EFFECT OF PHOSPHORUS, SULPHUR AND ZINC FERTILIZATION ON QUALITY OF MUSTARD (BRASSICA JUNCEA L.) GROWN UNDER SEMIARID CONDITIONS

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ABSTRACT

A field experiment was conducted to study the effect of P, S and Zn on quality characteristics of mustard. It was observed that oil, glucosinolate and protein contents were higher at 60 kg each of phosphorus and sulphur and 30 kg ZnSO₄/ha during both the years. On contrary, oil constants i.e. refractive index, iodine value and acid value were reduced due to application of P, S and Zn during both the years.

Phosphorus, being an important component of storage and structural compounds of seed like phytin, phospholipids and nucleic acids, plays a vital role in the nutrition of oilseed crops. Likewise, sulphur the constituent of sulphur containing amino acids like methionine, cystein and cystine enhance the grain, oil and protein yields and quality of oil. Zinc, on the other hand, by increasing the utilization of nitrogen, phosphorus and sulphur affects grain yield and quality of oilseed crops.

Thus, it was considered desirable to study the effect of P, S and Zn application on quality characteristics of mustard (Brassica juncea L.).

A field trial was conducted at New Dairy Farm, C.S. Azad University of Agriculture and Technology, Kanpur with 3 levels each of P₂O₅ and S i.e. 0, 30 and 60 kg/ha and 3 levels of Zinc i.e. 0, 15 and 30 kg ZnSO₄/ha. The soil of the experimental field was mildly alkaline in reaction and low in availability of P, S and Zn (Table 1). Available P, S and Zn were determined by methods described by Olsen et al. (1954), Chesnin and Yien (1950) and Atomic Absorption Spectrophotometer, respectively. Phosphorus, sulphur and zinc sulphate, were applied through DPA, elemental sulphur and Zinc sulphate, respectively. Uniform doses of N and K₂O were applied @ 80 and 40 kg/ha through urea (46% N) and muriate of potash (60% K₂O), respectively. Entire dose of P, S, K and Zn was applied basally at sowing whereas N was applied in two equal splits i.e. basal and top dressing at irrigation.

Seeds of variety Varuna (T-59) were sown in lines at 45 cm apart on 5th and 2nd Nov., during first year and second year, respectively and plant population was maintained by thinning after 15 days of sowing. Crop was harvested on 15th March during both the years. Grain samples were drawn from each treatment and analysed for oil, protein and glucosinolate contents. Oil was extracted by Soxhlet’s apparatus in petroleum ether and analysed for oil constants i.e. iodine value, refractive index and acid value. Iodine value and refractive index and acid value were determined by method as described by Jamieson (1943) and Kanwar and Chopra (1966), respectively. Protein content was determined by multiplying the total nitrogen determined by Kjeldahl’s method with the factor 6.25 (A.O.A.C., 1965). Glucosinolate content was determined by crushing and defatting the grains with petroleum ether and subsequently determining the sulphate ions (Mc Gee et al., 1965).

It is obvious from the data (Table 2) that application of 60 kg/ha of each
Table 1. Soil characters

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>First year</th>
<th>Second year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sand (%)</td>
<td>52.00</td>
<td>51.80</td>
</tr>
<tr>
<td>2.</td>
<td>Silt (%)</td>
<td>25.80</td>
<td>26.10</td>
</tr>
<tr>
<td>3.</td>
<td>Clay (%)</td>
<td>19.90</td>
<td>20.00</td>
</tr>
<tr>
<td>4.</td>
<td>pH</td>
<td>7.8</td>
<td>7.70</td>
</tr>
<tr>
<td>5.</td>
<td>EC (mmhos/cm²)</td>
<td>0.45</td>
<td>0.39</td>
</tr>
<tr>
<td>6.</td>
<td>CEC (m.e./100g)</td>
<td>12.50</td>
<td>11.80</td>
</tr>
<tr>
<td>7.</td>
<td>Organic carbon (%)</td>
<td>0.34</td>
<td>0.30</td>
</tr>
<tr>
<td>8.</td>
<td>Available P₂O₅ (kg/ha)</td>
<td>18.10</td>
<td>18.00</td>
</tr>
<tr>
<td>9.</td>
<td>Available sulphur (ppm)</td>
<td>7.20</td>
<td>6.70</td>
</tr>
<tr>
<td>10.</td>
<td>Available Zinc (ppm)</td>
<td>0.32</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Table 2. Effect of different levels of P, S and Zn on Grain yield, oil content and yield and glucosinolate and protein contents of Mustard

