Pah. J. Agri. Sci. Vol. 36(1-2), 1999

AGRO.PHYSIOLOGICAL RESPONSE OF SOYBEAN TO SPATIAL ARRANGEMENT AND IRRIGATION REGIMES

A.A. Kakar[1], A.H. Ansaris[2], S.M. Qayyum[3], S.N. Marri[2] & M.A. Shaikh[2]
[1,2] Agriculture Research Institutes, Sariab & Tandojam & [3]Sindh Agriculture University, Tandojam

Field trials were conducted during the years 1990-1993 at the Agriculture Research Institute, Tandojam. The spatial arrangements comprised 45x5, 45x10, 60x5 and 60x10 cm and irrigation regimes were 3, 4, 5, and 6 applied at various developmental stages. Six irrigations, applied at various growth stages (25 days of sowing, bud formation, flowering, pod initiation, seed formation and complete pod filling) resulted in significantly higher seed index, seed yield per hectare, seed oil content and dry matter accumulation. Planting patterns differed significantly for seed yield, seed index, oil content and dry matter accumulation. Although increasing inter -and intra-row spacing increased seed index and seed oil content but reduced seed yield and dry matter accumulation. Differences in seed index, seed yield per hectare and dry matter accumulation over the season were significant, whereas no significant differences in oil content were found. It is suggested that for getting better seed yield, oil content, dry matter accumulation, soybean should preferably be sown in the pattern of 45x10 cm and applied six irrigations.

Key words: agro-physiological response, spatial arrangement, irrigation management, soybean

INTRODUCTION

Among the various production practices, plauuuj,, pattern and irrigation play an important run, .: enhancing the productivity of soybean. According ll Pervez (1987) closer spacing between rows and plants gave higher seed yield than wider inter- and intra-row spacings. Egli *et al.* (1987).reported that increasing row spacing decreased seed yield, while closer spacing gave higher seed yield (Chaudhry *et al.,* 1988 and Qayyum *et al.,* 1988). Similarly, Agha *et al.* (1990) stated that wider row and plant spacings gave higher seed index and seed oil content, whereas seed yield was higher at closer row and plant spacing. Soybean irrigation 6 or 7 times at various growth stages resulted in better crop growth and higher seed yield, dry matter and oil content (Naescu *et al.,* 1984). Kadhem *et al.* (1985) found that seed yield of soybean increased significantly with irrigation applied at all growth stages, while Ramseur *et al.* (1985) stated that irrigation at flowering stage favoured reproductive development and increased seed yield and oil content. The present study was designed to assess the agro-physiological response of soybean to different spatial arrangements and irrigation regimes.

MATERIALS AND METHODS

Field trials for this study were conducted during the years 1990-1993 at the Agriculture Research Institute, Tandojam, There were four planting patterns viz. 45x5, 45x10, 60x5 and 60x10 cm and four irrigation regimes Le. 3 irrigations (25 days after sowing, bud formation, at flowering and pod initiation), 4 irrigations (25 days after sowing, at hml formation, at flowering and pod initiation), 5 irrirration« (25 days after sowing, bud formation, flowering, pod initiation and at grain formation) and 6 irrigations (25 days after sowing, bud formation, flowering, pod initiation, grain formation and at complete pod filling). The experiment was laid out in a split plot design with four replications. The net plot size measured 4x3.2m.

Homogeneous seed of a soybean variety Hampton was drilled at a rate of 50 kglha. Before 1st irrigation the seedlings were thinned to maintain intra-row spacing as per treatments. A basal fertilizer dose of 75-100-50 kg NPKlha was applied in the form of urea, SSP and SOP. **Full** dose ofP and K with a half dose of N was applied at the time of sowing, while the remaining half of N was topdressed in three equal splits each at 1st irrigation, bud formation and flowering respectively. At maturity, the seed yield and dry matter accumulation was recorded from subplots and then computed into kglha. The seed samples each comprising 100 seeds were drawn and seed index was worked out using electronic balance. The oil from 250 g seed sample from each treatment was extracted using electric miller and the content was expressed in percentage. The data collected were subjected to pooled analysis of variance. Treatment means were compared by using LSD test at 0.05P (Gomez and Gomez, 1984).

