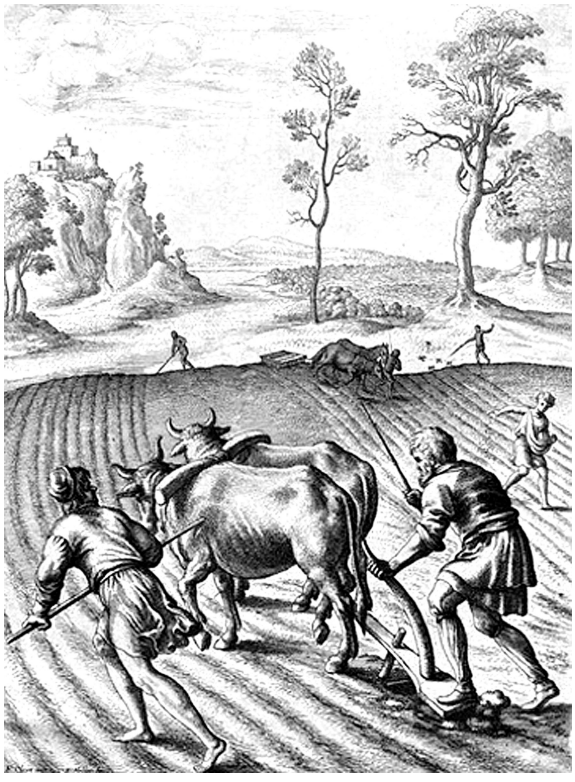
ISSN : 1812-5379 (Print)
ISSN : 1812-5417 (Online)
http://ansijournals.com/ja

JOURNAL OF AGRONOMY



ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Agronomy 1(1): 51-53, 2002 January-March 2002

Preliminary Selection of Potential Lines of Soybean

Mansab A. Khokhar, M. Ashraf, A. Fatah Soomro and Shahzad Asad
CSI, National Agricultural Research Center, Islamabad, Pakistan

Abstract: Twelve advanced exotic lines of soybean; AGS-194, NS-82-5250, Ciangman, Duiker, AGS-5, Sprito, Platte, Exp-15, Ocepar, PR-16, Decada and M-83-104 were tested for adaptability and high yield performance. Beans yield and their characteristics; days to maturity and plant height, pods per plant and 100-seeds weight, were significantly different among years and inter lines competition. An advanced line Sprito out yielded (> 3000 kg ha^{-1}) compared to other lines, therefore, picked up for National Uniform Yield Trials for wider adaptability. Lines; PR-16, Decada, AGS-5 and Ciangman were the second highest performers with bean yield of 2500 to 3000 kg ha^{-1} and selected for Intermediate Yield Trials for further evaluation. Fortunately, two line; Duiker and Exp-15 showed early maturing characters that could be crossed with high yielding lines in near future breeding programme.

Key words: Soybean, lines, selection, beans yield

Introduction

Pakistan is chronically deficient in the production of edible oils, so much so that 65 percent of the country's requirements are met through import (Anonymous, 2000-01). Since long local production of soybean is negligible and import of soybean as soy oil and soy meal has become necessary to meet the consumption requirements of the country. Soybean suffered a set back and has therefore, not been able to attain a respectable position among the cash crops. Its cultivation remained limited to a very small acreage and showed a declining trend when ever efforts were not made for its promotion.

Most of the existing cropping systems in Pakistan are cereal based. This has resulted in deterioration of soil health on one hand and loss of income from per unit of land, on the other. Inclusion of soybean in the existing cereal based cropping systems could help to improve the soil status through its nitrogen fixing ability and to disturb the continuous pest cycle. Introduction of soybean is only possible if early maturing and suitable cultivars easily adjusted in the existing system are developed. A new variety is tested/evaluated before it is released for general cultivation, therefore, plant morphological and agronomic characteristics are a pre-requisite for a variety evaluation committee (Aslam and Mirza, 1991).

