COMPARATIVE YIELD AND YIELD COMPONENTS OF LAND RACES AND IMPROVED SOYBEANS PLANTED ON DIFFERENT DATES

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ABSTRACT: In order to explore the production potential of land races a comparative study of three land races (Kulat brown, Kulat white and Mothi) and two improved varieties (NARC-II and Swat-84) of soybean at four planting dates (April 2, May 2, June 2 and July 2) in randomized complete block design, replicated four times was conducted at Agricultural University, Peshawar, Khyber Pakhtun Khwa, Pakistan during 2004 and 2005. Planting dates significantly affected pods plant^{-1}, seeds pod^{-1}, 100 seed weight and seed yield. Maximum pods plant^{-1}(74.2), seeds pod^{-1} (2.1) and seed yield (1459 kg ha^{-1}) was recorded for April planted crop. However, May planting produced heaviest seeds (11.5 g 100 seeds^{-1}). Yield and yield components were significantly affected by varieties. Swat-84 gave maximum seeds pod^{-1} (2.2) and seed weight (15.7 g 100 seeds^{-1}), while Kulat white produced maximum pods plant^{-1}(71.5). Improved variety NARC-II (1366 kg ha^{-1}) and land races Mothi (1322 kg ha^{-1}) and Kulat white (1281 kg ha^{-1}) produced statistically same yield. Heavier seeds were obtained in 2004 as compared to year 2005. For obtaining similar seed yield, land race Mothi should be planted in May and June. Equal seed yield and greater pods plant^{-1} of land races, suggested further exploration of land races.

Key words: Land races, planting date, pods, seeds, soybean, varieties

INTRODUCTION

Unavailability of region specific varieties and poor plant stand are of the major constraints, restricting soybean promotion and expansion. Suitable variety planted at optimum time may affect yield components and increase the yield per unit area. Review of previous research indicated that planting date affected several plant characteristics, Such as decrease in pods plant^{-1}.Khan (2001) found reduction from 165.2 to 17.3 pods plant^{-1} when planting was delayed from May to August. Rahman *et al*. (2006) demonstrated, that pods plant^{-1} in late planting was the major determinant of reduction in seed yield. . Mayhew and Caviness (1994) reported maximum seeds pod^{-1}from early planted soybean. Khan (2001) observed reduction in seeds pod^{-1}from 2.64 to 2.25 when planting was delayed from May to August. The range of seed weight per hundered seeds for several varieties reported was, 14 to 21 g 100^{-1} seeds (Rahman *et al*., 2006). Khan (2001) reported that seed yield decreased by 93.3 % when planting was delayed from May to August. Similar reduction in seed yield of various varieties with delayed planting was reported by Popp *et al*. (2002) and Rahman *et al*. (2006). Ashraf *et al.* (2010) tested 182 soybean diverse genotypes at 7 environmentally different locations and reported that seed yield ranged from 7.5 t0 15.9 g plant^{-1}. Similar variability was reported by Arshad *et al*. (2006) and Malik *et al*. (2007). Bajaj *et al*. (2008) demonstrated that seed quality traits of early maturing genotypes decreased whereas those of late-maturing genotypes improved when planting was delayed from April to June. The present study was therefore designed to evaluate potential of land races and improved varieties at different planting dates. Limited work has been reported on comparative performance of landraces and improved varieties of soybean on different dates in Peshawar valley.

MATERIALS AND METHODS

Three indigenous land races (Kulat brown, Kulat white, Mothi) and two improved soybean varieties (NARC-II, Swat-84) were planted at four planting dates (April 2, May 2, June 2, July 2) during 2004 and 2005 growing season on the same piece of land at Developmental farm Agriultural University, Peshawar. The soil of the experimental field was silty caly loam with montmorilonite clay type, low in nitrogen (0.03-0.04%) and organic matter (0.7-0.8%) and alkaline in nature. Kulat brown and Kulat white were procured from Mingora, Swat and Mothi was acquired from Mansehra, Hazara division. NARC-II was an improved variety released by the National Agricultural Research Center Islamabad and Swat-84 was a selection from Williams-82 released by Agriculture Research Institute, Mingora, Swat. Planting dates were allotted to main plot while varieties were allotted to sub plots. A plot size of 3m× 3m having six rows, 3 m long and 50 cm apart was used.

