

## Effect of sources of phosphorus on growth, yield, and nutrient uptake in pea (*Pisum sativum*)

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Pea (*Pisum sativum*) is the important pulse crop of India. In addition to its use as food for human and livestock, pea plays a critical role in nitrogen fixation. The yield of pea is poor mainly because of traditional way of cultivation. The yield may be proved through a change in culture practice. Phosphorus has also has an enhancing impact on plant growth and biological yield through its importance as energy storage and transfer necessary for metabolic processes. The effectiveness of different sources of phosphorus can be increased by several means. Enriching organic manure with rockphosphate is one of them. Among the sources available organic manures, vermicompost is a potential source due to the presence of readily available plant nutrients, growth enhancing substances and number of beneficial microorganisms like nitrogen fixing, phosphorus solubilising and cellulose decomposing organisms. Earthworm casts of *Eudrillus eugeniae* were rich in rockphosphate solubilising microbes and had high rockphosphate solubilising capacity. Thus, a field experiment was carried out to evaluate the effect of vermicompost enriched with rock phosphate on growth and yield of pea.

The investigation was carried out in a village Kargwan Rath Hamirpur (U.P.) on farmer field during rabi season 2013-2014. The soil of the experimental site was silt loam in texture having  $P^H$  7.6, electrical conductivity  $0.4 \text{ dSm}^{-1}$ , available N  $136.3 \text{ kg ha}^{-1}$ , available  $P_2O_5$   $26.4 \text{ kg ha}^{-1}$ , and available  $K_2O$   $205 \text{ kg ha}^{-1}$ . The experiment was laid out in a randomised block design with eight treatments and three replications. The treatments were  $T_1$  control,  $T_2$ -  $30 \text{ kg P}_2O_5 \text{ ha}^{-1}$ ,  $T_3$ - FYM alone,  $T_4$ - Vermicompost alone,  $T_5$ - Enriched vermicompost alone,  $T_6$ - DBS+ $30 \text{ kg P}_2O_5 \text{ ha}^{-1}$ ,  $T_7$ - FYM + $30 \text{ kg P}_2O_5 \text{ ha}^{-1}$ ,  $T_8$ - vermicompost+ $30 \text{ kg P}_2O_5 \text{ ha}^{-1}$ . The N and K was supplemented through urea,

and muriate of potash, respectively. Farm yard manure, dry biogas slurry and vermicompost @  $1, 5$  and  $5 \text{ t ha}^{-1}$  respectively and phosphorus were applied as basal dose as per treatments.

For the preparation of enriched vermicompost, rockphosphate was added to the bio-waste according to the  $P_2O_5$  requirement of pea ( $30 \text{ kg ha}^{-1}$ ). The vermicompost had  $1.83\% \text{ N}$ ,  $1.37\% \text{ P}_2O_5$  and  $2.47\% \text{ K}_2O$  while that of enriched vermicompost  $1.95\% \text{ N}$ ,  $2.15\% \text{ P}_2O_5$  and  $2.67\% \text{ K}_2O$ . Farmyard manure and dry biogas slurry used in the experiment contained  $0.5\% \text{ N}$ ,  $0.33\% \text{ P}$ ,  $0.5\% \text{ K}$  and  $1.6\% \text{ N}$ ,  $1.5\% \text{ P}$ ,  $1.0\% \text{ K}$ , respectively. Pea seeds (**TYPE-9** Variety) were sown in the last week of October, 2013. Yield and yield attributes were recorded at harvest. The grain and straw samples were analysed for their nitrogen, phosphorus and sulphur content by adopting standard procedures (Jackson 1973).

The growth yield and yield attributes were significantly influenced by different treatments. Application of  $30 \text{ kg P}_2O_5 \text{ ha}^{-1}$  resulted in significantly superior to control in respect of growth and yield attributes. The increase in these parameters may be owing to the important vigour of the plants possibly by balanced supply of P (Singh *et al.* 2017). Maximum values of plant height, nodule plant<sup>-1</sup>, nodule dry weight plant<sup>-1</sup>, number of pods plant<sup>-1</sup>, and number of seeds pod<sup>-1</sup> were recorded with enriched vermicompost (Table-1) reported that performance of rock-phosphate was increased in the presence of earthworms by 15-30 % and observed an increase in the available P and plant available N. The higher availability of nutrients (N and P) might have contributed to higher yield by the application of enriched vermicompost. Similar observations by the application of enriched organic manures have been reported by Patra *et al.* (2017).

