RESPONSE OF MUSTARD (BRASSICA JUNCEA) TO VARYING LEVELS OF SULPHUR AND FORTIFIED VERMICOMPOST UNDER LOAMY SAND SOIL

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ABSTRACT
Effect of sulphur and fortified vermicompost on growth and yield of mustard [Brassica juncea] was carried out at College of Agriculture, Swami Kesawanand Rajasthan Agricultural University, Bikaner (Rajasthan) during rabi season: 2010-11. Sixteen treatment combinations comprising four levels of each sulphur and fortified vermicompost were evaluated. Progressive increase in levels of sulphur from control to 40 kg ha\(^{-1}\) resulted significant improvement in growth and yield attributes. Seed yield and net returns during the crop season, it represented the seed yield 15.98 q ha\(^{-1}\) that was 8.9 and 24.02 per cent higher than 20 kg ha\(^{-1}\) and control, respectively. Remaining at par with 60 kg ha\(^{-1}\), it also fetched 10.47 and 30.4 per cent higher net returns than above levels of sulphur. Growth and yield attributes, seed yield as well as net returns in mustard also increased considerably with every increase in levels of fortified vermicompost. The highest value of most of these attributes was recorded under 6.0 t ha\(^{-1}\), only. Providing the seed yield of 18.65 q ha\(^{-1}\), this level enhanced it to the extent of 10.86, 13.34 and 79.68 per cent over 4.0 t ha\(^{-1}\), 2.0 t ha\(^{-1}\) and control, respectively. Application of fortified vermicompost at 6.0 t ha\(^{-1}\) fetched the maximum net returns of Rs 29551 ha\(^{-1}\) that were 8.17, 33.73 and 86.05 per cent higher than 4.0 t ha\(^{-1}\), 2.0 t ha\(^{-1}\) and control.

Key words: Brassica juncea, Fortified vermicompost, Growth, Mustard, Sulphur, Yield.

INTRODUCTION
Rape seed and mustard [Brassica juncea (L) Czern and Coss] is an important oilseed crop of family cruciferae and occupies a prominent place among oilseed crops being next to groundnut. In world, India occupies first place in area, while, it is next to China in production and contributing 5.5 m ha area with 6.4 mt production (Anonymous, 2009-10). In Rajasthan, first in both area and production of rapeseed and mustard in the country occupying 23.25 lac ha area and 27.00 lac t production with productivity (1161 kg ha\(^{-1}\)) in the state is much lower than its realizable yield potential of 2200 to 2400 kg ha\(^{-1}\) (Anonymous, 2009-10). mustard oil is used for edible and industrial purposes, oil cakes, green stems and leaves are used as cattle feed and green fodder. The seed and oil of mustard have a peculiar pungency due to a glycoside “Sinigrin” (C\(_{16}\)H\(_{16}\)O\(_{9}\)NS\(_2\)K) thus making it suitable for condiments and can be used for the preparation of pickles, curries and vegetables.

Sulphur is essential to plant and especially has emerged as the third important plant nutrient to oilseed crops and plays a multiple role in their nutrition. It involved in the synthesis of oil and is a constituent of proteins, vitamins (biotin, thiamine) and sulphur containing amino acids, i.e., cysteine, cystine and methionine. Besides these, it is also used as soil amendment and for controlling pathogens. Saalbach (1973) reported that sulphur deficiency tends to affect adversely to the growth and yield of seed crop, which reduces the crop-yield to an extent of 10-30 per cent. Soil organic matter plays a key role in influencing the nutrient dynamics in soils. Vermicompost also improves soil aeration, reduces soil erosion and evaporation losses of water accelerates, the process of humification, stimulates the microbial activity, deodourification of obnoxious smell, destruction of pathogens, detoxification of pollutant soil and also takes part in improving the physical conditions of the soil. (Manna and Hagra,

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Vermicompost was fortified (enriched) by the addition of 2 per cent zinc sulphate during the preparation of the vermicompost.

**MATERIALS AND METHODS**

A field experiment was conducted at the Agronomy farm of College of Agriculture, Bikaner during Rabi of 2010 using mustard cv. Bio-902 (Pusa jai kisan) as the test crop. The experimental soil was loamy sand in texture, alkaline in reaction (pH 8.5) with EC- 0.15 dSm\(^{-1}\), low organic carbon (0.13%) as well as low in available N, P, K and S (113, 20, 114 kg ha\(^{-1}\) and 8.5 mg kg\(^{-1}\), respectively). Sixteen treatment combinations comprising four levels of each sulphur (0, 20, 40 and 60 kg ha\(^{-1}\)) and fortified vermicompost (0, 2, 4 and 6 t ha\(^{-1}\)) were evaluated in randomized block design and replicated thrice. A recommended dose of 90 kg N and 40 kg P\(_2\)O\(_5\) ha\(^{-1}\) were applied at the time of sowing through Urea and DAP, respectively. Sulphur and fortified vermicompost were applied before sowing as per treatments and incorporated well into the soil. The mustard variety Bio-902 (Pusa jai kisan) was sown in rows spaced 30 cm apart in the second fortnight of October during rabi of 2010. Adequate management practices and plant protection measures were followed to raise a good crop.

