0.40 | 0.34 |
| $T_8$ | 0.34 | 0.43 | 0.40 | 0.37 | 0.35 |
| $T_9$ | 0.33 | 0.42 | 0.39 | 0.36 | 0.34 |
| $T_{10}$ | 0.33 | 0.45 | 0.43 | 0.39 | 0.35 |
| $T_{11}$ | 0.35 | 0.45 | 0.42 | 0.39 | 0.37 |
| $T_{12}$ | 0.34 | 0.45 | 0.42 | 0.39 | 0.35 |
| $T_{13}$ | 0.34 | 0.44 | 0.42 | 0.38 | 0.35 |
| $T_{14}$ | 0.33 | 0.43 | 0.40 | 0.37 | 0.33 |
| $T_{15}$ | 0.34 | 0.45 | 0.43 | 0.40 | 0.34 |
| $T_{16}$ | 0.35 | 0.45 | 0.43 | 0.39 | 0.39 |
| $T_{17}$ | 0.34 | 0.45 | 0.42 | 0.39 | 0.36 |
| S.E.d(±) | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |
| $CD_{0.05}$ | 0.03 | 0.02 | 0.02 | 0.03 | 0.03 |

### 3.3 Effect of organic manures on total potassium content in chickpea

The data related to total potassium concentration in chickpea are presented in Table 6. Irrespective of different treatments the amount of total potassium concentration in plant increased up to 40$^{th}$ day after sowing seeds followed by a decline till harvest.

Detailed study revealed that comparing with the untreated control, significantly higher total potassium concentration was observed in soil treated with organic manures at different stage of crop growth excepting 40$^{th}$ day after sowing This showed that addition of organic matter improved crop growth which explained the increase in the potassium concentration (Mohammadi *et al.*, 2010; Bairwa and Yadav, 2017) [23, 5]. Irrespective of different doses of treatments, no significant influence on the total potassium content of chickpea was observed in soil treated with different organic sources during the whole growth stage. At harvest, from the soil amended with organic manures, the highest potassium content was recorded in $T_{12}$ (1.38 %) which is at par with $T_{15}$ (1.37 %) and the lowest was in $T_4$ (1.32 %).

**Table 6:** Effect of organic manures on total potassium content (%) in chickpea

| Treatment | Days after sowing seeds | | | | |
|---|---|---|---|---|---|
| | 20 | 30 | 60 | 80 | Harvest |
| $T_1$ | 1.29 | 1.61 | 1.45 | 1.33 | 1.28 |
| $T_2$ | 1.39 | 1.98 | 1.62 | 1.49 | 1.37 |
| $T_3$ | 1.35 | 1.63 | 1.52 | 1.42 | 1.33 |
| $T_4$ | 1.34 | 1.66 | 1.53 | 1.44 | 1.32 |
| $T_5$ | 1.35 | 1.67 | 1.54 | 1.43 | 1.35 |
| $T_6$ | 1.36 | 1.64 | 1.53 | 1.42 | 1.34 |
| $T_7$ | 1.38 | 1.67 | 1.56 | 1.44 | 1.36 |
| $T_8$ | 1.36 | 1.70 | 1.54 | 1.44 | 1.34 |
| $T_9$ | 1.36 | 1.67 | 1.53 | 1.43 | 1.33 |
| $T_{10}$ | 1.36 | 1.66 | 1.53 | 1.44 | 1.34 |
| $T_{11}$ | 1.37 | 1.65 | 1.52 | 1.43 | 1.36 |
| $T_{12}$ | 1.36 | 1.63 | 1.55 | 1.44 | 1.38 |
| $T_{13}$ | 1.36 | 1.68 | 1.54 | 1.43 | 1.35 |
| $T_{14}$ | 1.37 | 1.62 | 1.53 | 1.42 | 1.33 |
| $T_{15}$ | 1.38 | 1.66 | 1.54 | 1.44 | 1.37 |
| $T_{16}$ | 1.38 | 1.67 | 1.56 | 1.44 | 1.34 |
| $T_{17}$ | 1.38 | 1.68 | 1.56 | 1.45 | 1.36 |
| S.E.d(±) | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 |
| $CD_{0.05}$ | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 |

