EFFECT OF PHOSPHORUS AND SULPHUR APPLICATION ON PERFORMANCE OF VEGETABLE PEA (PISUM SATIVUM L.) CV. PANT MATAR-2

Jitendra Kumar

Chaudhary Charan Singh University Campus,
Meerut - 250 004, India

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ABSTRACT

A field experiment was conducted during the winter season of 2009-10 to find out the optimum dose of phosphorus and sulphur on growth, nodulation, yield attributes and yield of garden pea (Pisum sativum L.). Four levels of P₂O₅ (0, 20, 40 and 60 kg/ha) and three levels of sulphur (0, 20 and 40 kg/ha), were applied through single super phosphate and gypsum, respectively. Treatments were replicated three times in factorial randomized block design. Application of phosphorus and sulphur resulted in an increase in various growth characters, nodulation, yield attributing traits and yield of garden pea. The application of 60 kg P₂O₅ produced the highest mature green pod yield (73.83 q/ha). Similarly the levels of sulphur up to 40 kg/ha showed linear increased in growth, nodulation and yield of garden pea. The application of 40 kg sulphur produced the highest yield of 66.51 q/ha.

Key words : Phosphorus, Sulphur, Growth, Yield, Nodulation, Vegetable pea.

INTRODUCTION

Vegetable pea or garden pea (Pisum sativum L.) is the most important vegetable belonging to the family Leguminosae. Green seeds of garden pea contain 7.2% protein (Choudhury, 1967) and thus, it is much ahead of the next popular legume vegetable viz., French bean, which contains only about 1.7% of protein. Besides being protein rich, the garden peas are also a good supplier of several minerals and vitamins. Peas are taken either as a cooked vegetable or used in fried or soup forms. They are also canned, frozen or dehydrated. The environmental factors like temperature, humidity, light intensity, rainfall etc. which regulate a number of morphological and physiological responses of the plant, are considered important in determining the yield. Besides these factors, the adequate supply of macro and micro nutrients is also essential for getting optimum plant growth and yield.

Phosphorus is one of the most important nutrients for plants and garden pea. Phosphorus contributes directly to both the yield and quality of garden pea. Phosphorus plays an important role in physiological functions of the plant. It is a constituent of Adenosine di phosphate (ADP), sugar phosphate and nucleic acid, proteins and several co-enzymes, which are of great importance in energy transformation and metabolic process of the plants. The nitrogen fixation is much accelerated when optimum quantity of phosphorus is available in the soil.

Sulphur is now recognized as major plant nutrient, along with nitrogen, phosphorus and...
potassium. It is essential for the growth and
development of all crops, without exception. Most
of the plants requirement of sulphur is absorbed
through the roots in the form of sulphate (SO$_4$\(^{2-}\)).
Sulphur deficiency is becoming more critical with
each passing year which is severely restricting crop
yield, produce quality, nutrient use efficiency and
economic returns on millions of farms. Like any
essential nutrient, sulphur has certain specific
functions to perform in the plant. Thus, sulphur
deficiencies can only be corrected by the application
of sulphur fertilizer (Tandon and Messick, 2007).

It is clear that these two nutrients play
leading role in increasing the production of peas.
However, response to these nutrient applications
may vary from soil to soil and variety to variety.
Pant Matar-2 is an early variety but its cultural
and nutritional requirement could not be studied
so far.

**MATERIALS AND METHODS**

The studies were conducted during the
winter season of 2009-10 at Horticultural
Research Farm, Ch. Charan Singh University,
Meerut on the sandy loam soil having pH 7.3,
available nitrogen 0.053%, phosphorus 0.0082%,
potash 0.019%, electrical conductivity 1.4
(m. mhos/cm), fine sand 55.40%, silt 23.40% and
clay 21.2%. The experiment was laid out in
factorial randomized block design with 3
replications. Treatments consisted of 4 levels of
phosphorus (0, 20, 40 and 60 kg/ha) and 3 levels
of sulphur (0, 20 and 40 kg/ha). Phosphorus and
sulphur were applied through single super
phosphate and gypsum, respectively. The sowing
was done on 6$^{th}$ October 2009 by keeping row to
row distance of 30 cm and plant to plant 7.5 cm.
Crop received 3 three irrigations during its life
span. The basal dose of nitrogen (20 kg/ha) and
potash (60 kg/ha) was applied through urea and
muriate of potash, respectively. The variety “Pant
Matar-2” is an early maturing dwarf pea.