High seed rate of 95 kg ha^{-1} was used. The plants were thinned at unifoliolate leaf stage to 5cm between plants, maintaining 20 seedlings per meter row length. A basal recommended dose of 25kgN and 64kg P_2O_5 ha^{-1} was applied as diammonium phosphate (DAP) at the time of planting. Weeds were controlled twice through manual weeding and 4-6 irrigations were applied in all. Each treatment was replicated four times in randomized complete block design with split plot arrangement. Data was recorded on pods plant $^{-1}$, seeds pod $^{-1}$, seed weight and seed yield. Pods $plant^{-1}$ were counted from ten randomly selected plants. Seeds pod^{-1} were calculated from ten randomly selected pods from each treatment. Mean of five samples containing 100 seeds in each treatment were used for determining, weight of hundred seeds. Two central rows were harvested, sun dried, threshed and cleaned to determine seed yield. Data was subjected to statistical analysis according to the appropriate design and means were tested using least significant difference test (LSD) at $P > 0.05$ probability level (Steel and Torrie, 1984).During 2004 mean minimum and maximum temperature recorded was 15.2 and 29.8ºC. Mean relative humidity noted was 70 %. Total annual rainfall was 222 mm with minimum in May to July (3mm). In 2005 mean minimum and maximum temperature was 13.8 and 28ºC. Mean annual relative humidity was 80%. Total annual precipitation was 296 mm with sufficient spread from January to September.

RESULTS AND DISCUSSION

Pods $plant^{-1}$: Highest pods $plant^{-1}$(74.2) were produced by April planting followed by May planting, whereas minimum pods $plant^{-1}$(29.4) were produced by July planting (Table 1.). Pods $plant^{-1}$ decreased as planting was extended from April to July. Substantial reductions in pods $plant^{-1}$ with late planting have been reported by Elmore, (1990). Khan (2001) found a reduction from 165.2 to 17.3 pods $plant^{-1}$ when planting was delayed from May 2 to August 2. The decrease in number of pods $plant^{-1}$ with delayed planting may be attributed to the decline in number of nodes and branches $plant^{-1}$ due to shorter growing period, Rehman *et al*. (2006) demonstrated that number of pods $plant^{-1}$ in late planting was the major determinant of reduction in seed yield.

Kulat white produced maximum pods $plant^{-1}$ (71.5) followed by Kulat brown and Mothi (Table 2.). The lowest pods $plant^{-1}$(32.6) were recorded for NARC-II. Pods $plant^{-1}$ in land races were 78 % higher than improved varieties (Table 3). Junyi *et al*. (1984) reported 72 and 61 pods $plant^{-1}$ on the average for determinate and indeterminate cultivars, which supported our findings. Similarly lower number of pods in improved varieties may be due to their short plant height and short growing period. Dates x Varieties (DxV) interaction revealed that Kulat white produced maximum pods $plant^{-1}$ when planted in April (Fig. 1). Pods $plant^{-1}$ decreased when planting was delayed. Similar pattern was observed for Mothi. In Kulat brown pods $plant^{-1}$ increased when planting was advanced from April to May and then declined when planting was delayed to June and July. In NARC-II pods $plant^{-1}$ decreased when planting was delayed from April to July. However, in Swat-84, pods $plant^{-1}$ increased when planting advanced from April to May but further reduction was not consistent.

Seeds pod^{-1}: Maximum seeds pod^{-1} (2.1) were produced by April planting and minimum (1.5) by July planting (Table. 1.). May and June planting did not show significant differences in seeds pod^{-1}. The findings of Khan (2001) are in agreement with our results, who reported decline in seeds pod^{-1} from 2.64 to 2.25 with delay in planting from May to August. Seeds pod^{-1} being a genetically controlled character was less affected by factors other than the variety. Elmore (1990) believed that seeds pod^{-1} slightly increased with delay in planting from May 7 to June 15. Among the varieties, Swat-84 produced more than two seeds pod^{-1}, significantly higher than all other varieties (Table. 2). Kulat brown produced minimum seeds pod^{-1} (1.5). Statistically there was no difference in seeds pod^{-1} produced by Kulat white, Mothi and NARC-II. Improved varieties produced significantly greater number of seeds pod^{-1} as compared with land races (Table 3.). The interaction between DxV revealed that Swat-84 produced maximum seeds pod^{-1} when planted in April (Fig. 1). Seeds pod^{-1} decreased when planting was delayed from April to July. Similar pattern was observed for Kulat brown, Kulat white and Mothi. In NARC-II seeds pod^{-1} decreased when planting was advanced from April to May, but slightly increased when planting was delayed further to June and July.

