Pak.J.Bot., 31(1): 103-108, 1999.

EFFECT OF SOWING DATES AND ROW SPACINGS ON SOYBEAN YIELD AND YIELD COMPONENTS IN AUTUMN UNDER RAINFED CONDITIONS

SHER MAHMOOD SHAH, M. ASLAM, S. SHAFIQ AND M. ASLAM HAYAT*

Oil Seed Research Institute, NARC, Islamabad, Pakistan.

Abstract

A field experiment was conducted to evaluate the effect of sowing dates and row spacings on yield and yield components of different soybean genotypes under rainfed conditions. The newly developed test genotypes NARC-V and NARC-III produced significantly higher yield of 4264 and 4262 kg per hectare, respectively, at 45 cm apart rows. The check genotype William-82 gave smallest grain yield. Highest number of pods per plant were observed in NARC-IV and NARC-V, when planted on early date and gradually decreased as the sowing was delayed. The genotype NARC-IV and NARC-V produced highest number of pods when planted at 45 cm apart rows. Number of pods decreased as the spacing was decreased. William-82, being a taller genotype, produced taller plants when planted early. Delayed plantings and closer spacings produced smaller plants.

Introduction

Soybean is one of the most important oil and protein crop in the world. In Pakistan soybean is non-conventional oil seed crop which means that still it needs greater efforts to enter in farmer's tradition, although the soil and climate essential for the successful growing of soybean are available in most parts of the country. Yet agronomic research, specially the improved cultural practices are required to obtain the highest seed yield. Higher yield is mostly obtained by planting crop at most appropriate sowing date and maintaining requisite plant population per unit area.

Savoy *et al.*, (1992) found higher seed yield of maturity group III and IV soybean cultivars when planted at an early date suggesting that higher yield were obtained because the rainfall pattern of the area coincided with the growth and development of early sown crop compared to delayed sowing. Similar conditions are available in the Islamabad region where the average of last decade of the rainfall is approximately 987 mm per annum and out of this more than 60% occurred during July-September (Sheikh *et al.*, 1988). Smith (1968) has suggested that soybean can be planted over an extended period in southern USA because of long frost free season, but higher yield was obtained when different soybean cultivars were sown at optimum planting dates. Similar frost free period, June-October, is available under Potwar conditions and as such is very suitable for soybean cultivation. Some workers have reported higher yield when

*University of Arid Agriculture, Rawalpindi, Pakistan.

Table 1. Plant height (cm) of different soybean genotypes as affected by sowing dates.

Sowing dates	NARC-III	NARC-IV	NARC-V	William-82
3-July	77.04	72.6	76.9	81.56
14-July	73.12	69.78	78.44	85.3
25-July	68.54	69.89	71.88	73.44
4-Aug	57.09	53.6	61.06	64.13

LSD (0.05) = 0.9588

indeterminate soybean cultivars were planted in narrow rows compared to wider ones (Cooper, 1971; Costa *et al.*, 1980). Study was therefore carried out to determine the effect of planting date and row spacing on the seed yield and its components of 4 indeterminate soybean genotypes belonging to maturity group III, under non-irrigated conditions in autumn season of the Potwar region.

Materials and Methods

The study was conducted in autumn 1992 and 1993 at the National Agricultural Research Centre, Islamabad, to evaluate the effect of sowing dates and row spacings on yield and yield components of four indeterminate soybean genotypes viz., NARC-III, NARC-IV, NARC-V and William-82. The plantings were carried out on 4th July, 15th July, 26th July and 6th August in 1992 and on 2nd July, 13th July, 24th July and 3rd August in 1993. The soil moisture content at the planting time, in both years, was near field capacity i.e., 19%. A fertilizer dose of NP 50-25 kg per hectare was incorporated into the soil at the time of seed bed preparation. Sowing was carried out with the help of man driven plough, using seed rate of 100 kg per hectare. The experiment was laid out in a split-split plot design with four replications. Main plot treatment was sowing dates and planted in series, not at random. Genotypes were as sub plot treatment and row spacings as sub-sub plot treatment in randomized complete block arrangements.