RESULTSANDDISCUSSION

Significant differences were found in seed index, seed yield/ha, oil content and dry matter accumulation due to irrigation regimes (Table 1). Six irrigations applied at various development stages (i.e. 25 days after sowing, bud formation, flowering, pod initiation, grain formation and at complete pod filling) resulted in greater seed index (14.16g), seed yield (2501 kg/ha), oil content (19.95%) and dry matter accumulation (4920.55

Table 1. Analysis of variance for seed index, seed yieldlha, oil content and dry matter accumulationlha, of soybean under different planting patterns, irrigation regimes and years

Source of variation	d.f,	Mean squares'			
		Seed index (g)	Seed yieldlha (kg)	Oil content (%)	Dry matter accumulationl ha
Years (Y)	2	9.561 **	0.218 **	1184.00 NS	416291.930**
Replications with years	9	0.341 NS	0.012 NS	406.00 NS	51591.177 NS
Irrigations (I)	3	461.473 **	17.865 **	35742.00 **	11497164.545**
YxI	6	0.756 NS	0.003 NS	643.00 NS	20607.243NS
Pooled error (I)	27	0.091	0.007	644.00	14162.818
Planting patterns (P)	3	51.922 **	1.402 **	45853.00 **	1741057.584**
YxP	6	0.232 NS	0.004 NS	821.00 NS	49357.447 **
IxP	9	4.051 **	0.122 **	5050.00 **	18769.980NS
YxlxP	18	0.210 NS	0.004 NS	562.00 NS	9174.422 NS
Pooled error un	99	0.092	0.008	599.00	11560.558

** Significant at P<O.Ollevel of probability; NS= Non-significant.

Table 2. Mean seed index, seed yieldlha, oil content and dry matter accumulation of soybean under different planting patterns, irrigation regimes and years

Parameters	Seed index (g)	Seed yield/ha (kg)	Oil content (%)	Dry matter accumulation /ha (kg)
Years				
1990	10.897 b	1967.00 a	19.206 a	4487.424 b
1991	10.642 c	1911.00 a	18.983 a	4360.623 c
1993	11.414 a	2077.00 a	19.229 a	4510.364 a
S.E.	0.038	10.00	0.100	14.876
P<0.05	0.070	-	-	30.796
P<O.Ol	0.105	-	-	41.207
Irrigation regimes				
T1 = 3 irrigations	8.115 d	1243.00 d	18.031 c	3962.664
T2 = 4 irrigations	8.599 c	1686.00 c	18.898 b	4103.932 c
T3 = 5 irrigations	13.180 b	2401.00 a	18.949 a	4820.533 a
T4 = 6 irrigations	14.162 a	2501.00 a	19.949 a	4920.553 a'
S.E.	0.075	20.00	0.201	29.752
P<0.05	0.154	41.00	0.412	60.992
P<O.Ol	0.208	55.40	0.557	82.413
Planting patterns				
SI = 45x 5 cm	9.899 d	1973.00 b	18.258 c	4504.041 b
S2 = 45 x 10 cm	10.449 c	2205.00 a	18.435 c	4684.325 a
S3 = 60 x 5 cm	11.485 b	1880.00 c	19.522 b	4384.974 c
S4 = 60 x 10 cm	12.223 a	1814.00 d	20.342 a	4235.875 d
S.E.	0.075	20.00	0.201	29.752
P<0.05	0.149	36.60	0.398	50.909
P<O.Ol	0.197	52.60	0.529	78.248

kg/ha) followed by five and four irrigations, whereas three irrigations yielded the lowest (Table 2). This indicated that six irrigations applied at various developmental stages appeared to be optimum for getting good production of soybean. These results are in line with those of Kadhem *et al.* (1985) and Ramseur *et al. (1985).*

It was further observed that seed index, seed yieldlha, oil content and dry matter accumulation were affected significantly by the planting patterns. Increasing inter- and intra-row spacing (60x10cm) correspondingly increased seed index (12.22 g) and seed oil content (20.24%). Seed yield (2206.00 kg/ha) and dry matter accumulation (4235.88 kg/ha) were found to be higher at closer row and plant (45 x 10 cm) because of increased plant population and more dry matter accumulation. By contrast, increased row spacing resulted in lower plant population but improved seed size, seed weight and oil content (Table 2). Results reported earlier by Pervez (1987, 1989) and Qayyum *et al.* (1987) are in consonance with these findings.

Effect of years was significant for all the parameters studied except oil content of seed (Table 1). This might be attributed to the variation in environmental temperature as soybean is sensitive to climatic factors particularly reduced photoperiod and air temperature, leading to reduced, vegetative growth, early maturity and thus lower production (Summerfied *et al.,* 19'83). It was further indicated that there was a significant interaction (year x spacing) for dry matter, seed index, seed yield and seed oil content. Significant interaction of irrigation and spacing showed that at wider spacing loss of moisturo was higher due to high evaporation rate than at closer spacing.

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