Seed weight (g $100seeds^{-1}$): Maximum seed weight (11.4 g 100 $seeds^{-1}$) was recorded for May planting followed by April planting (Table. 1.). Minimum seed weight (8.4 g 100 $seeds^{-1}$) was recorded for seeds from July planted crop. Seed weight significantly declined during June and July planting. Reduction in seed weight with delayed planting was well documented and reported by several workers (Khalil *et al*., 2001; Khan, 2001 and Rahman 2006). Production of bolder seeds in May and April may be attributed to longer growth and seed filling periods compared with June and July planted crop. Maximum seed weight (15.7 g 100 $seeds^{-1}$) was recorded for Swat-84, followed by NARC-II. The smallest seeds (6.7 g $100seeds^{-1}$) were produced both by Kulat brown and Kulat white (Table 2.). The average seed weight (15.3 g $100seeds^{-1}$) in improved varieties was more than double the weight of land races (6.9 g $100seeds^{-1}$) (Table. 3). Small seed weight of land races was a varietal characteristic. The range of seed weight for several varieties reported by Elmore (1990) was 10.7 to 21.0 g $100seeds^{-1}$. The interaction between DxV revealed that

Swat-84 and NARC-II planted in May produced the heaviest seeds (Fig. 2). Seed weight decreased when planting was advanced from May to June and drastically declined when planting was further delayed to July. In Kulat brown, Kulat white and Mothi seed weight decreased when planting was delayed from April to July.

Seed yield (kg ha^{-1}): Maximum seed yield (1459 kg ha^{-1}) was given by April planted crop (Table. 1). There was no significant difference in seed yield of April and May planted crop. Significant reduction in seed yield was observed when planting was delayed to June and July. Minimum seed yield (927 kg ha^{-1}) was given by July planted crop. The reduction in seed yield due to delayed planting may be attributed to the reduction in pods plant^{-1}, and seeds pod^{-1}. Similarly, Khan *et al*. (2004) observed steady decrease in yield when planting was delayed from May to August. Moreover, reduction in seed yield with delayed planting was confirmed and reported by Bello *et al*. (1996); Popp *et al*. (2002); and Rahman *et al*. (2006). NARC-II gave maximum (1366 kg ha^{-1}) and Kulat brown gave the minimum (1133 kg ha^{-1}) seed yield (Table 2.). Seed yield of Mothi and Kulat white was statistically equal to NARC-II. Improved varieties produced higher seed yield than land races. Wide variation in varietal seed yield reported by Khan *et al*. (2004);malik *et al*. (2007) and Ashraf *et al*. (2010) suported our findings. Seed yield in land races decreased by 14.5 % when planted earlier in April and by 15 % and 31 % when planting was delayed to June and July respectively. In improved varieties, the seed yield steadily decreased by 26.8, 31.0 and 54.8 % when planting was delayed from April to May, June and July respectively. Khan *et al*. (2004) supported our findings and reported that yield in Epps (determinate) and Williams-82 (indeterminate) decreased at the rate of 58.6 kg and 163.6 kg ha^{-1} day^{-1} when planting was delayed from May to August. It is evident from the two years average that there was no difference in mean seed yield between the land races and improved varieties (Table. 3). The interaction between DxV revealed that NARC-II produced maximum seed yield when planted in April (Fig. 2). Seed yield decreased when planting was delayed. Similar pattern was observed for Swat-84. In Mothi seed yield increased when planting was advanced from April to June, thereafter reduction in seed yield was observed from June onward, . In Kulat white and Kulat brown seed yield increased when planting was advanced from April to May, but decreased when planting was delayed from May onward.

Pods plant^{-1}, seeds pod^{-1} and seed weight were the major components contributing to seed yield. Although the number of pods plant^{-1} were 78 % greater in land races than improved varieties, yet in improved varieties the seeds pod^{-1} were about 17 % higher and the seed size was almost more than double the land races, which compensated for the higher number of pods and as a result the difference in seed yield between the land races and improved varieties was decreased. Planting dates significantly affected all parameters. Pods plant^{-1}, seeds pod^{-1}, seed weight and seed yield decreased when planting was extended from April to July.

Table 1. Pods plant^{-1}, Seeds pod^{-1}, Seed weight (g 100 seeds^{-1}) and Seed yield (kg ha^{-1}) of soybean varieties as affected by planting dates over two years.

