SHORT COMMUNICATION

Genotypic Variability for Root Length in Soybean Germplasm

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Soybean is the second most important oilseed crop of India. Yellow seeded soybean was introduced in India in 1963-64. Over a period of four decades there has been an exponential increase in area and production of the crop, but the productivity is stagnant at around one ton per hectare (Lal & Rana, 2000). The lack of soybean varieties to deal with terminal drought is the greatest handicap in the fight against the drought.

Soybean season in India spreads over four months. Usually, it starts with the onset of monsoon in the second fortnight of June and ends in the month of September. However, it might extend into the month of October, if there is delay in sowing. The analysis of rainfall and evapotranspiration data of Indore center shows that there is recurrent drought during the month of September, which affects grain formation resulting in low yield (Anonymous 2006). There is ample rainfall during the months of July and August; therefore, the crop has to survive on residual moisture during the month of September. Under the terminal drought, the water extracted by the root system and the efficiency of water use determines the amount of dry matter produced. Root length and density are important traits in inducing tolerance to drought. Indirect selection for drought can be made through these traits. Under similar conditions deep-rooted soybean has been found to be tolerant to drought in USA. A drought tolerant plant introduction (PI 416937) was identified in the USDA soybean germplasm collection and is characterized by tolerance to wilting during severe drought stress (Sloane *et al.*, 1990).

The studies on drought tolerance in soybean with respect to role of root system can be classified into three different areas, those related with screening of germplasm to study the variability for root length, those related with root growth models and predictions; and those related with efficient methods for studying the root system. Hida *et al.* (1995) studied differences in dry matter production and root system development between soybean cultivars under deficient soil moisture conditions. It is suggested that root system development may be responsible for the differences in ecophysiological characters. Mehetre *et al.*, (1997) studied correlation and path analysis studies of partitioning in root growth and yield characters in soybean (*Glycine max* (L.) Merrill).

Seventy-four genotypes comprising of eight early maturing (<85 days), thirty nine medium duration (86-105 days) and twenty-seven late maturing duration (>106 days); were analyzed at three different stages for studying the variation in root length and density in two different studies. Forty genotypes comprising of eight early maturing (<85 days), eighteen medium duration (86-105 days) and fourteen late maturing lines (>109 days) were grown in polythene bags (75 X 45 cm), with five replication during the first year. A set of 34 lines with 21 genotypes from medium maturity group and 13 genotypes from late maturity group were screened during the second year. Observations were collected at three different stages at 15, 30 and 45 days after sowing, for studying the variation in root length.

The results from first year of screening were subjected to statistical analysis. The analysis of variation among different accessions for root length revealed statistically significant variation in root length at all the three stages (Table 1). In the early maturity group mean root length was 38.71 cm with the maximum root length of 56 cm (Table 2). In the medium maturity group mean root length observed was 45.54 cm and the maximum root length was 58 cm. In the late maturity group the mean root length observed was 40.14 cm and the

Table 1. ANOVA for root length 45 days after sowing

Sources	Degrees of Freedom	Sum of squares	Mean squares	F value	Probability
Replication	1	92.99	92.988	6.888	0.012
Genotypes	3	9267.87	237.638	17.60	0.000
Error	39	526.54	13.500		

Coefficient of Variation: 10.05%

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Table 2. Variation in Root length (in cm)

Duration	Mean	SD	CV	Range	
				Minimum	Maxmum
Early maturity	38.7188	14.89213	38.46	23.0	56
Medium maturity	45.5417	12.07704	26.51	19.0	58
Late maturity	40.1428	17.23138	42.92	17.5	87

	15 days after sowing		30 days after sowing		45 days after sowing	
	Min	Max	Min	Max	Min	Max
Genotype	EC471522	EC458370	EC471510 EC471522	EC458370	EC471372	TGX1864-19F
Length	2.9cm	15.75cm	6.0cm	20.5 cm	15.75	87.0 cm

Table 3. ANOVA for root length (in cm) in 34 germplasm lines of soybean

Sources	Degrees of Freedom	Sum of squares	Mean squares	F value
Genotypes	33	20599.315	624.222	21.4215
Error	33	961.621	29.140	
Total	67	961.621		

Coefficient of Variation: 9.23%
CD: 5.39 cm

Table 4. Variation in root length (in cm) in 34 germplasm lines of soybean

Duration	Mean	SD	CV	Range	
				Minimum	Maxmum
Medium maturity	55.32	15.84	28.63	26.00	90.00
Late maturity	63.46	21.03	33.13	36.25	92.75

maximum root length observed was 87 cm. No significant correlation was observed between days to maturity and root length. The data for second year of screening was analyzed. Similar results were obtained in the second year also. There were significant differences between the root lengths of the genotypes screened. However, correlation between the root length and days to maturity was non-significant (Table 3 & Table 4). Similar results were reported by Turman *et al.*, (1995). They studied cultivar and planting date effects on soybean root growth.

From this study four promising early maturing lines with longer roots length (EC 471373, EC471514, EC471568 and EC 471585) were selected for use in the breeding programme for inducing resistance against terminal drought.

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