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Performance and Nodulation Efficiency of Soybean Cultivars

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Abstract: Seven soybean [*Glycine max* (L.) Merrill] cultivars viz. Kharif-93, Ajmeer, Malakand-91, Ags-297, Swat-84, Ags-62 and Wahab-93 were planted at the Research Farm of Agricultural University Peshawar on May 13, 1998 to determine the yield potential and nodulation efficiency of these cultivars in relation to other important agronomic characters. Kharif-93 ranked first by producing highest grain yield (2498 kg/ha^{-1}), followed by Ags-297 (2206 kg/ha), while the lowest grain yield of 810 kg ha^{-1} was recorded for Wahab-93. Average values of grain yield decreased from 2233.5 (2068-2498 kg ha^{-1}) in group Ito 1512.6 (810-2042 kg ha^{-1}) in group II. Similarly the average values of days to maturity, plant height, nodules number, nodules weight, branches and pods per plant and dry matter yield decreased in descending order from 148 to 113 days, 120.4 to 88.3 cm, 54.7 to 40, 0.54 to 0.37 9, 8.7 to 5.4, 85.7 to 61.3, 12110 to 7500 kg ha^{-1} in group Ito group II, respectively and showed positive association with grain yield. The relationship of 100-seed weight with grain yield was negative because its average values increased from 14.1 g in group I to 16.1 g in group.

Key words: Soybean, *Glycine max* (L.) Merrill, yield, nodules, agronomic characters

Introduction

Pakistan is chronically deficient in the production of edible oils, to the extent that 70 percent of the country requirements are met through import costing huge amounts of foreign exchange annually. Domestic edible oil production from all sources has grown at the rate of 2.56% annually over the last 24 years, whereas the domestic consumption is increasing at an annual rate of 7.7%. Soybean is the most important oil and protein crop throughout the world. At present, soybean oil is the largest component of the world's edible oils. The world production of edible oils consists 30.3% of soybean. In Pakistan, soybean has suffered a setback and has therefore, not been able to attain a respectable position among the oil seed crops. Keeping in view the importance of soybean this project was initiated to study the yield potential and other important characters of these cultivars to find out suitable cultivar under the climatic conditions of Peshawar valley. Amanullah and Hatam (1999) reported significantly positive correlation of grain yield with plant height, branches and pods per plant and dry matter yield. The correlation between grain yield and 100-seed weight was significantly negative. The correlation of days to maturity with grain yield was positive but non-significant. Shannon (1972) reported positive correlation of pods per plant and 100-seed weight with grain yield. Rajpur *et al*. (1983) reported that pods per plant, seeds per plant and seed index had a direct effect on seed yield. Rana and Yousaf (1988) reported that plant height, pods per plant and days to maturity showed a significant and positive correlation with grain yield. Aslam *et al*. (1989) reported that yield ranking of the varieties varied across different environments. Plants in indeterminate group were taller than plants in determinate group (Shah *et al*., 1989). Ansari (1990) reported positive and significant association of seed yield with branches and pods per plant. Kazmi *et al*. (1991) reported that seed yield per plant had positive and highly significant correlation with days to maturity, plant height and pods per plant.

Materials and Methods

Seven cultivars of soybean *(Glicine max* (L.) Merrill) viz. Ajmeer, Malakand-91, Wahab-93, Kharif-93, Ags-297, Swat-84 and Ags-62 were planted at the Research Farm of NWFP Agricultural University Peshawar on May 13, 1998 to study the yield potential and nodulation efficiency of these cultivars in relation to other important characters under the climatic conditions of Peshawar valley. Randomized complete block design was used with four replications by assigning each treatment to a plot of 8 m^2. Each plot 50 consisted of 6 rows, 4 meter long with row to row distance cm. A basal dose of 25 kg N and 64 kg P_2O_5 per hectare was applied as DAP and incorporated into the soil during ploughing. Irrigation was applied when required. Weeds were controlled manually at a proper time. Data were recorded on days to maturity, plant height, number and weight of nodules per plant, pods per plant, 100-seed weight, total dry matter and grain yield. Nodules were collected as described by Hatam (1977). Data were analyzed statistically and means were compared using LSD test.

Results and Discussion

Statistical analysis of the data revealed that days to maturity, plant height, number and weight of nodules per plant varied significantly in different cultivars (Table 1). Days to maturity varied from 111 (Wahab-93) to 152 (Ags-297). Three cultivars of group II were early maturing while four cultivars of group I *were* late maturing. Average values of days to maturity decreased from 148 in group I to 113 in group II. The difference in days to maturity could be due to photoperiod, because different cultivars respond differently to a particular photoperiod. Plant height varied from 76.5 (Wahab-93) to 125.5 cm (Ags-297). Average values of plant height decreased from 120.4 in group I to 88.3 in group II. Plant height showed positive association with days to maturity i.e. three cultivars with short growth period produced shorter plants than four cultivars with long growth period. Similar results were reported by Rana and Yousaf (1988) and Kazmi *et al*. (1991).