Planting Dates	Pods plant^{-1}	Seeds pod^{-1}	Seed weight (g 100seeds^{-1})	Seed yield (kg ha^{-1})
April,2	74.2 a	2.1 a	10.7 b	1459 a
May,2	68.6 b	1.7b	11.4 a	1457 a
June,2	33.7 c	1.7b	10.4 c	1234 b
July,2	29.4 c	1.5 c	8.4 d	927 c
LSD 0.05	5.4	0.132	0.124	104.0

Means of the same category followed by different letters are significant at $P > 0.05$ using LSD test.

Table 2. Pods plant^{-1}, Seeds pod^{-1}, Seed weight (g 100 seeds^{-1}) and Seed yield (kg ha^{-1}) as affected by soybean varieties over two years.

Varieties	Pods plant^{-1}	Seeds pod^{-1}	Seed weight (g 100seeds^{-1})	Seed yield (kg ha^{-1})
Kulat brown	57.9 b	1.5 c	6.7 d	1133 c
Kulat white	71.5 a	1.8 b	6.7 d	1281 ab
Mothi	57.7 b	1.7 b	7.2 c	1322 ab
NARC-II	32.6 d	1.7 b	14.8 b	1366 a
Swat-84	37.4 c	2.2 a	15.7 a	1245 b
LSD 0.05	4.7	0.164	0.178	109.0

Means of the same category followed by different letters are significant at $P > 0.05$ using LSD test.

Table 3 Pods plant^{-1}, Seeds pod^{-1}, Seed weight (g 100 seeds^{-1}) and Seed yield (kg ha^{-1}) of soybean land races vs improved varieties and 2004 VS 2005.

Soybean/Year	Pods plant^{-1}	Seeds pod^{-1}	Seed weight (g 100seeds^{-1})	Seed yield (kg ha^{-1})
Land races	62.4a	1.7b	6.9b	1245
Improved varieties	35.0b	2.0a	15.3a	1306
Year-I (2004)	52.8	1.8	10.3	1256
Year-II (2005)	50.1	1.8	10.2	1283

Means of the same category followed by different letters are significant at $P > 0.05$ using LSD test.

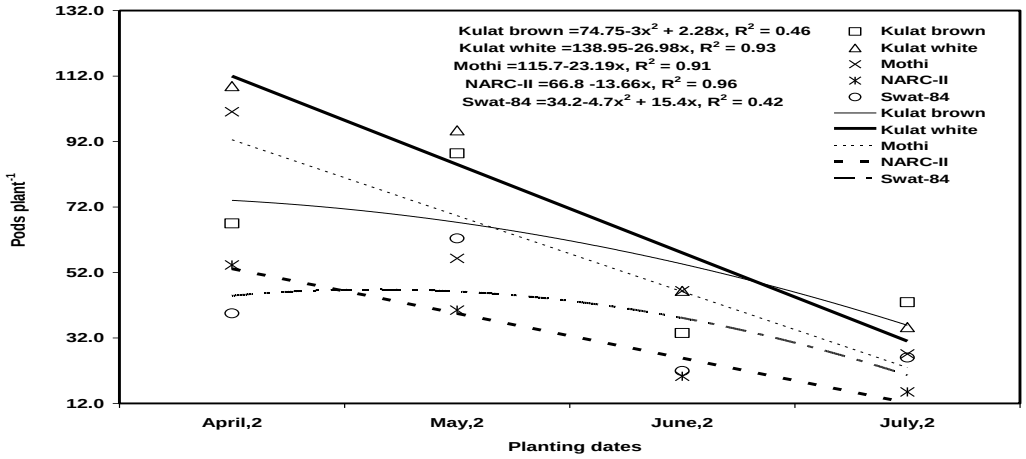

Fig 1. Pods plant^{-1}and seeds pod^{-1}as affected by planting dates over two years.

Fig 2. Hundred seed weight (g) and seed yield (kg ha^{-1}) as affected by planting dates over two years.

Conclusions: Planting dates significantly affected yield and yield components, Seed yield, and yield components values declined when planting was delayed from April to July. Varieties significantly affected yield and yield components. Maximum pods plant^{-1} were recorded for land races. Improved varieties produced maximum seed yield, hundred seed weight and seeds pod^{-1}. NARC-II and Mothi produced the highest seed yield when planted in April and June respectively.

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