Table 2. Plant height (cm) of different soybean genotypes as affected by row spacings.

Spacing (cm)	NARC-III	NARC-IV	NARC-V	William-82
22.5	63.41	62.14	67.97	71.23
30	67	65.44	70	74.35
37.5	69.94	66.13	72.63	77.88
45	75.45	71.22	77.69	80.98

LSD (0.05) = 0.9588

Table 3. Number of Pods per plant of different soybean genotypes as affected by sowing dates.

Sowing dates	NARC-III	NARC-IV	NARC-V	William-82
3-July	30.4	35.4	33	30.31
14-July	35.05	37.31	36.66	33.71
25-July	25.36	26.16	30.14	24.44
4-August	24.65	24.11	24.43	25.31

LSD (0.05) = 0.9551

Each treatment contained 4 rows per genotype with row spaced 22.5, 30.0, 37.5, and 45.0 cm apart and 5 meter long. Herbicide, Stomp (Pendimethalin), was used before emergence and after that hand weeding was carried out manually when ever needed.

At physiological maturity a random sample of 5 plants was taken from two central rows of each plot to determine plant height and pods per plant. Data on seed yield was recorded by harvesting two central rows and was converted into kg per hectare. Data over the years were consistent, therefore, the combined analysis of variance and least significant difference at 5% probability level were used to compare the treatment means (Bricker, 1991). The analysis of variance was carried out for plant height, number of pods per plant and seed yield.

Results and Discussion

The results were consistent over the years, therefore, a combined analysis was carried out to interpret the results.

Plant height: Various soybean genotypes differed significantly from each other when planted at different sowing dates (Table 1). The tallest plants (85.3 cm) were produced by William-82 (a taller variety) when planted on 14 July, whereas, the smallest plants (53.6 cm) were produced by NARC-IV which was planted on 4 August. Generally plant height at maturity increased in case of earlier sowing dates and tallest plants were observed from the crop sown at the start and mid of July. A significant reduction in height occurred as the sowing was delayed (end July-early August). It indicated that in early sowing there was sufficient time for the genotypes to exploit the soil and environmental resources for their vegetative development compared to late sowing.

Genotype x row spacing interacted significantly for plant height (Table 2). Tallest plants (80.98 cm) were observed in William-82 at 45 cm spacing, whereas, the smallest plants were produced by NARC-IV at 22.5 cm apart rows. Generally taller plants were observed in wider rows compared to narrow rows. It could be due to greater interception of sun rays which affect better development of plant. Genotype NARC-IV was found dwarf among all the test genotypes which is its genetic characteristic.

Pods per plant: Genotype x sowing date showed significant differences for pods per plant (Table 3). Highest number of pods were observed in NARC-IV followed by NARC-V when planted on 14 July with non-significant differences among the two.

Table 4. Number of Pods per plant of different soybean genotypes as affected by row spacings.

Spacing (cm)	NARC-III	NARC-IV	NARC-V	William-82
22.5	24.74	26.36	26.59	25.69
30	28.06	29.1	30.19	27.25
37.5	29.88	32.55	32.28	29.21
45	32.78	34.96	35.17	31.63

LSD (0.05) = 0.9551

Smallest number of pods were observed in NARC-IV followed by NARC-V when planted on 4 August. Genotypes sown earlier produced greater number of pods per plant compared to late sown. The earlier sowing probably had more period compared to later dates of sowing which had smaller vegetative and reproductive period causing reduction in growth and development and ultimately produced smaller number of pods per plant. It indicated that mid July sowing is the best for higher pod bearing under Potwar conditions.

The pods per plant for various genotypes were also significantly affected by varying row spacings (Table 4). The genotype NARC-V and NARC-IV produced highest number of pods at 45 cm rows apart. William-82 produced smallest number of pods when planted at 22.5 cm rows apart and smaller at closer rows. It could be due to the reason that wider rows had intercepted more light and enjoyed more space, therefore, had greater vegetative growth resulting in increased number of pods per plant. Such similar observations have been made by Aslam *et al.*, (1993) who reported significantly smaller number of pods at 30 cm rows apart compared to 45 cm spacing.

