Research Notes: Pakistan: Path-coefficient analysis of developmental and yield components in soybean

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Path-coefficient analysis of developmental and yield components in soybean.

Abstract: Interrelationships among different characters were determined by simple correlations and path-coefficient analysis using 36 diverse and elite cultivars representing different geographical origin. The results revealed a highly significant positive association of the branches per plant and pods per plant with grain yield. The pods per plant also showed a high direct influence on grain yield. Thus, from this investigation, it is suggested that pods per plant and number of branches per plant are the primary yield components that should be given due emphasis in selecting high yielding genotypes in soybean.

Introduction: Grain yield is a complex character and is the ultimate expression of different components. The knowledge of interrelationship among various developmental and productive traits is necessary for framing effective breeding programs. Further, path-coefficient analysis is useful in assessing the real contribution of various component characters towards grain yield, so that direction for desired improvement may be developed. Present study was undertaken to work out the association among various metric traits in soybean and to develop suitable selection criteria.

Materials and methods: Materials used and methods adopted for the present investigation have been described earlier (Rajput et al., 1985). However, the details are given below.

The experiment was conducted during summer 1984 at the AEARC, Experimental Farm, Tandojam. Thirty-six soybean varieties of diverse origin were grown in a randomized complete block design with four replications. Each replication consisted of a single 4-meter row. Seed was drilled at a row distance of 45 cm. Plant-to-plant distance was maintained at 5 cm by thinning the crop before first irrigation. At maturity, five competitive plants from each replication of all the varieties were randomly selected and observed for plant height, number of branches per plant, pod length, pods per plant, seeds per pod, 100-grain weight, and grain yield per plant.

The genotypic correlations were worked out according to the methods suggested by Hayes et al. (1955). Path-coefficient analysis was carried out according to the procedure outlined by Dewey and Lu (1959).
Results and discussion: All the characters have shown positive relationship with yield. Highly significant ($P < 0.01$) and positive correlation values between yield and pods per plant (0.8311) and branches per plant (0.6846) were observed (Table 1). Similar correlations have been reported earlier by Malhotra et al. (1972) and Lal and Haque (1971) in soybean. Estimates of correlations for plant height (0.3965) and pod length (0.3174) with grain yield were moderate but did not reach the significance level. Earlier, Giriraj and Kumar (1974) observed similar relationship between plant height and yield in mungbean.

Table 1. Correlation coefficients among different characters in soybean

<table>
<thead>
<tr>
<th>Characters</th>
<th>Plant height</th>
<th>Pod length</th>
<th>Seeds/pod</th>
<th>Branches/plant</th>
<th>Pods/plant</th>
<th>100-grain weight</th>
<th>Grain yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height</td>
<td>-0.1775</td>
<td>0.0325</td>
<td>0.1731</td>
<td>0.4738*</td>
<td>-0.3819</td>
<td>0.3965</td>
<td></td>
</tr>
<tr>
<td>Pod length</td>
<td>0.6034**</td>
<td>0.1407</td>
<td>0.0341</td>
<td>-0.139</td>
<td>0.0924</td>
<td>0.3805</td>
<td>0.3174</td>
</tr>
<tr>
<td>Seeds/pod</td>
<td>-0.139</td>
<td>-0.0638</td>
<td>0.0924</td>
<td>0.1495</td>
<td>-0.2444</td>
<td>0.6846**</td>
<td></td>
</tr>
<tr>
<td>Branches/plant</td>
<td>0.7778**</td>
<td>0.2444</td>
<td>-0.3635</td>
<td>0.8312**</td>
<td>0.0016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pods/plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100-grain weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*,**Significant at the 5% and 1% levels, respectively.

The correlation values of six quantitative traits with grain yield are partitioned into direct and indirect effects (Table 2). These effects are also explained diagramatically in Figure 1. Pods per plant registered the highest direct and positive effects (0.7833). 100-grain weight also exerted considerably high direct positive effect (0.3229). Direct effects of other characters like plant height, pod length, and seeds per pod were low, so did not appear to have influenced the grain yield substantially.

Pods per plant, which had registered maximum direct effect, also contributed to yield indirectly through branches per plant. Other traits like plant height and pod length also contributed via pods per plant to grain yield. This clearly establishes that pods per plant is the most important component of seed yield in soybean. Like the results of this investigation, Chand et al. (1957) and Katiyar et al. (1977) had earlier noted quite a large direct effect of pods per plant on seed yield and suggested that, while
Fig. 1. Path diagram showing direct and indirect effects of various agronomic characters on grain yield in soybean

1 = Plant height
2 = Pod length
3 = Seeds/pod
4 = Branches
5 = Pods/plant
6 = 100-grain weight
7 = Plant yield
x = Residual effect
Table 2. Direct and indirect effects of different characters on grain yield in soybean

<table>
<thead>
<tr>
<th>Characters</th>
<th>Plant height</th>
<th>Pod length</th>
<th>Seeds/pod</th>
<th>Branches/plant</th>
<th>Pods/plant</th>
<th>100-grain weight</th>
<th>Grain yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height</td>
<td>0.1391</td>
<td>-0.0175</td>
<td>0.0040</td>
<td>0.0231</td>
<td>0.3712</td>
<td>-0.1233</td>
<td>0.3964</td>
</tr>
<tr>
<td>Pod length</td>
<td>-0.0247</td>
<td>0.0989</td>
<td>0.0748</td>
<td>0.0188</td>
<td>0.0267</td>
<td>0.1229</td>
<td>0.3174</td>
</tr>
<tr>
<td>Seeds/pod</td>
<td>0.0045</td>
<td>0.0597</td>
<td>0.1239</td>
<td>-0.0186</td>
<td>-0.0499</td>
<td>0.0298</td>
<td>0.1495</td>
</tr>
<tr>
<td>Branches/plant</td>
<td>0.0241</td>
<td>0.0139</td>
<td>-0.0173</td>
<td>(0.1335)</td>
<td>0.6093</td>
<td>-0.0789</td>
<td>0.6846</td>
</tr>
<tr>
<td>Pods/plant</td>
<td>0.0659</td>
<td>0.0034</td>
<td>-0.0079</td>
<td>0.1039</td>
<td>(0.7833)</td>
<td>-0.1174</td>
<td>0.8312</td>
</tr>
<tr>
<td>100-grain weight</td>
<td>-0.0531</td>
<td>0.0376</td>
<td>0.0115</td>
<td>-0.0326</td>
<td>-0.2847</td>
<td>(0.3229)</td>
<td>0.0016</td>
</tr>
</tbody>
</table>

*Figures in parenthesis indicate direct effect.

selecting for high yield, main emphasis should be placed on pods per plant.

Branches per plant, another important component of yield as revealed by the present study, though having low direct effect, exerted high indirect effect via pods per plant making the total effect (0.6846) highly significant (P<0.01). Similar findings have been reported earlier by Singh et al. (1977) in lentil.

The high value of the residual effect (0.431) was perhaps due to sampling error and many other characters that were not taken into consideration in the present study. From the foregoing discussion of the results obtained in the present study, it could be inferred that the pods per plant was the most important component of grain yield. Branches per plant was the other important component of yield in soybean. Thus, it is suggested that soybean ideotype for grain yield should be heavy bearing with profuse branching.

References


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