Although success of a variety depends on several inter related climatic, agronomic and economic considerations, the amount and distribution of rainfall is very important factor under rainfed conditions (Khokhar *et al.*, 1985). A variety development is dependent upon sufficient genetic variability among the genotypes to permit effective selection. It is, therefore, important to select soybean lines which have the ability to tolerate to unpredictable agronomic and climatic conditions. This study was, therefore conducted to select lines for early maturing characters with good yield over the years for further evaluations in the system.

Materials and Methods

The study was conducted under National Agricultural Research System (NARS) at National Agricultural Research Center (NARC), Islamabad during, 1998, 1999 and 2000. The site is located at 34° North and 73° East at 526m above see level. The soil was sandy loam, moderately well drained having pH 7.9 with below 0.8 % organic matter, 2.0ppm phosphorous and 78ppm potassium. A set of twelve lines of soybean was planted in a randomized complete block design (RCBD) with three replications. Following were the lines; AGS-194, NS-82-5250, Ciangman, Duiker, AGS-5, Sprito, Platte, Exp-15, Ocepar, PR-16, Decada and M-83-104.

Soybean was seeded in the first week of July at a planting rate of 40kg ha^{-1}. Row spacing was kept as 0.45m while plant to plant spacing were maintained at 5cm. All other cultural practices including ploughing and planking were kept normal as recommended for these soils. Chemical fertilizers; NPK were broadcast @ 18:46:50kg ha^{-1} at the time of seed bed preparation. Weeds were controlled manually and through mechanical means. Attack of hairy caterpillar was controlled by applying Karate (Lembda Cyhalothrin) @ 625ml ha^{-1} (Aslam *et al.*, 1993). Agromet data recorded by Water Resources Research Institute (WRRI), NARC, Islamabad were obtained to see its relation with growth and yield of soybean planted under rainfed conditions is presented in Table 1. Experiment was harvested and threshed in the second week of October. Agronomic characteristics like days to maturity, plant height, pods per plant, 100 seeds weight and beans yield were recorded. Days to maturity were determined by subtracting the date of sowing from the date of maturity when approximately 95 % of the pods were matured (by visual observation). Plant height of ten plants was measured from the soil surface to the flowering point of each plant at maturity, therefore, determined the plant height as mean of ten plants. Total number of pods on the main stem and total number of pods on all branches were counted from ten plants for mean.

100-seeds of each line was counted randomly and weighed to

Table 1: Normal rain (1961-1990) and actual rain obtained between July to October 1998, 1999 and 2000 at NARC, Islamabad

Month	Normal (mm)	Actual (mm)			Deviation from Normal (mm)		
		1998	1999	2000	1998	1999	2000
July	267	294	197	250	27	-70	-17
August	310	310	213	279	0	-97	-31
September	98	223	157	55	125	59	-43
October	29	63	00	00	34	-29	-29
Total	704	890	567	584	186	-137	-120

Source: WRRI, NARC, Islamabad

determine seed weight. Beans yield after drying the seeds, adjusted to a moisture content of 13 % for each plot. A combined analysis of year and treatment for yield data was done in a randomized complete block design with the help of MSTAT statistical procedures. Difference among treatment means was computed using the least significant difference (LSD) method at 0.05 probability level. Correlation among lines for yield and yield components was also determined.