Seed Yield: Interaction of sowing date, row spacings tested for the seed yield of 4 soybean genotypes revealed significant differences among each other (Table 5). Highest seed yield of 4264 and 4262 kg per ha was produced by genotype NARC-V and NARC-III, respectively, when planted on mid July at 45 cm rows apart. Lowest seed yield of 2010 kg per ha was recorded in William-82 when planted on 4 August at 22.5 cm rows apart.

All the test genotypes produced statistically similar and highest seed yield when planted on early or mid July at 45 cm apart rows. Similarly, all genotypes produced lowest seed yield when planted on Ist week of August at 22.5 cm spacing. It is clear from the data that three way interaction of sowing date x row spacing x genotype contributed more towards seed yield when test genotypes were planted at early dates with wider spacing. Generally delayed sowing with closer spacing resulted in significant yield reductions. The possible reason could be that early or mid July sowings were provided with longer period for vegetative growth. However, the number of pods per plant were also significantly higher for earlier sowings and this component has contributed towards final seed yield.

Table 5. Combined effect of sowing dates and row spacings on the seed yield of different soybean genotypes.

	(22.5 cm)				(30.0 cm)				(37.5 cm)				(45.0 cm)			
Sowing dates	NARC-III	NARC-IV	NARC-V	William-82	NARC-III	NARC-IV	NARC-V	William-82	NARC-III	NARC-IV	NARC-V	William-82	NARC-III	NARC-IV	NARC-V	William-82
3-July	2752	3050	3096	2566	3219	3658	3188	2714	3679	3904	3540	3446	4251	4150	4054	4051
14-July	3220	3020	2770	2867	3391	3136	3268	3163	3800	3339	3479	3376	4262	4210	4264	4047
25-July	2606	2665	2659	2100	2788	2829	2963	2413	3085	2996	3092	2658	3393	3491	3357	3008
4-Aug	2133	2166	2160	2010	2480	2560	2234	2415	2860	2856	2755	2794	3072	3146	2991	3025

LSD (0.05) = 361.1

Since shorter days start by the end of September, therefore, the sowing in late July or early August could not avail the longer sunny days. Our results are similar to Savoy *et al.*, (1992) and Quresh & Rahim (1987) who reported that earlier planting of soybean produced significantly higher grain yield than late sowing. They further mentioned that higher yields of earlier planting are ascribed to photo period response which lengthened both vegetative and reproductive stages enabling crop to produce more dry matter which was efficiently utilized by the prolonged grain filling period after flowering resulting in higher seed yield.

References

Aslam, M., N.A. Khan, M.S. Mirza and Naeemullah. 1993. Effect of different row and plant spacings on soybean yield and its components. *Pak. J. Agric. Res.*, 14:143-148.

Bricker, B. 1991. MSTAT: *A micro computer program from the design management and analysis of agronomic research experiments*. Michigan State University, MI.

Cooper, R.J. 1971. Influence of soybean production practices on lodging and seed yield in high productive environments. *Agron. J.*, 63:490-493.

Costa, J.A., E.S. Oplinger and J.W Pendleton. 1980. Response of soybean cultivars to planting pattern. *Agron. J.*, 72:153-156.

Quresh, Z. and M. Rahim. 1987. Harvest index, grain yield and biological yield of soybean as affected by sowing dates and varieties. *Pak. J. Agric. Res.*, 8: 387-393.

Savoy, B.R., J.T. Cothren and C.R. Shumway. 1992. Early season production system utilizing indeterminate soybean. *Agron. J.*, 84:394-398.

Sheikh, A.D., D. Berlee and M. Azeem. 1988. Analytics of Barani Farming System of Northern Punjab: cropping intensity, Crop-livestock Interactions and Food self Sufficiency. *PARC/CIMMYT* Paper No.88-2 p.53.

Smith, R.I. 1968. Effect of date of planting and row width on yield of soybean. *Crop., Sci. Fe. Proc.*, 28:130-133.

(Received for publication 22 April 1996)