EFFECT OF ORGANIC MANURES ON YIELD AND YIELD ATTRIBUTING CHARACTERS OF POTATO

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KEYWORDS: potato, organic manures, farm yard manure, vermicompost, yield attributing characters

Potato is undoubtedly one of the most important crop, high yields require both organic and mineral fertilization. Nutrients in organic forms significantly affect potato plant growth, development and yield (Plaza, 2004). The use of organic amendments such as traditional thermophilic composts has long been recognized as an effective means of improving soil structure, enhancing soil fertility, increasing microbial diversity and populations (Barakan et al., 1995), microbial activity (Zink and Allen, 1998), improving the moisture-holding capacity of soils and increasing crop yields. Vermicomposts are finely-divided mature peat-like materials with a high porosity, aeration, drainage, water-holding capacity and microbial activity which are stabilized by interactions between earthworms and microorganisms in a non-thermophilic process (Edwards and Burrows, 1988). Vermicomposts is a rich source of nutrients, vitamins, enzymes, antibiotics, plant growth regulators and other plant growth-influencing materials produced by microorganisms (Shambhavi and Sharma, 2011). Though the number of buds, rate of multiplication and yield potential are mainly controlled by genetic traits but potato cultivars placed for seed purpose should show potential for producing maximum number of tubers per plant which can be enhanced by different agronomic interventions. So, a study was conducted with FYM and vermicompost to compare their effect on potato seed production.

Uniform size (20-25 g) sprouted virus free buffer stock tubers of Indian potato cultivars viz., Kufri Ashoka, Kufri Badshah, Kufri Bahar, Kufri Chandramukhi, Kufri Chipsona 1, Kufri Chipsona 2, Kufri Kanchan, Kufri Lalima, Kufri Lauvkar and Kufri Pukhraj were planted (2-3 cm depth) in pots (20 × 20 cm) 3/4th filled with two different organic manures in the ratio of 2:1 v/v (T₁: Soil: Farmyard manure; T₂: Soil: Vermicompost) in polyhouse having evaporative cooling conditions during the 1st week of September. The organic manures as well as soil was sterilized separately and mixed in the above said ratio before filling in the pots. The approximate quantity of FYM and vermicompost used per pot was about 300 and 200 g respectively. Standard manurial and cultural practices were followed for raising the seed crop. Pots were irrigated daily as per need. The recommended dose of NPK fertilizers (120 N:100 P₂O₅:100 K₂O kg/ha) was applied in two split doses, 50% N, 100% P and 100% K at the time of planting and remaining 50% of N 45 days after planting (DAP). Halums were cut after 110 days of planting. The experiment was conducted in a factorial (10 × 2) completely randomized design. Each treatment comprised five replicates, each

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replicates consist of five pots. Temperature inside the polyhouse was recorded daily from planting to haulm cutting. Maximum temperature was ranged from 18°C to 30°C and minimum from 14°C to 18°C. Data were collected on various yield attributing characters like plant height (40 DAP), number of stems per plant, number of compound leaves per plant (70 DAP), number of tuber produced per plant and tuber weight per plant (at harvest). The two-way analysis of variance was done using the software AGRES and means were separated according to the least significant differences at 0.05 level of probability.

Results indicated that the plant height, number of compound leaves and tuber weight was significantly affected by organic manures and varieties whereas, the number of stems were significantly influenced by the type of organic manure and not by varieties. Organic manures significantly influenced the plant height, FYM enhanced the plant height in Kufri Ashoka, Kufri Bahar, Kufri Chandramukhi, Kufri Chipsona-2, Kufri Lalima, Kufri Lauvkar and Kufri Pukhraj whereas, vermicompost in Kufri Badshah. However, organic manures had no effect on plant height of Kufri Kanchan. This may be due to genetic variation of cultivars (Kumar et al., 2011). Among the varieties, maximum plant height was noticed in Kufri Chipsona-2 (79.6 cm) with FYM, while it was minimum in Kufri Bahar with vermicompost (23.0 cm) 40 DAP. FYM registered maximum number of stems in Kufri Lalima (3.8) while Kufri Badshah (1.4) produced least number of stems on vermicompost. However, number of stems of Kufri Ashoka, Kufri Bahar, Kufri Chandramukhi, Kufri Chipsona-2, Kufri Kanchan and Kufri Lauvkar were not affected by the type of organic manure. FYM was significantly effective in enhancing the number of compound leaves in varieties Kufri