Results and Discussion

The statistical analysis of the data revealed that performance of the potential lines for all agronomic parameters was significantly different over the years. Similarly, inter line competition also showed significantly different response (Table 2). Interaction for days to maturity, plant height, pods per plant, 100 - seeds weight and beans yield between year and line was also significant. Coefficient of variation for all yield and yield components is varied. It is 1.18 % for days to maturity, 7.49 % for plant height, 18.24 % for pods per plant, 14.51 % for 100-seeds weight and 8.29 % for beans yield. Soybean crop matured in 102 days in 1998, 99 days in 1999 and it took 101 days to mature during 2000. Maximum plant height, pods per plant and 100-seeds weight were recorded in 1998. Plants remain short with 66 cm in 1999. Less number of pods (41) and low 100-seeds weight of 11.33gm was recorded during 2000. Beans yield, 3232kg ha^{-1} was obtained in the year 1999, 2466kg ha^{-1} in 2000 and 1764kg ha^{-1} in 1998. Inter-varietal competition revealed that lines; Ocepar, Duiker and Exp-15 were early maturing with 94 to 95 days and lines; NS-82-5250, Sprito, AGS-194, N-83-104 and Ciangman were medium maturing with 97 to 100 days. While lines; AGS-5, Platte, Decada and PR-16 took above 100 days to mature (Table 2). Lines having plant height below 70 cm were ranked as short stature, lines with 71 to 80 cm height were of medium height and lines having above 80 cm plant height were stated as tall lines. Lines; Duiker, Ciangman, M-83-104 and Exp-15 have short plant. Lines; AGS-194, Ocepar, AGS-5 and Sprito have medium height and lines; Platte, Decada, PR-16 and NS-82-5250 have tall plants. Less number of pods per plant (< 60) were produced by Ocepar and M-83-104. Pods number from 61 to 65 were recorded in lines; Decada, Duiker, NS-82-5250, AGS-194 and PR-16. Lines; AGS-5, Exp-15 Ciangman, Sprito and Platte exhibited above 65 pods per plant. Four lines; Ocepar, M-83-104, Duiker and AGS-5 were light in weight (below 12 grams per 100 beans). Medium weight (12 - 13 grams) lines were Platte, AGS-194, Ciangman and NS-82-5250 while lines Decada, Exp-15, PR-16 and Sprito produced above 13g per 100-seeds weight. Yield results showed very interesting picture of this exotic material. Only one line Sprito could cross the figure of 3000kg ha^{-1}. Four lines; Ciangman, AGS-5, Decada and PR-16 produced 2500 to 3000kg ha^{-1} of beans. Seven lines even could not cross the bench mark (2500kg ha^{-1})of the beans yield. The correlation among all the yield components was significantly positive. A positive association between days to maturity and plant height, weak positive among days to maturity and pods per plant, 100- seeds weight and beans yield was noticed. Plant height showed weak positive association with pods per plant, 100-seeds weight and beans yield. Pods per plant also have positive but weak correlation with 100-seeds weight and beans yield. A strong positive association between 100-seed weight and beans yield was observed (Table 3). These findings are in conformity with those of Amanullah and Hatam (2000).

Above normal rain in the month of September, 1998 at late reproductive stages might have contributed towards delay in maturity compared to the years 1999 and 2000. Number of days between stages can also be influenced by temperature, day length, variety and other agronomic factors (Fehr and Caviness, 1977). While Amanullah and Hatam (2000) stated that difference in days to maturity could be the result of photoperiod where different lines respond differently to a particular photoperiod. Similarly, tall plants obtained during 1998, might be the contribution of good and timely rainfall in the early vegetative stages compared to 1999 and 2000. Rainfall was below normal during last two years at Islamabad (Table 1). Above normal rain and ambient temperature which ranges from 30.1 (maximum) to 14.5 °C (minimum) during 1998 might have played an important role to enhance the days to maturity, plant height, number of pods per plant and 100-seeds weight. Heavy rainfall during 1998 at late reproductive stages,

Table 2: Soybean yield and yield components comparison among different advanced lines over the years under rainfed conditions