Table 1: Effect of various sources of nutrient on yield and yield attributes on Pea

| Treatments     | Plant height(cm) | No. of Nodule plant <sup>-1</sup> | Nodule dryweight (g plant <sup>-1</sup> ) | No. of pods plant <sup>-1</sup> | No. of seeds pod <sup>-1</sup> | Grain yield (qha <sup>-1</sup> ) | Straw yield (qha <sup>-1</sup> ) |
|----------------|------------------|-----------------------------------|---|---------------------------------|--------------------------------|----------------------------------|----------------------------------|
| T <sub>1</sub> | 81.7             | 24.7                              | 20.5                                      | 23.0                            | 5.48                           | 16.11                            | 21.10                            |
| T <sub>2</sub> | 90.7             | 39.6                              | 32.9                                      | 23.9                            | 6.19                           | 23.32                            | 30.32                            |
| T <sub>3</sub> | 91.5             | 40.7                              | 33.8                                      | 23.5                            | 6.19                           | 23.49                            | 30.54                            |
| T <sub>4</sub> | 94.3             | 41.6                              | 34.5                                      | 24.6                            | 6.37                           | 24.33                            | 31.60                            |
| T <sub>5</sub> | 96.9             | 44.5                              | 36.9                                      | 24.8                            | 6.63                           | 25.00                            | 32.25                            |
| T <sub>6</sub> | 93.1             | 41.5                              | 34.5                                      | 24.5                            | 6.37                           | 23.99                            | 31.18                            |
| T <sub>7</sub> | 92.4             | 41.5                              | 33.4                                      | 24.0                            | 6.28                           | 23.82                            | 30.72                            |
| T <sub>8</sub> | 94.4             | 43.3                              | 36.0                                      | 24.1                            | 6.42                           | 24.50                            | 31.85                            |
| CD(P=0.05)     | 0.9              | 0.4                               | 0.3                                       | 0.1                             | 0.06                           | 1                                | 2                                |

The uptake of nutrients (N, P and S) in grain and straw increased significantly over control with different treatments (Table 2). Application of 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> resulted in significantly higher uptake of N, P and S by pea grain and straw which may be attributed to increased nutrient content and yield (Lal *et al.*

2016). Maximum N, P, S uptake was recorded in grain and straw with enriched vermicompost followed by vermicompost +30 kg P<sub>2</sub>O<sub>5</sub> showing the values of 79.2, 11.2, 9.7 kg ha<sup>-1</sup> in grain and 56.1, 9.0, 9.6 kg ha<sup>-1</sup> in straw respectively. This might be due to more available nutrients.

Table 2: Effect of various treatments on N, P and S uptake (kg ha<sup>-1</sup>) in pea

| Treatments   | Nitrogen |       | Phosphorus |       | Sulphur |       |
|--|----------|-------|------------|-------|---------|-------|
|  | Grain    | Straw | Grain      | Straw | Grain   | Straw |
| T <sub>1</sub> control   | 51.5     | 35.0  | 7.2        | 5.5   | 6.0     | 5.7   |
| T <sub>2</sub> 30 kg P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup>          | 74.4     | 52.1  | 10.3       | 8.5   | 8.9     | 8.8   |
| T <sub>3</sub> 10t FYM ha <sup>-1</sup>                                      | 74.9     | 52.5  | 10.5       | 8.5   | 9.2     | 8.8   |
| T <sub>4</sub> 2.5t VC ha <sup>-1</sup>                                      | 77.8     | 55.0  | 10.7       | 8.5   | 9.5     | 9.2   |
| T <sub>5</sub> 2.5t EVC ha <sup>-1</sup>                                     | 79.2     | 56.1  | 11.2       | 9.0   | 9.7     | 9.7   |
| T <sub>6</sub> 2.5t DBS+30 kg P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup> | 76.8     | 54.2  | 10.5       | 8.7   | 9.3     | 9.0   |
| T <sub>7</sub> FYM+30 kg P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup>      | 76.0     | 53.1  | 10.5       | 8.6   | 9.3     | 8.9   |
| T <sub>8</sub> VC+30 kg P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup>       | 78.1     | 55.4  | 10.8       | 8.9   | 9.5     | 9.2   |
| CD(P=0.05)   | 0.04     | 0.03  | 0.60       | 0.50  | 0.51    | 0.57  |

VC=Vermicompost, EVC=Enriched vermicompost, DBS=dry biogas slurry

for crop growth and development. Patra *et al.* (2011) Yadav *et al.* (2016) and also reported such beneficial effects of organic matter and enriched compost application in different crops.

The present study revealed that improved nutrient uptake, growth and yield of pea could be brought by the application of vermicompost enriched with rockphosphate.

## REFERENCES

- Jackson, M. L. (1973) *Soil Chemical Analysis*, Prentice Hall of India Pvt. Ltd., New Dehli, pp.111-203.
- Lal, M., Pal, A. K., Agrawal, M. C., Usharani, K., Seema Chandrika, D. and Singh, A. P. (2016) Effect of phosphorus and molybdenum on yield and nutrient uptake of fababean. *Annals of Plant and Soil Research* **18** (3): 262-265
- Patra, P.S.; Sinha, A.C. and Mahesh S.S. (2011) Yield, nutrients uptake and quality of groundnut (*Arachis hypogea*) kernels as affected by organic sources of nutrient. *Indian Journal of Agronomy*, **56**(3):237-241.
- Singh, D., Khare, A., and Singh, S. V. (2017) Effect of phosphorus and molybdenum nutrition on yield and nutrient uptake in

lentil (*Lens culinaris* L). *Annals of Plant and Soil Research* **19** (1): 37-41

Yadav, S.; Verma, Arvind and Napalia, V. (2016)  
Effect of P, S and seaweed sap on growth,

yield and nutrient uptake of chick pea  
(*Cicer arietinum* L) *Indian Journal of Agronomy*, **17**(3):496-502.