PERFORMANCE OF SOYBEAN CULTIVARS UNDER RAINFED CONDITIONS OF ISLAMABAD

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ABSTRACT: Ten cultivars of soybean, [Glycine max (L.) Merr.] belonging to different maturity groups were grown under rainfed conditions at the National Agricultural Research Centre, Islamabad, during 1976 and 1977. The data was recorded on plant height, number of pods per plant, days to maturity and seed yield. Variety, 'Bragg' significantly out yielded (1615 kg/ha) other varieties while 'Calland' gave the lowest yield (833 kg/ha). Variety, 'Bragg' was also the tallest (87.5 cm in height) among all the cultivars. On an average, 'Forrest' and 'Ransom' had maximum number of pods per plant, i.e., 26.2 and 26.0, respectively, followed by 'Bragg' with 25.5 pods per plant. Varieties, 'Bragg', 'Bossier' and 'Davis' took 102 days to mature and thus formed a late maturity group while 'Williams', 'Clark' and 'Calland' matured in 84 – 86 days and formed an early maturing group. Plant height, pods per plant and days to maturity showed a significant and positive correlation with seed yield. Path coefficient analysis indicated that number of pods/plant and days to maturity had more direct effect on seed yield than plant height.

Key Words: Glycine max; Varieties; Rainfed Farming; Maturity; Crop Yield; Yield Components; Pakistan.

INTRODUCTION

Soybean (Glycine max (L.) Merr.) is one of the most important protein and oil rich crops of the world. It is Asiatic in origin most probably originated somewhere in China where it was used as food, long before the existence of written records (Smith and Circle, 1980). It has a wide range of adaptability and includes germplasm adapted to latitude from 0 to more than 50 degrees (Howell and Caldwell, 1980), and is grown successfully in many parts of the world. Boote (1981) conducted field trial on the response of soybean cultivars of 0 to VIII maturity groups in southern USA. He observed that soybean cultivars were very much affected by the day length. Cultivars in groups 0 to I were early maturing but low yielding and in groups II to VI, the cultivars were high yielding whereas those in groups VII and VIII had prolonged flowering period and thus were very late. Parrini et al. (1979) reported that cultivar 'Williams' did not give a stable yield each year and was affected by the prevailing environmental conditions.

In India Khurana and Yadava (1982) observed that cultivars 'Williams' and 'Clark-63' possessed average stability and general adaptability to all environments for seed yield. Gautam and Singh (1977) found that the seed yield per plant positively correlated with days to maturity, plant height and pods per plant.

An indigenous soybean type is grown in the North West Frontier Province of Pakistan since centuries where it is used as pulse in human food. It is very low yielding and grown on very limited area. Soybean was reintroduced in Pakistan in mid 1960s from United States as an oil crop. Since then exotic germplasm of soybean is being tested extensively to find out suitable cultivars for different agroclimatic regions of Pakistan. The present study was conducted in the same context of research objectives for the rainfed areas of Islamabad region.

MATERIALS AND METHODS

The varietal evaluation studies were conducted at National Agricultural Research...
Centre, Islamabad, during monsoon seasons of 1976 and 1977. The seed material was obtained from the College of Agriculture, University of Illinois, Urbana-Champaign, Illinois, USA, and comprised ten varieties, belonging to different maturity groups. Planting dates for the two years, 1976 and 1977, were July 17, and July 11, respectively.

The experiments were laid out in the Randomized Complete Block Design with four replications. The four row plots were 5m long and rows were spaced 60 cm apart. Only two central rows were harvested for obtaining seed yield. All other parameters on plant height, number of pods per plant and days to maturity, were recorded on the same two central rows. The number of pods/plant and height were mean of five plants selected at random.

All the data recorded were analyzed according to Fisher (1950) and the comparison of treatment means were made by Duncan's multiple range test. Correlation coefficients of all characters evaluated were also obtained. Path coefficient analysis was also done to determine the direct effect of different traits on seed yield. To appreciate the climatic conditions of the area of study data regarding the total monthly precipitation received and temperatures prevailing during growth periods in 1976 and 1977 were also recorded (Table 1).

RESULTS AND DISCUSSION

The seed yield and yield components and their correlation are described in the following text.

Seed Yield

The soybean cultivars showed highly significant differences in the seed yield obtained during both the years, 1976 and 1977. The mean yields of both years were not significantly different (Table 2). The variety, 'Bossier' (1308 kg/ha). Both high yielding varieties belong to maturity group VII. On an average of two years' yield data variety 'Calland', which belongs to maturity group III, gave the lowest yield (833 kg/ha). Whereas, 'Williams' which also belongs to maturity group III gave consistently high yields in both years and ranked third among the ten cultivars in the test. The yield of 'Williams' was consistent in both the years which is in contrast to that reported by Parrini et al. (1979). Other cultivars belonging to maturity groups IV to VII viz., 'Davis', 'Clark-63', 'Forrest', 'Ransom', 'Essex' and Columbus' are intermediate in yields ranging from 931 to 1050 kg/ha. Variety x year interaction was non-significant which indicated that varieties behaved almost similarly relative to each other in both years for seed yield.