### 3.4 Effect of organic manure application on dry matter yield of chickpea

The data on dry matter yield of chickpea are presented in Table 7. Result revealed that the application of different doses of organic manures increased the dry matter yield of chickpea up to 80$^{th}$ day and then decreased at harvest. It was also observed that the dry matter yield of chickpea grown in soils amended with organic manures was significantly higher than control on 60$^{th}$, 80$^{th}$ day and at harvest. However, on 30$^{th}$ day, dry matter yield of the crop grown in soil applied with 15 t ha$^{-1}$ of organic manures was significantly higher over control. Enhanced agronomic effectiveness of organic manures was reflected by increased dry matter yield (Arancon *et al.*, 2003; Khadija *et al.*, 2004; Defline *et al.*, 2005; Patil *et al.*, 2012; Shah and Kumar, 2014; Sahu *et al.*, 2015; Mohajerani *et al.*, 2016) [1, 18, 12, 26, 31, 29, 22]. Reports on improvement of dry matter accumulation with organic manure application were given by Jat and Ahlawat (2006) [17]. Comparing among the three doses of organic manures, the highest dry matter yield of chickpea was observed in soils treated with 15 t ha$^{-1}$ followed by 10 t ha$^{-1}$ and 5 t ha$^{-1}$. The increase in dry matter yield with increase in levels of applied organic manures could be due to the increase in readily available nutrients released from the organic sources (Deshpande *et al.*, 2015; Patil *et al.*, 2012) [13, 26].

Further study pointed out that there was no significant difference of dry matter yield among the crops grown in the soil applied with the same level of manures. At harvest, the highest dry matter yield was observed in soil treated with $T_{15}$ (4806.67 mg pot$^{-1}$) which is at par with $T_{17}$ (4756.67 mg pot$^{-1}$) and the lowest in $T_3$ (4506.67 mg pot$^{-1}$).

**Table 7:** Effect of organic manures on dry matter yield (mg pot$^{-1}$) of chickpea

| Treatments | Days after sowing seeds | | | | |
|---|---|---|---|---|---|
| | 20 | 30 | 60 | 80 | Harvest |
| $T_1$ | 483.33 | 1583.33 | 3056.67 | 5256.67 | 4330.00 |
| $T_2$ | 573.33 | 1626.67 | 3296.67 | 5353.33 | 4423.33 |
| $T_3$ | 573.33 | 1620.00 | 3390.00 | 5513.33 | 4506.67 |
| $T_4$ | 543.33 | 1633.33 | 3363.33 | 5590.00 | 4543.33 |
| $T_5$ | 563.33 | 1616.67 | 3483.33 | 5636.67 | 4640.00 |
| $T_6$ | 556.67 | 1600.00 | 3353.33 | 5556.67 | 4556.67 |
| $T_7$ | 583.33 | 1630.00 | 3486.67 | 5586.67 | 4590.00 |
| $T_8$ | 566.67 | 1650.00 | 3530.00 | 5640.00 | 4653.33 |
| $T_9$ | 553.33 | 1670.00 | 3520.00 | 5620.00 | 4673.33 |
| $T_{10}$ | 563.33 | 1640.00 | 3596.67 | 5710.00 | 4683.33 |
| $T_{11}$ | 563.33 | 1696.67 | 3563.33 | 5670.00 | 4603.33 |
| $T_{12}$ | 560.00 | 1670.00 | 3590.00 | 5670.00 | 4693.33 |
| $T_{13}$ | 580.00 | 1830.00 | 3663.33 | 5796.67 | 4723.33 |
| $T_{14}$ | 573.33 | 1836.67 | 3626.67 | 5743.33 | 4710.00 |
| $T_{15}$ | 566.67 | 1910.00 | 3763.33 | 5833.33 | 4806.67 |
| $T_{16}$ | 570.00 | 1873.33 | 3686.67 | 5750.00 | 4720.00 |
| $T_{17}$ | 576.67 | 1886.67 | 3760.00 | 5810.00 | 4756.67 |
| S.E.d(±) | 76.10 | 84.53 | 82.13 | 100.17 | 68.23 |
| $CD_{0.05}$ | NS | 173.03 | 168.11 | 205.05 | 139.66 |

## 4. Conclusion

Result revealed that the application of organic manures at different doses had no significant effect on the nitrogen, phosphorus and potassium content of chickpea at different stages of crop growth. Organic manure addition enhanced the macronutrient concentration and dry matter yield as compared to plants grown in control. There was no significant difference of dry matter yield among the crops grown in the soil applied with the same level of manures. Agronomic efficiency of organic manures is more at higher dose application.