Observations were recorded in Table 1 and
2 on plant height, number of leaves, number of
branches, number of nodules, fresh weight of
nodules, dry weight of nodules, days taken to first
flowering, days taken to marketable maturity, pod
length, number of pods per plant, number of seeds
per pod and yield (q/ha).

**RESULTS AND DISCUSSION**

**Effect on growth parameters :**

Increasing levels of phosphorus increased the
plant height, number of leaves, number of branches
per plant, number of nodules and fresh and dry
weight of nodules Significantly more plant height
(44.68 cm), number of leaves (12.38) and branches
(1.53), number of nodules (55.12), fresh weight of
nodules (879.34 mg) and dry weight of nodules
(153.52 mg) were observed up to 60 kg P$_2$O$_5$/ha
application. The increase in growth characters with
the application of phosphorus may be due to its role
in oxidation-reduction and energy transfer reaction
of cell metabolism eg. photosynthesis, respiration
and fat metabolism. It favours the nitrogen fixation
by increasing nodules formation (Jakobsen, 1985).
The positive effect of phosphorus on nodulation may
be through the development of better root system
which would have encouraged formation of more
number of nodules. These results were similar to
the results of Svoboda et al., (1971) and Kumar
(2000). Similar increase in growth parameters by
the influence of phosphorus were reported by Prasad
and Maurya (1989).

Significant response to sulphur levels was
observed in all growth parameters i.e. plant height
(42.89 cm), number of leaves (11.78), number of
branches (1.48), number of nodules (52.33), fresh
weight of nodules (792.12 mg) and dry weight of
nodules (144.59 mg). The dose of 40 kg S/ha resulted
in an increase in all growth parameters. The increase
in growth characters with the application of sulphur
might be due to its use in the manufacture of
chlorophyll. Sulphur increases The nodules formation
in the roots of garden pea. Similar increase in
growth characters with the application of sulphur
had also been reported by Scherer and Lang (1996).
Effect of phosphorus and sulphur on the growth and nodulation of vegetable pea.

Table 1: Effect of Phosphorus and Sulphur on the growth and nodulation of vegetable pea.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant height (cm) at harvest</th>
<th>No. of leaves/ plant</th>
<th>No. of branches per plant at final harvest</th>
<th>No. of nodules per plant at 60 DAS</th>
<th>Fresh weight of nodules (mg) at 60 DAS</th>
<th>Dry weight of nodules (mg) at 60 DAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>P₀ (0 kg/ha)</td>
<td>37.28</td>
<td>10.12</td>
<td>1.23</td>
<td>44.75</td>
<td>503.51</td>
<td>129.57</td>
</tr>
<tr>
<td>P₁ (20 kg/ha)</td>
<td>39.89</td>
<td>11.29</td>
<td>1.36</td>
<td>49.36</td>
<td>742.29</td>
<td>139.69</td>
</tr>
<tr>
<td>P₂ (40 kg/ha)</td>
<td>43.78</td>
<td>12.15</td>
<td>1.49</td>
<td>53.18</td>
<td>831.36</td>
<td>147.91</td>
</tr>
<tr>
<td>P₃ (60 kg/ha)</td>
<td>44.68</td>
<td>12.38</td>
<td>1.53</td>
<td>55.12</td>
<td>879.34</td>
<td>153.52</td>
</tr>
<tr>
<td>S₀ (0 kg/ha)</td>
<td>39.96</td>
<td>11.26</td>
<td>1.31</td>
<td>48.78</td>
<td>693.15</td>
<td>140.76</td>
</tr>
<tr>
<td>S₁ (20 kg/ha)</td>
<td>41.36</td>
<td>11.42</td>
<td>1.40</td>
<td>50.69</td>
<td>732.10</td>
<td>142.66</td>
</tr>
<tr>
<td>S₂ (40 kg/ha)</td>
<td>42.89</td>
<td>11.78</td>
<td>1.48</td>
<td>52.33</td>
<td>792.12</td>
<td>144.59</td>
</tr>
</tbody>
</table>

