Growth Analysis of Various Soybean Varieties

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ABSTRACT

Leaf area index (LAI) and crop growth rate (CGR) of those soybean varieties increased rapidly especially at the early growth period. Using closest spacing produced higher LAI and CGR compared to others. Improved Pelican and Taichung were found to produced higher yield than other four varieties.

Other growth analysis components such as relative growth rate (RGR) and net assimilation rate (NAR) were not affected by spacing employed. Yield of soybean was found greatest at 5 cm. spacing.

In case of soybean *(Glycine max* (L.) Merr.) which is usually cultivated under row culture, variation in row and plant spacings will be done with greatest facility. Differences in planting pattern more or less result in different plant canopies out of which one or more of them may be most suitable for the best utilization of solar radiation (2). In order to appreciate the yielding ability of plant as the factor which is influenced by other environmental factors, the growth of plants should be considered. Thus, using growth analysis technique as a tool to determine the growth of soybean may solve explain the physiological problems which limit the yield of soybean production (3).

The purpose of this experiment is to study the effect of spacing on the physiological components and their relationship to gain yield of six soybean varieties.

Materials and Methods

Six varieties of soybean; Semmes, Dare, Hill, Improved Pelican, Lee, and Taichung were used in this experiment. Four plant spacings at 5, 10, 15 and 20 cm. were planted in a row of 60 cm. apart, which was equivalent to a plant population of 333,333; 166,666; 111,111; and 83,333 plants per hectare. A split plot design was used with the varieties as its main plot and plant spacings as subplots, there were three replications. Samples for dry matter, leaf area and agronomic characteristics were randomly selected from the 6 rows from one end. Harvest plot composed of four consecutive rows at the other end.

The experiment was conducted from August to November 1975. Soybean was grown on a clay loam soil which was classified as a reddish brown lateritic soil whose pH varies from 5.5-6.8.

Sample for LAI and dry matter determination were initiated at the third trifoliate leaves stage or 28 day after planting and continued every week until soybean plants reached their maximun podding. Leaf area was measured from the punch out disc. The relationship of dry weight and leaf area versus time were then, obtained the value of relative growth rate, crop growth rate, net assimilation rate for each sampling interval (1).

Results

Leaf Area Index (LAI): The results showed that at early stage of growth LAI of all varieties do not differ from each other, whereas the difference was found significant at 42 days after planting. Improved Pelican and Taichung produced higher LAI than the other four varieties ($P < 0.05$). Maximum LAI of five varieties were attained between 42 to 49 days after planting with an exception of Improved Pelican which obtained its maximum LAI later than others. The result revealed that high density consistently produced higher LAI than low density and the difference

Table 1. Mean of LAI of four plant spacings.

Spacing employed	Cutting intervals				
	28 days	35 days	42 days	49 days	56 days
5 cm.between plants	0.91	2.40	3.23	3.59	3.13
10 cm.between plants	0.46	1.23	1.70	1.93	1.85
15 cm.between plants	0.33	0.89	1.23	1.40	1.40
20 cm.between plants	0.28	0.74	1.08	1.29	1.31
	*	*	*	*	*

* Significant at 5 % level

Table 2. Mean of LAI of six soybean varieties.

Varieties	Cutting intervals				
	28 days	35 days	42 days	49 days	56 days
Semmes	0.52	1.47	1.86	1.60	1.63
Dare	0.50	1.16	1.62	1.94	1.65
Hill	0.39	1.16	1.58	1.87	1.37
Improved Pelican	0.43	1.46	2.31	2.60	2.86
Lee	0.54	1.21	1.45	1.48	1.38
Taichung	0.58	1.43	2.05	2.85	2.64
	NS	NS	*	*	*

NS Non significant,
* Significant at 5 % level.

Table 3. Mean of CGR of four plant spacings.

Spacing employed	Cutting intervals			
	28 days	35 days	42 days	49 days
5 cm.between plants	18.91	105.54	172.17	119.80
10 cm.between plants	9.19	59.70	88.82	82.41
15 cm.between plants	6.57	39.93	72.19	68.39
20 cm.between plants	5.64	33.58	62.63	68.00
	*	*	*	NS

NS Non significant, * Significant at 5 % level.

Table 4. Grain yield in kg/ha of six soybean varieties at four plant spacings.

Varieties	Spacing employes				
	5 cm.	10 cm.	15 cm.	20 cm.	Mean
Semmes	216.94	1336.2	1040.6	932.5	1370.0
Dare	2258.7	1458.1	1301.9	1182.5	1543.7
Hill	1468.7	1095.6	836.2	846.9	1062.0
Improved Pelican	2488.7	1734.4	1427.5	1521.2	1793.0
Lee	1741.2	993.7	888.7	760.6	1096.2
Taichung	1963.1	1729.4	1584.4	1675.6	1737.5
Mean	2015.1	1391.2	1180.1	1153.1	1435.0

LSD (0.5) for variety mean comparison = 42.8
for spacing mean comparison = 17.8

Table 5. Correlation values between yields and some physiological components of six soybean varieties at four plant spacings.

Variety	LAI	RGR	CGR	NAR
Semmes	0.835**	-0.042^{NS}	0.683*	-0.279^{NS}
Dare	0.883**	0.078^{NS}	0.811**	0.001^{NS}
Hill	0.963**	-0.025^{NS}	0.791**	-0.098^{NS}
Improved Pelican	0.835**	0.228^{NS}	0.844**	0.243^{NS}
Lee	0.843**	-0.159^{NS}	0.594*	-0.203^{NS}
Taichung	0.533^{NS}	-0.323^{NS}	0.290^{NS}	-0.291^{NS}

* Significant at 5% level of probability.

** Significant at 1% level of probability.

were found statistically significant ($P < 0.05$) at all sampling date (Table 1 and 2).

Relative Growth Rate (RGR): Significant difference of varieties and spacings were not found in all sample date for RGR. After soybean reached 35 days of age, the RGR curve of all six varieties and four different spacings declined.

Crop Growth Rate (CGR): Crop growth rate at the time the sample taken were not significantly different among six varieties used. Different plant spacings gave rise to the different CGR significantly ($P < 0.05$) during the first to the third sampling date (28, 35, and 42 days after planting). Higher density generally had higher CGR (Table 3).

Net Assimilation Rate (NAR): The result of the NAR for all variety and spacings do not show any significant difference at each sampling date. Net assimilation rate of all spacings declined as the season progressed. Higher densities showed lower NAR than lower density.

Yield: The result in Table 4 shown significant difference for varieties of soybean ($P < 0.05$). The highest yield obtained from Improved Pelican was 1,793 kg/ha. Apparently, the lowest yield of 1,062 kg/ha was obtained from Hill. Close spacing or high density generally contributed to the higher yield than wider spacings.

Correlation between yield and some physiological components are presented in Table 5. It was evident that grain yield of all varieties except Taichung were most highly correlated with LAI and CGR. Grain yield increased proportionately with an increase in LAI.

Literature Cited

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