Parameters	Days to maturity (days)	Plant height (cm)	Pods $plant^{-1}$ (No.)	100-seeds weight (gm)	Beans yield (Kg ha^{-1})
Year (Y)					
1998	101.92a	87.28a	85.72a	13.83a	1784.33c
1999	98.67c	66.39c	68.47b	13.26a	3232.06b
2000	100.53b	78.86b	41.03c	11.33b	2465.50a
LSD (0.05)	0.557	2.729	5.580	0.874	97.200
Advance lines (AL)					
AGS-194	98.56f	71.78cd	63.67bcd	12.39bcd	2455.89de
NS-82-5250	97.89f	94.00a	62.44bcd	12.94bc	2287.00efg
Ciangman	100.33de	69.33de	71.33ab	12.52bcd	2610.44bcd
Duiker	94.78g	66.00e	61.11bcd	11.24cd	2201.56fg
AGS-5	101.22d	76.11c	65.22bcd	11.86cd	2637.22bcd
Sprito	97.89f	77.22c	77.00a	15.48a	3005.89a
Platte	104.89c	85.11b	77.33a	12.33bcd	2475.78cde
Exp-15	94.89g	69.44de	66.44abc	13.83ab	2476.67cde
Ocepar	94.44g	73.78cd	54.33d	10.86dcd	2326.22ef
PR-16	110.67a	90.00ab	64.67bcd	15.46a	2683.22b
Decada	109.11b	88.00b	61.00bcd	13.76ab	2655.22bc
M-83-104	99.78e	69.33de	56.33cd	11.01d	2112.44g
LSD (0.05)	1.114	5.457	11.160	1.748	194.4
Interaction (Y x AL)	**	**	*	*	**
C.V. (%)	1.18	7.49	18.24	14.51	8.29

Means with the same letter are not significantly different at 0.05 probability level

Table 3: Soybean yield and yield components correlation among each other

Parameters	Days to maturity	Plant height	Pods per plant	100-seed weight	Beans yield
Days to maturity		0.647	0.485	0.457	0.391
Plant height	0.647		0.136	0.185	0.263
Pods per plant	0.185	0.136		0.515	0.659
100-seed weight	0.457	0.457	0.515		0.781
Beans yield	0.391	0.263	0.659	0.781	

full pod (R4) and beginning seed (R5) described by Fehr and Caviness (1977) might have decreased beans yield compared with years 1999 and 2000. These results are in accordance with the findings of Faware *et al.* (1998) and Raut *et al.* (1997). They obtained more yield from early maturing varieties, followed by medium and late maturing varieties, respectively. Similarly, Weilenman *et al.* (2000) reported that an enhancement of biological yield and harvest index could lead to an increase in economic yield from soybean varieties of maturity group III and VI. It is concluded that due to high yielding and early maturing characteristics, an advanced line Sprito could go directly in the National Uniform Yield Trials to be tested for wider adaptability. While lines; PR-16, Decada, AGS-5 and Ciangman would be further tested in an Intermediate Yield Trials. On the other hand, all remaining lines would be kept in the preservation laboratory of Plant Genetic Resource Institute, NARC, Islamabad. Among these, two lines; Duiker and Exp-15 have early maturing characters that could be obtained through crossing with high yielding line in near future by the plant breeders.

References

Amanullah and M. Hatam, 2000. Performance and nodulation efficiency of soybean line. Pak. J. Biol. Sci., 3: 1812-1823.

Anonymous, 2000-01. Economic Survey of Pakistan. Economic Advisor's Wing. Finance Division, Islamabad.

Aslam, M., M.S. Mirza, M. A. Khokhar, S. M. Shah, N. Javed and Naeemullah, 1993. Crop Production Bulletin No. 3, Soybean Production, PARC, Islamabad.

Aslam, M. and M. S. Mirza, 1991. Proposal of early maturing and high yielding lines of soybean. PARC, Islamabad.

Faware, S. p., G. B. Halvankar and V. M. Raut, 1998. Stability of soybean lines under different plant densities and growth conditions. Soybean Genetics Newsletter, 25: 88-89.

Fehr, W.R. and C.E. Caviness, 1977. Stages of soybean development. Special report 80. Iowa State University, Ames, IA, USA.

Khokhar, M.A., R. Amin and S. Ahmad, 1985. Effect of different tillage and planting on the yield of soybean under rainfed conditions of Pothwar uplands. J. Agric. Res., 23: 11-15.

Raut, V.M., S.P. Taware, G.B. Halvankar and V.P. Patil, 1997. Stability analysis for oil and yield in soybean. Soybean Genetics Newsletter, 24: 92-95.

Weileman, D.E., M. E. Tau and J. Luquez, 2000. Variations of biomass, economic yield and harvest index among soybean line of MG-III and MG-IV in Argentina. Soybean Genetics Newsletter, 27: 3.