## 5. References


1. Arancon NQ, Lee S, Edwards CA, Atiyeh R. Effects of humic acids derived from cattle, food and paper-waste vermicomposts on growth of greenhouse plants. Pedobiologia. 2003; 47:741-744.
2. Azarmi R, Giglou MT, Taleshmikail RD. Influence of vermicompost on soil chemical and physical properties in tomato (*Lycopersicum esculentum*) field. African Journal of Biotechnology. 2008; 7(14):2397-2401.

3. Babu GK, Seshaiah BV. Effects of phosphates on yield and nutrient uptake in paddy. Agropedology. 2006; 16(1):50-53.
4. Badanur VP, Poleshi CM, Naik BK. Effect of organic matter on crop yield, physical and chemical properties of a Vertisol. Journal of the Indian Society of Soil Science. 1990; 38:429-430.
5. Bairwa S, Yadav PK. Influence of FYM, inorganic fertilizers and micronutrients on soil nutrient status and plant nutrient contents and their uptake by African marigold (*Tagetes erecta* Linn.). International Journal of Current Microbiological and Applied Sciences. 2017. 6(6):1362-1370.
6. Beaulah A, Vadivel E, Rajadirai KR. Studies on the effect of organic manures and inorganic fertilizers on the quality parameters of Moringa (*Moringa oleifera* Lam) cv. PKM1. In: Abstracts of the UGC Sponsored, National Seminar on Emerging Trends in Horticulture, Department of Horticulture, Annamalai University, Annamalai Nagar, Tamil Nadu, 2002, 127-128.
7. Borah DK, Bordoloi PK, Karmakar RM, Baruah NG, Das. Practical Manual for Fundamental of soil Science (Part-III). Jorhat, Assam, 1987.
8. Bray RH and Kurtz LT. Determination of total, organic and available forms of phosphorus in soils. Soil Science. 1945; 59:39-45.
9. Chakarborti M, Singh NP. Bio-compost: a novel input to organic farming. Agrobios Newsletter. 2004; 2(8):14-15.
10. Dahiphale AV, Giri DG, Thakre GV, Gin MD. Effect of integrated nutrient management on yield and yield contributing parameters of the scented rice. Annals of Plant Physiology. 2003; 17:24-26.
11. Davari MR, Sharma SN, Mirzakhani M. The effect of combinations of organic materials and biofertilizers on productivity, grain quality, nutrient uptake and economics in organic farming of wheat. Journal of Organic System. 2012; 7(2):26-35.
12. Defline S, Tognetti R, Desiderio E, Alvino A. Effect of foliar application of N and humic acids on growth and yield of durum wheat. Agronomy for Sustainable Development. 2005; 25:183-191.
13. Deshpande AN, Dalavi SS, Pandey SH, Bhalerao VP, Gosavi AB. Effect of rock phosphate along with organic manures on soil properties, yield and nutrient by wheat and chickpea. Journal of the Indian Society of Soil Science. 2015; 63(1):93-99.
14. Food and Agriculture Organization (FAO) of the United Nations. Agricultural production year book. Regional office for Asia and the Pacific, Bangkok, 2014.
15. Graham RD, Humphrius JM, Kitchen JL. More enhanced cereals: a sustainable foundation for diet. Asia Pacific Journal of Clinical Nutrition. 2000; 9:9.
16. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd., New Delhi, 1973.
17. Jat RS, Ahlawat IPS. Direct and residual effect of vermicomposting, biofertilizers and phosphorus on soil nutrient dynamics and productivity of chickpea-fodder maize sequence. Journal of Sustainable Agriculture. 2006; 27:41-54.
18. Khadija B, Said F, Abderrahmane L, Ahmed N, Naaila O, Ciavatta C. Nitrogen fertilizer value of sewage sludge co-composts. Agronomie. 2004; 24(8):487-492.
19. Khankhane PJ, Yadav BR. Comparative manurial performance of FYM, biogas slurry and sewage sludge. Annals of Agricultural Research, New Series. 2003; 24(1):148-150.
20. Kumar J. Missed opportunities. In: The Hindu Survey of Indian Agriculture. 1997; 49-53.