Plant Height

The cultivars evaluated differ highly significantly for their heights (Table 2). 'Bragg' and 'Bossier' were the tallest cultivars and they attained mean heights of 87.5 and 85.5 cm, respectively. Other tall varieties were 'Davis', 'Ransom' and 'Forrest', whereas, 'Calland', 'Williams', 'Clark-63', 'Essex' and 'Columbus' belonging to III, IV and V maturity groups were short statured varieties.
and their average heights ranged from 59.5 to 68.5 cm.

Plant height x variety interaction was significantly high as well as year means for plant heights differed highly significantly. It indicated that varieties performed inconsistently in both years for height, e.g., 'Bragg' was 102 cm tall in 1976 but in 1977 it attained a height of 73 cm only. In contrast 'Columbus' and 'Essex' showed a consistent trend, for plant height in both years. In general almost all cultivars, except 'Essex' and 'Columbus', were shorter in 1977 than in 1976. High rainfall in August, 1976 (Table 1) caused excessive vegetative growth and thus all the varieties were taller, in general, this year.

Pods per Plant

The difference in the mean values of pods per plant for different varieties were highly significant (Table 2). Maximum number of pods per plant were observed in varieties, 'Forrest' (26.2), 'Ransom' (26.0) and 'Bragg' (25.6). The cultivars 'Clark-63', 'Williams', 'Columbus' and 'Calland' had relatively lesser pods than 'Davis', 'Bossier' and 'Essex' which had 22.8, 21.7 and 20.5 pods/plant, respectively.

Variety x year interaction for pods per plant was non-significant while difference in year means for number of pods/plant was highly significant. The varieties had, in general, lesser pods in 1976 than in 1977 probably because of the excessive vegetative growth during 1976 delayed the reproductive phase and thus resulted in lesser number of pods per plant.

Days to Maturity

In Islamabad the ten cultivars of soybean constituted only three groups of maturity i.e., late, medium and early. 'Bragg', 'Bossier', 'Davis' and 'Ransom' fall in late maturity group and took 99 to 102 days to mature (Table 2). 'Williams', 'Clark-63' and 'Calland' took 84 to 86 days to mature and thus made an early maturity group. Whereas,
'Forrest', 'Columbus' and 'Essex' constituted a medium maturity group and took 91 – 95 days to mature. It indicated that the response of soybean cultivars regarding time to maturity was different when grown in Islamabad than when grown in the United States.

Correlation Among Growth Characteristics and Seed Yield

Since information regarding days to maturity was available for 1976 only, all the correlations between different traits were calculated from the set of data obtained during 1976. All the characteristics were significantly correlated with each other (Table 3). Significant and positive correlations were observed among seed yield, pods per plant, plant height and days to maturity which indicates that the taller plants were also high yielding as well as being late in maturity. These results are in agreement with those obtained by Gautam and Singh (1977) in India. Correlation between plant height and seed yield is critically evaluated by path coefficient analysis and direct and indirect effects of plant height on yield (Table 4). Plant height which has highly significant simple correlation with seed yield has lowest direct effect on yield. Whereas number of pods/plant and days to maturity have high direct effect on the seed yield and thus are more important traits affecting it. Path coefficient analysis indicated that selection for more number of pods per plant shall increase the seed yield rather than selection for taller plants. The positive correlation between days to maturity and yield indicated that increase in growth period of plants also increased the total biomass production in the soybean cultivars. This correlation goes against the requirement of existing cropping system of the country in which early maturity cultivars having high yielding potentials are needed.

Thus present study indicated that the soybean cultivars 'Bragg' and 'Bossier', are most promising and could be cultivated

<table>
<thead>
<tr>
<th>Character</th>
<th>Plant height</th>
<th>No. of pods/plant</th>
<th>Days to maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>0.411**</td>
<td>0.397**</td>
<td>0.486**</td>
</tr>
<tr>
<td>Height</td>
<td>0.591**</td>
<td></td>
<td>0.709**</td>
</tr>
<tr>
<td>No. of pods/plant</td>
<td></td>
<td></td>
<td>0.481**</td>
</tr>
</tbody>
</table>

** Significant at one percent level of probability.

Table 3. Correlation co-efficients among different characteristics of soybean (Glycine max L.) at Islamabad during 1976

Table 4. Direct and indirect effects of different traits on seed yield calculated by path coefficient analysis

| Direct effect of plant height on seed yield | 0.033 a |
| Direct effect of plant height via number of pods/plant | 0.119 |
| Indirect effect of plant height via days to maturity | 0.259 |
| Total | 0.411 |

| Direct effect of number of pods/plant on seed yield | 0.201 a |
| Indirect effect of number of pods/plant via plant height | 0.020 |
| Indirect effect of number of pods/plant via days to maturity | 0.176 |
| Total | 0.397 |

| Direct effect of days to maturity on seed yield | 0.366 a |
| Indirect effect of days to maturity via plant height | 0.023 |
| Indirect effect of days to maturity via number of pods/plant | 0.097 |
| Total | 0.486 |

\( r = \text{Coefficient of correlation.} \\
\( a = \text{Standard partial regression coefficient.} \)

successfully under rainfed conditions of Islamabad during monsoon season. However, being late maturing varieties their maturity period conflicts with wheat planting season. To overcome this situation, 'Williams', an early maturing variety also having reasonable
yielding potential, could be used for planting in Islamabad and surrounding areas which matures during the last week of October and thus provides enough time to the farmers to prepare the land and plant wheat in the proper planting season.

LITERATURE CITED