Table 1. Effect of farm yard manure and vermicompost on yield attributing character of potato cultivars.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Plant height (cm)</th>
<th>No. of stems/plant</th>
<th>No. of compound leaves/plant</th>
<th>No. of tubers/plant</th>
<th>Tuber wt. (g/plant)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FYM</td>
<td>VC</td>
<td>Mean</td>
<td>FYM</td>
<td>VC</td>
</tr>
<tr>
<td>Kufri Ashoka</td>
<td>38.8</td>
<td>35.0</td>
<td>36.5</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Kufri Badshah</td>
<td>46.4</td>
<td>49.6</td>
<td>48.0</td>
<td>2.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Kufri Bahar</td>
<td>34.2</td>
<td>23.0</td>
<td>28.6</td>
<td>3.6</td>
<td>3.2</td>
</tr>
<tr>
<td>Kufri Chandramukhi</td>
<td>48.0</td>
<td>41.6</td>
<td>44.8</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Kufri Chipsona 1</td>
<td>42.0</td>
<td>36.0</td>
<td>39.0</td>
<td>3.0</td>
<td>1.6</td>
</tr>
<tr>
<td>Kufri Chipsona 2</td>
<td>79.6</td>
<td>69.0</td>
<td>74.3</td>
<td>2.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Kufri Kanchan</td>
<td>34.8</td>
<td>33.8</td>
<td>34.3</td>
<td>2.8</td>
<td>2.2</td>
</tr>
<tr>
<td>Kufri Lalima</td>
<td>37.0</td>
<td>27.4</td>
<td>32.2</td>
<td>3.8</td>
<td>2.2</td>
</tr>
<tr>
<td>Kufri Lauvkar</td>
<td>36.4</td>
<td>30.6</td>
<td>30.5</td>
<td>1.8</td>
<td>2.4</td>
</tr>
<tr>
<td>Kufri Pukhraj</td>
<td>37.0</td>
<td>28.8</td>
<td>33.0</td>
<td>2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Mean</td>
<td>43.4</td>
<td>37.5</td>
<td>37.5</td>
<td>2.8</td>
<td>2.3</td>
</tr>
</tbody>
</table>

CD (0.05) V 4.14** NS 6.2* 3.09** 18.3**
T 1.85** 0.38* 2.75** 1.38* 8.18**
SEd V 2.08 0.43 3.09 1.55 9.19
T 0.93 0.19 1.38 0.69 4.11

VC= vermicompost; **= significant at 1% level of probability; *=significant at 5% level of probability; NS=non significant; wt.=weight

Badshah, Kufri Bahar, Kufri Chipsona-1, Kufri Chipsona-2, Kufri Kanchan, Kufri Lalima and Kufri Pukhraj. But the type of organic manures had no effect on number of compound leaves in the varieties Kufri Ashoka, Kufri Chandramukhi and Kufri Lauvkar (Table 1). The maximum number of tubers per plant was recorded in Kufri Lalima (18.2) with FYM, whereas they were minimum in Kufri Lauvkar (4.8) with vermicompost. The effect of vermicompost on number of tubers was at par with FYM in most of the varieties however, FYM statistically increased per plant tuber yield in almost all the varieties except Kufri Chipsona-2 and the maximum tuber yield per plant was recorded in Kufri Chipsona-1 (132 g).

In general, most of the yield attributing characters of potato were significantly augmented by farmyard manure as compared to vermicompost. These may be due to increased availability of humic substances to act as plant growth regulators and promote growth (Goenadi and Sudharama, 1995). Recently, Canellas et al. (2000) identified exchangeable auxin groups from humic acids extracted from cattle manure, following a structural analysis, which enhanced root elongation, lateral root emergence and plasma membrane H^+_ATPase activity of maize roots. Roy et al. (2001) and Linus et al. (2004) also reported enhanced yield of potato cultivars amended with FYM whereas, our results contradicts the earlier findings of many workers in various crops (Arancon et al., 2003; Arancon et al., 2004). It was also reported that the positive effects of vermicomposts on plant growth and yield were not due to nutrients but due to the availability of plant growth-influencing materials such as plant growth regulators and humic acids, produced by the enormously increased microbial populations resulting from earthworm activity (Arancon et al., 2004). In our study, the reduced yield attributing characters of potato in vermicompost may be due to loss of beneficial microbial populations particularly fungi, bacteria and actinomycetes (Edwards, 1998) during sterilization. Arancon et al. (2005) also reported the degradation of vermicomposts and microbial activity on exposure to sun and air. In our study, the inferior performance of different varieties grown on vermicompost may be due to type of residue used for preparation of vermicompost. The type of residues influencing the quality of vermicompost was also reported earlier by Arancon et al. (2004).

As per the visual observation upto 60 days of planting FYM enhances the plant height in all the varieties as compared to vermicompost however, the effect of FYM on plant height declined towards maturity and attained equivalent height by the time of maturity. The reduced plant height in vermicompost during initial growth period may be due to slow release of nutrients for absorption by plants. Shi-wei and Fu-zhen (1991) also reported strong retention of nutrients by vermicomposts which has large particulate surface area. In conclusion, FYM improved the plant height, number of compound leaves, number of tubers and tuber yield as compared to vermicompost. Therefore, wherever the use of sterilized potting media is necessary FYM can be used successfully instead of vermicompost.

LITERATURE CITED


Effect of organic manure on potato yield


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