21. Lungmuana, Ghosh M and Patra PK. Effect of integrated nutrient management on available phosphorus influencing grain and straw yield of rice (cv. IR-36) in an Alfisol. Journal of crop and weed. 2013; 9(1):89-93.
22. Mohajerani S, Fazel MA, Madani H, Lak S, Modhej A. Effect of the foliar application of humic acid on red bean cutivars (*Phaseolus vulgaris* L.). Journal of Experimental Biology and Agricultural Sciences. 2016; 4(5):519-524.
23. Mohammadi K, Ghalavand A, Aghaalikhani M. Effect of organic matter and biofertilizers on chickpea quality and biological nitrogen fixation. International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering, 2010, 4(8).
24. Naidu DK, Radder BM, Patil PL, Hebsur NS, Alagundagi SC. Effect of integrated nutrient management on nutrient uptake and residual fertility of chilli (cv. *Byadgi dabbi*) in a vertisol. Karnataka Journal of Agricultural Sciences. 2008; 22(2):306-309.
25. Pandey N, Verma AK, Anurag, Tripathi RS. Integrated nutrient management in transplanted hybrid rice (*Oryza sativa* L.). Indian Journal of Agronomy. 2007; 52(1):40-42.
26. Patil SV, Halikatti SI, Hiremath SM, Babalad HB, Sreenivasa MN, Hebsur NS, *et al*. Effect of organics on growth and yield of chickpea (*Cicer arietinum* L.) in vertisols. Karnataka Journal of Agricultural Sciences. 2012; 25(3):326-331.
27. Rajkhowa DJ, Saikia M, Rajkhowa KM. Effect of vermicompost and levels of fertilizer on green gram. Legume Research. 2003; 26(1):63-65.
28. Reddy KR, Khaleel R, Overcash MR. Nitrogen, phosphorus and carbon transformations in a coastal plain soil treated with animal manures. Agricultural Wastes. 1980; 2:225.
29. Sahu YK, Chaubey AK, Mishra VN, Rajput AS, Bajpai RK. Effect of integrated nutrient management on growth and yield of rice (*Oryza sativa* L.) in Inceptisol. Plant Archives. 2015; 15(2):983-986.
30. Setia RK and Sharma KN. Dynamics of forms of inorganic phosphorus during wheat growth in a continuous maize-wheat cropping system. Journal of the Indian Society of Soil Science. 2007; 55:139-146.
31. Shah RA and Kumar S. Effect of integrated nutrient management on vegetative growth and yield of transplanted hybrid rice (*Oryza sativa* L.) crop. International Journal of Agriculture and Crop Sciences. 2014; 7(11):863-869.
32. Singh G, Sekhon HS, Kaur H. Effect of farm yard manure, vermicompost and chemical nutrients on growth and yield of chickpea (*Cicer arietinum* L.). International Journal of Agricultural Research. 2012; 7(2):93-99.
33. Singh YP, Sharma A. Effect of sources of phosphorus and microbial inoculation on productivity, nutrient availability in soil and uptake of nutrients by chickpea (*Cicer arietinum*) grown on sandy loam soil. Indian Journal of Agricultural Sciences. 2011; 81(9):834-837.
34. Subbiah BV, Asija GL. A rapid procedure for estimation of available N in soils. Current Sciences. 1956; 25:259-260.
35. Sultana MS, Rahman MH, Rahman MS, Sultana S, Paul AK. Effect of integrated use of vermicompost, pressmud

and urea on the nutrient content of grain and straw of rice (Hybrid Dhan Hira 2). International Journal of Scientific and Research Publications. 2015; 5(11):2250-3153.
36. Vimala P, Illias MK, Salbiah H. Effect of rates of organic fertilizer on growth, yield and nutrient content of cabbage (*Brassica oleraceae* var. Capitata) grown under shelter. Acta-Horticulturae. 2006; 7(10):391-397.
37. Walkey A, Black IA. An examination of the Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil Sciences. 1934; 37:29-38.
38. Watson CA, Atkinson D, Gosling P, Jackson LR, Rayns FW. Managing soil fertility in organic farming systems. Soil Use and Management. 2002; 18:239-247.