<table>
<thead>
<tr>
<th>Levels (kg/ha)</th>
<th>Grain yield (q/ha)</th>
<th>Oil content (%)</th>
<th>Oil yield (%/ha)</th>
<th>Glucosinolate content (%)</th>
<th>Protein content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FIRST YEAR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphorus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>15.00</td>
<td>39.72</td>
<td>5.96</td>
<td>1.891</td>
<td>33.48</td>
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<tr>
<td>30</td>
<td>16.75</td>
<td>40.47</td>
<td>6.78</td>
<td>2.066</td>
<td>35.27</td>
</tr>
<tr>
<td>60</td>
<td>16.19</td>
<td>40.77</td>
<td>6.60</td>
<td>2.235</td>
<td>37.59</td>
</tr>
<tr>
<td>Sulphur</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>14.41</td>
<td>38.07</td>
<td>5.49</td>
<td>1.884</td>
<td>31.90</td>
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<tr>
<td>30</td>
<td>16.14</td>
<td>41.27</td>
<td>6.66</td>
<td>2.095</td>
<td>36.49</td>
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<tr>
<td>60</td>
<td>17.39</td>
<td>41.62</td>
<td>7.24</td>
<td>2.213</td>
<td>37.94</td>
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<tr>
<td>Zinc sulphate</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>15.24</td>
<td>39.99</td>
<td>6.10</td>
<td>2.033</td>
<td>33.89</td>
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<td>15</td>
<td>16.10</td>
<td>40.40</td>
<td>6.50</td>
<td>2.069</td>
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<td>6.74</td>
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<tr>
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<td>0.010</td>
<td>0.516</td>
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<tr>
<td>CD at 5%</td>
<td>0.653</td>
<td>0.677</td>
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<td>0.028</td>
<td>1.463</td>
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<tr>
<td><strong>SECOND YEAR</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Phosphorus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>19.64</td>
<td>39.42</td>
<td>7.74</td>
<td>1.833</td>
<td>30.55</td>
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<td>8.77</td>
<td>2.044</td>
<td>32.37</td>
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<tr>
<td>60</td>
<td>22.20</td>
<td>40.96</td>
<td>9.09</td>
<td>2.185</td>
<td>34.42</td>
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<tr>
<td>Sulphur</td>
<td></td>
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</tr>
<tr>
<td>0</td>
<td>18.61</td>
<td>37.97</td>
<td>7.07</td>
<td>1.818</td>
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<td>41.33</td>
<td>8.93</td>
<td>2.077</td>
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<tr>
<td>60</td>
<td>23.20</td>
<td>41.73</td>
<td>9.68</td>
<td>2.167</td>
<td>34.84</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>20.07</td>
<td>40.02</td>
<td>8.03</td>
<td>1.989</td>
<td>30.86</td>
</tr>
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<td>15</td>
<td>21.21</td>
<td>40.38</td>
<td>8.57</td>
<td>2.03</td>
<td>32.83</td>
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<td>40.62</td>
<td>8.99</td>
<td>2.050</td>
<td>33.66</td>
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<tr>
<td>SEm ±</td>
<td>0.208</td>
<td>0.178</td>
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<td>0.028</td>
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<tr>
<td>CD at 5%</td>
<td>0.590</td>
<td>0.493</td>
<td></td>
<td>0.080</td>
<td>0.728</td>
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</tbody>
</table>

phosphorus and sulphur and 30 kg ZnSO₄/ha gave maximum oil, glucosinolate and protein content during both the years. It is interesting to note that though the oil content was higher at 60 kg P₂O₅/ha application, oil yield was maximum at 30 kg P₂O₅/ha during 1982-83 which might be ascribed to higher grain yield at this very level. These results are in
Table 3. Effect of different levels P, S and Zn on oil constants

<table>
<thead>
<tr>
<th>Levels (kg/ha)</th>
<th>First year</th>
<th></th>
<th>Second year</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Refractive index</td>
<td>Iodine value</td>
<td>Acid value</td>
<td>Refractive index</td>
</tr>
<tr>
<td>Phosphorus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1.4714</td>
<td>112.9</td>
<td>1.02</td>
<td>1.4715</td>
</tr>
<tr>
<td>30</td>
<td>1.4718</td>
<td>111.7</td>
<td>1.02</td>
<td>1.4718</td>
</tr>
<tr>
<td>60</td>
<td>1.4714</td>
<td>111.2</td>
<td>1.01</td>
<td>1.4717</td>
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<tr>
<td>Sulphur</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1.4717</td>
<td>113.3</td>
<td>1.06</td>
<td>1.4716</td>
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<td>1.4715</td>
<td>111.8</td>
<td>1.01</td>
<td>1.4717</td>
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<td>1.4714</td>
<td>110.8</td>
<td>0.99</td>
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<tr>
<td>Zinc sulphate</td>
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</tr>
<tr>
<td>0</td>
<td>1.4715</td>
<td>112.0</td>
<td>1.02</td>
<td>1.4717</td>
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<td>15</td>
<td>1.4715</td>
<td>111.9</td>
<td>1.02</td>
<td>1.4716</td>
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<td>30</td>
<td>1.4715</td>
<td>111.9</td>
<td>1.02</td>
<td>1.4716</td>
</tr>
</tbody>
</table>

Application of P, S and Zn, though had not remarkable effect on oil constants but increase in the levels of these nutrient elements had depressing effect on oil constants (Table 3). These findings are in close conformity with the findings of Southern (1967) and Singh (1983) who reported remarkable improvement in oil quality by bringing down iodine and acid values due to S application.

REFERENCES