these data that the cultivated varieties of groundnut can be distinguished into two characteristic main groups, based on their flowering pattern and branching arrangement of the main shoot.

The sequentially branched types consisting of Valencia and Spanish groups practically showed no differences in their flowering, and they were, therefore, treated as a single group throughout this study. These flowered early in about 22 days from the date of sowing and exhibited a sudden increase in their flowering, producing the maximum number of flowers in the fifth week itself, subsequent to which there was a gradual reduction. The alternately branched types which include Virginia and spreading, flowered late in about 28–51 days and they showed a gradual increase in the number of flowers produced, with the maximum observed at about the ninth week from the date of sowing, after which there was a general reduction. Flowering in alternately-branched group extended over a longer period than in sequentially-branched varieties by about 15 days. In this respect, the number of flowers produced in spreading varieties is greater than in Virginia types. It was interesting to note that the sequentially-branched types produced considerably lesser flowers than the alternately-branched forms. None of the varieties studied were found to be intermediate in their flowering pattern between the two groups of alternately- and sequentially-branched types. This provides further support to the classification recommended by Sarma et al. that the cultivated varieties of groundnut should be mainly divided on the basis of their branching pattern, and not according to their growth habit, and that Virginia-bunch, semi-bunch and semi-spreading types should be grouped together with the spreading varieties for breeding and other purposes of comparison.

Though flowering pattern in cultivated varieties of groundnut was extensively studied by Ali Mohammed et al., Shibuya, Gregory, Bouffil, Smith, Seshadri and Varisai Mohammad, in which different patterns of flowering were recognised, the present study suggests for the first time that the variations in flowering pattern are dependent on the branching arrangement of the stem in the cultivated groundnut.

The authors are thankful to Dr. M. S. Swaminathan, Director, Indian Agricultural Research Institute, New Delhi, for suggesting the problem on the classification of cultivated varieties of groundnut and keen interest throughout the course of the work.


EFFECT OF SEED INOCULATION WITH PSEUDOMONAS SP. ON PHOSPHATE UPTAKE AND YIELD OF MAIZE

Seed inoculation with Pseudomonas sp. has been found to increase the yield of various crops. Significant increases in phosphate uptake and crop yields due to inoculation with Bacillus megaterium var. phosphaticum have been reported. The present note reports the effect of seed inoculation with Pseudomonas sp. on phosphate uptake and yield of maize.

A pot culture experiment was carried out with maize treated with hydroxyapatite tagged with P32, as an insoluble phosphate source at the rate of 80 kg P2O5/hectare. Alluvial sandy loam soil from Delhi of pH of 8-0 and 35 kg P2O5/hectare available phosphorus was used in this experiment. Tagged hydroxyapatite was prepared by adding radioactive phosphoric acid to 10% solution of dipotassium hydrogen phosphate following the procedure described by Sperber. Basal dose of 100 kg N/hectare and 40 kg K2O/hectare in the form of ammonium sulphate and muriate of potash was applied. Seeds were inoculated with Pseudomonas sp. (27 B), a good rock phosphate solubilizer, and Bacillus polymyxa (II5) and sown.

The crop was harvested after eight weeks. Phosphate content of the plants was estimated by vanadomolybdate method. Radio Phosphorus in the digested plant material was determined as described by Mackenzie and Dean. GM counter with binary scaler was
used for recording the data. From the radioassay data the uptake of fertilizer and soil phosphorus was calculated.

The total dry yield, total phosphate uptake and uptake from added phosphate source and soil phosphorus are given in Table I.

**Table I**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Dry matter yield (g)</th>
<th>Total phosphate uptake (mg)</th>
<th>Uptake of phosphorus (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pot</td>
<td>Hydroxyapatite</td>
<td>Soil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(mg)</td>
<td>(mg)</td>
</tr>
<tr>
<td>Uninoculated</td>
<td>15.20</td>
<td>31.62</td>
<td>6.87</td>
</tr>
<tr>
<td>Pseudomonas sp. (27 B)</td>
<td>28.70</td>
<td>65.12</td>
<td>11.71</td>
</tr>
<tr>
<td>Bacillus polymyxa (H 5)</td>
<td>17.40</td>
<td>30.94</td>
<td>8.44</td>
</tr>
<tr>
<td>C.D. at 5%</td>
<td>5.95</td>
<td>20.48</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

N.S.—Not significant.

Statistical analysis of the data revealed significant increase in dry matter yield and phosphate uptake by the plants due to seed inoculation with *Pseudomonas* sp. but not with *B. polymyxa*. Inoculation with *Pseudomonas* sp. resulted in significant increase in uptake of soil phosphorus but this was not so with *B. polymyxa*. However, the amounts of hydroxyapatite phosphorus solubilized by the cultures did not differ significantly from that of uninoculated control.

Our thanks are due to Dr. W. V. B. Sundara Rao, Dr. N. S. Subba Rao and Dr. B. Rama-moorthy for providing necessary facilities.


**COMPARATIVE STUDIES ON THE EFFECTS OF BOSEIMYCIN AND STREPTOMYCIN IN BACILLUS SUBTILIS**

BOSEIMYCIN$^{1,2}$ is a basic water-soluble, broad spectrum antibiotic. Preliminary studies on the biochemical changes induced by boseimycin were carried out with a sensitive strain of *Bacillus subtilis*. A comparison of such changes with those of streptomycin is reported here.

Medium of the following composition was used in all experiments: glucose, 10 g; glutamic acid, 5 g; KH$_2$PO$_4$, 1.75 g; MgSO$_4$.7 H$_2$O, 0.02 g; KCl, 5 g; MnSO$_4$.4 H$_2$O, 0.01 g; FeSO$_4$.7 H$_2$O, 0.01 g; water, 1,000 ml. The pH of the medium was adjusted to 7.1. Metabolic studies were performed by comparing the rates of utilization of various substrates. 250 ml Erlenmeyer flasks containing 80 ml of the medium were inoculated with 0.5 ml freshly-grown (24 hr-old) Bacillus subtilis culture and incubated at 37°C under stationary condition. Antibiotic solutions were added at submininal inhibitory concentrations at zero time. Cells were separated from the broth by centrifugation, then washed twice with distilled water and finally dried overnight at 60°C and the dry weight of the cells was determined. The culture filtrates were preserved below 4°C for analyses. Estimation of glucose was done according to the method of Folin and Wu,$^3$ lactic acid by the method of Barker and Summeran,$^4$ phosphate by that of Hertha and Ephriam,$^5$ and nitrogen by nesslerisation. Readings were taken in a Klett Summerson photoelectric colorimeter. Quantitative estimation of nitrogen and phosphorus were carried out on aliquots previously digested with sulphuric acid. The results of analyses are summarized in Tables I and II.

In the above growth medium, under stationary condition, it was observed that a maximum growth in control culture reached after 93 hours and subsequent loss of weight is accounted for lytic action of the cells, whereas in both boseimycin- and streptomycin-treated cultures growth continued even after 93 hours. The growth rate in the antibiotic-treated culture was low and this slower growth rate is comparable to the rate of utilization of different substrates in the medium. The medium maintained a steady lower pH value in the treated cultures all through the growth period. In control experiment, maximum lactic acid production reached during