Four cultivars with taller plants exhibited indeterminate growth habit while 3 cultivars with shorter plants showed determinate growth habit. Similar results were reported by Shah *et al*. (1989). Number of nodules per plant varied from 27 (Ags-62) to 95 (Swat-84). Weight of nodules per plant varied from 0.31 for Malakand-91 and Ags-62 each to 0.90 g for Swat-84. Average values of number and weight of nodules per plant decreased from 54.7 to 40 and 0.54 to 0.37 g from group I to group II, respectively. Branches and pods per plant, 100-seed weight, dry matter yield and grain yield varied significantly among different cultivars (Table 2). Branches per plant varied from 2.5 (Wahab-93) to 10.5 (Swat-84). Average values of branches per plant decreased from 8.7 in group I to 5.4 in group II. Branches per plant showed positive association with days to maturity and plant height i.e., three cultivars with short maturity and shorter plants produced less number of

Table 1: Plant characteristics and nodulation of soybean cultivars

Cultivars	Days to Maturity	Plant Height (cm)	Nodules/plant	Nodules weight/plant
Kharif-93	148.00 B	121.5 AB	54.00 B	0.52 B
Ags-297	152.00 A	125.5 A	43.00 D	0.43 BC
Swat-84	150.00 AB	124.5 A	95.00 A	0.90 A
Ags-62	142.00 C	110.0 BC	27.00E	0.31 D
Mean Group I	148.00	120.4	54.7	0.54
Ajmeer	114.00 D	106.0 C	48.00 C	0.42 C
Malakand-91	113.00 DE	83.0 D	28.00 E	0.31 D
Wahab-93	111 E	76.5 D	44.00 CD	0.40CD
Mean Group II	113.00	88.3	40.00	0.37
LSD value at 5%	2.820	12.60	3.830	0.026

Table 2: Branches and pods per plant, 100-seed weight, dry matter and grain yield (kg ha^{-1}) soybean cultivars

Cultivars	Branches/plant	Pods/plant	100-seed weight (g)	DM yield (kg ha^{-1})	Grain yield (kg ha^{-1})
Kharif-93	8.5 AB	95.00 B	13.53 C	10940 B	2498.00A
Ags-297	8.3 AB	106.00 A	15.38 B	13440 A	2162.00AB
Swat-84	10.5 A	77.00 C	14.98 B	14060 A	2206.00AB
Ags-62	7.7 B	65.00 D	12.73 C	10000 BC	2068.00C
Mean Group	18.7	85.7	14.1	12110	2233.5
Ajmeer	6.5 B	68.00 CD	16.55 A	8438 CD	2042.00BC
Malakand-91	7.3 B	65.00 D	14.74 B	7813 CD	1686.00C
Wahab-93	2.5 C	51.00E	17.02 A	6250 D	810.00D
Mean Group II	5.4	61.36	16.1	7500	1512.6
LSD value at 5%	1.6	9.431	1.158	2324.894	409.207

branches per plant (2.5-7.3) than four cultivars (7.7-10.5) with long maturity and taller plants. These results are in conformity with those of Amanullah and Hatam (1999).

Pods per plant varied from 51 (Wahab-93) to 106 (Ags-297). Average values of pods per plant decreased from 85.7 in group I to 61.3 in group II. The association of pods per plant with days to maturity, plant height and branches per plant was positive. Similarly, Rana and Yousaf (1988), Kazmi *et al*. (1991) and Amanullah and Hatam (1999) reported positive correlation of pods per plant with days to maturity and plant height. 100-seed weight varied from 12.73 (Ags-62) to 17.02 g (Wahab-93). Average values of 100-seed increased from 14.1 in group I to 16.1 g in group II. 100-seed weight showed negative association with days to maturity, plant height, branches and pods per plant and grain yield. Similar results were reported by Amanullah and Hatam (1999). However, Shannon (1972) reported positive correlation of 100-seed weight with pods per plant and grain yield. Dry matter yield varied from 6250 (Wahab-93) to 14060 kg ha^{-1} (Swat-84). Four cultivars with long maturity, taller plants and maximum number of branches per plant produced 38% higher DM yield than three cultivars with short maturity, shorter plants and minimum number of branches per plant. These results are in conformity with those of Amanullah and Hatam (1999). Grain yield varied from 810 (Wahab-93) to 2498 kg ha^{-1} (Kharif-93). Average values of grain yield decreased from 2233.5 in group Ito 1512.6 in group II. Grain yield showed positive association with days to maturity. Similar results were reported by Rana and Yousaf (1988) and Kazmi *et al*. (1991). Grain yield showed positive association with plant height. Similar results were reported by Rana and Yousaf (1988), Kazmi *et al*. (1991) and Amanullah and Hatam (1999). Grain yield showed positive association with branches per plant.

Similar results were reported by Ansari (1990) and Amanullah and Hatam (1999). Grain yield showed positive association with pods per plant. Similar results were reported by Shannon (1972), Rajpur *et al*. (1983), Rana and Yousaf (1988), Ansari (1990), Kazmi *et al*. (1991) and Amanullah and Hatam (1999). The association of 100-seed weight with grain yield was negative. These results are in conformity with those of Amanullah and Hatam (1999). However, Shannon (1972) reported positive correlation between 100-seed weight and grain yield. The relationship of nodules weight and number with grain yield was not very well established. Similar results were reported by Rana and Yousaf (1988) and Kazmi *et al*. (1991). Grain yield showed positive association with plant height. Similar results were reported by Rana and Yousaf (1988), Kazmi *et al*. (1991) and Amanullah and Hatam (1999). Grain yield showed positive association with branches per plant.

Similar results were reported by Ansari (1990) and Amanullah and Hatam (1999). Grain yield showed positive association with pods per plant. Similar results were reported by Shannon (1972), Rajpur *et al*. (1983). Rana and Yousaf (1988), Ansari (1990), Kazmi *et al.* (1991) and Amanullah and Hatam (1999). The association of 100-seed weight with grain yield was negative. These results are in conformity with those of Amanullah and Hatam (1999). However, Shannon (1972) reported positive correlation between 100-seed weight and grain yield. The relationship of nodules weight and number with grain yield was not very well established.

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