SEm± 0.25 0.08 0.01 0.40 14.79 0.22
C.D. at 5% 0.74 0.23 0.04 1.17 43.39 0.66

Table 2: Effect of Phosphorus and Sulphur on flowering and yield of vegetable pea.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Days taken to first flowering</th>
<th>Days taken to marketable maturity</th>
<th>Pod length (cm)</th>
<th>No. of pods per plant</th>
<th>No. of seeds per pod</th>
<th>Yield of mature green pods (q/hq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P₀ (0 kg/ha)</td>
<td>33.86</td>
<td>55.83</td>
<td>8.46</td>
<td>12.50</td>
<td>5.67</td>
<td>59.68</td>
</tr>
<tr>
<td>P₁ (20 kg/ha)</td>
<td>32.49</td>
<td>54.62</td>
<td>8.83</td>
<td>15.06</td>
<td>6.40</td>
<td>63.62</td>
</tr>
<tr>
<td>P₂ (40 kg/ha)</td>
<td>31.25</td>
<td>52.81</td>
<td>9.02</td>
<td>17.61</td>
<td>6.90</td>
<td>68.29</td>
</tr>
<tr>
<td>P₃ (60 kg/ha)</td>
<td>30.12</td>
<td>50.68</td>
<td>9.17</td>
<td>19.96</td>
<td>7.20</td>
<td>73.83</td>
</tr>
<tr>
<td>S₀ (0 kg/ha)</td>
<td>31.11</td>
<td>52.38</td>
<td>8.63</td>
<td>16.17</td>
<td>5.90</td>
<td>66.38</td>
</tr>
<tr>
<td>S₁ (20 kg/ha)</td>
<td>32.07</td>
<td>53.48</td>
<td>8.85</td>
<td>16.27</td>
<td>6.38</td>
<td>66.43</td>
</tr>
<tr>
<td>S₂ (40 kg/ha)</td>
<td>32.60</td>
<td>53.98</td>
<td>9.12</td>
<td>16.40</td>
<td>7.35</td>
<td>66.51</td>
</tr>
</tbody>
</table>

SEm± 0.15 0.06 0.16 0.11 0.17 0.16
C.D. at 5% 0.44 0.17 0.47 0.33 0.52 0.47

Effect on flowering and yield:
Increasing levels of phosphorus i.e. 60 kg P₂O₅/ha help in shortening the days taken to first flowering (30.12) and marketable maturity (50.68) over control. The length of pod and number of seeds/pod also showed the significant results. The maximum yield (73.83 q/hq) was obtained at 60 kg P₂O₅/ha which was higher over control (59.68 q/ha). Phosphorus increased the yield and quality of pea because it is the important constituent of nucleic acid, phospholipids and co-enzymes. Similar results were reported by Bahadur et al., (1990) and Patel et al., (1998).

Application of sulphur encouraged the vegetative development, increasing levels of sulphur prolong the days taken to first flowering and marketable maturity (32.60 days) and (53.98 days), respectively. Forty kg sulphur/ha increased the length...
of pod (9.12 cm) and number of seeds/pod (7.35) as compared to control. The number of pods per plant and number of seed/pod obtained with 20 and 40 kg S/ha were at par but higher to control. The improvement in crop growth, nodulation and yield attributes with sulphur application could be ascribed to its pivotal role in regulation of the metabolic and enzymatic processes including photosynthesis, respiration and legume- Rhizobium symbiotic nitrogen fixation reflected in increased yield. Similar results were also reported by Rao et al., (2001). No significant interaction effects of levels of phosphorus and sulphur on growth, yield attributes and yield of garden pea were noted.

The application of P and S in deficient, soils appears to have synergistic relationship and the application of fertilizers supplying both the nutrients would be beneficial.

REFERENCES