**RESULTS AND DISCUSSION**

**Effect of sulphur:** One year results present in Table 1 indicated that mustard crop responded very well to sulphur application in terms of improvement in various growth and yield attributing characters viz. plant height, branches per plant, number of siliquae per plant, seeds per siliqua and test weight. Every increase in level of sulphur significantly enhanced most of these attributes up to 40 kg ha\(^{-1}\) over lower levels. It represented the plant height, branches per plant, number of siliquae per plant, seeds per siliqua and test weight of 176.23 cm, 19.10, 171.02, 13.32 and 4.72 g, respectively that were 32.32, 40.64, 31.23, 32.80 and 17.7 per cent higher than noted under control. However, it remained at par with 60 kg ha\(^{-1}\). Where in the maximum values of most of characters were recorded. The corresponding increase rendered by this level in above characters was 37.44, 42.56, 32.9, 35.0 and 20.2 per cent. The results corroborated with the findings of Jogi et al. (2009) and Kapur et al. (2010) who have also reported that growth and growth attributes increased significantly with application of 40 to 60 kg S ha\(^{-1}\).

Results further showed that application of sulphur at 40 kg ha\(^{-1}\) represented significantly higher seed yield during the crop season (Table 2). It provided the seed yield of 15.98 q ha\(^{-1}\) that was 8.9 and 24.02 per cent higher than obtained with 20 kg ha\(^{-1}\) and control, respectively. It also fetched the highest net returns of Rs 25913 ha\(^{-1}\). Further increase in level of sulphur to 60 kg ha\(^{-1}\), through maximized the seed yield (16.09 q ha\(^{-1}\)) and net returns (25609 q ha\(^{-1}\)) but the increase was not upto the level of significance. These results are close agreement with those reported by Kumar et al. (2006), Piri and Sharma (2006), Jain et al. (2008), Jogi et al. (2009) who have also reported increase in seed and stover yields of mustard with application of sulphur.

**TABLE 1.** Effect of sulphur and fortified vermicompost on growth and yield attributing characters of mustard.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant height (cm)</th>
<th>Branches /plant</th>
<th>Siliquae /plant</th>
<th>Seeds /siliqua</th>
<th>Test weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Sulphur levels (kg ha(^{-1}))</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>133.18</td>
<td>13.58</td>
<td>130.32</td>
<td>10.03</td>
<td>4.01</td>
</tr>
<tr>
<td>20</td>
<td>161.11</td>
<td>16.40</td>
<td>151.40</td>
<td>12.10</td>
<td>4.44</td>
</tr>
<tr>
<td>40</td>
<td>176.23</td>
<td>19.10</td>
<td>171.02</td>
<td>13.32</td>
<td>4.72</td>
</tr>
<tr>
<td>60</td>
<td>183.05</td>
<td>19.36</td>
<td>173.16</td>
<td>13.54</td>
<td>4.82</td>
</tr>
<tr>
<td>CD at 5%</td>
<td>11.64</td>
<td>0.81</td>
<td>7.00</td>
<td>0.51</td>
<td>0.22</td>
</tr>
<tr>
<td><strong>B. Fortified vermicompost levels (t ha(^{-1}))</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>135.49</td>
<td>13.19</td>
<td>121.54</td>
<td>10.31</td>
<td>3.99</td>
</tr>
<tr>
<td>2.0</td>
<td>158.30</td>
<td>16.05</td>
<td>151.79</td>
<td>12.02</td>
<td>4.45</td>
</tr>
<tr>
<td>4.0</td>
<td>173.53</td>
<td>18.78</td>
<td>170.57</td>
<td>13.23</td>
<td>4.72</td>
</tr>
<tr>
<td>6.0</td>
<td>186.25</td>
<td>20.41</td>
<td>182.01</td>
<td>13.42</td>
<td>4.83</td>
</tr>
<tr>
<td>CD at 5%</td>
<td>11.64</td>
<td>0.28</td>
<td>7.00</td>
<td>0.51</td>
<td>0.22</td>
</tr>
</tbody>
</table>
Effect of fortified vermicompost: Growth and yield determining characters also showed profound improvement due to application of fortified vermicompost (Table 1 & 2). Plant height, branches per plant, number of siliqua per plant were improved significantly with successive addition of fortified vermicompost up to 6.0 t ha\(^{-1}\), whereas, significant improvement in seeds per siliqua and test weight was observed up to 4.0 t ha\(^{-1}\), only. However, the maximum values of all the characters were obtained at 6.0 t ha\(^{-1}\). This level of vermicompost increased the plant height, branches per plant, number of siliqua per plant, seeds per siliqua and test weight to the extent of 37.5, 54.7, 49.7, 30.2 and 21.05 per cent per cent respectively. However, it was found statistically similar with 6.0 t ha\(^{-1}\) in respect of all these characters.

It is also evident from the data presented in Table 2 that increasing level of fortified vermicompost brought about significantly higher seed yield of mustard up to 6.0 t ha\(^{-1}\) over preceding levels during the crop season. It provided the seed yield of 18.65 q ha\(^{-1}\) that was 10.86, 13.34 and 79.68 per cent more than recorded under 4.0 t ha\(^{-1}\), 2.0 t ha\(^{-1}\) and control, respectively. The maximum net returns were obtained with the application of 6.0 t ha\(^{-1}\), only. These results were in accordance with the findings of Premi et al. (2004), Singh and Singh (2006) and Akbari et al. (2010).

### REFERENCES


