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Evaluation and selection of promising soybean lines in diverse environments

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Abstract

An experiment was conducted to evaluate the performance of eight selected soybean lines along with two check varieties in respect of maturity period, seed yield and yield contributing characters at five different locations during rabi season of 2007. Except number of seeds per pod, other yield contributing characters, seed yield and maturity period showed significant variations both in individual location and combined over locations. Among the lines and check varieties BAU-S/64 produced the highest number of branches per plant (4.7) while the check variety Sohag produced the lowest (2.8). Bangladesh soybean-4 produced the highest number of pods per plant (61). The seed yield of BAU-S/69 was the highest (2920 kg/ha) followed by BAU-S/64 (2721 kg/ha) while BAU-S/5 produced the lowest seed yield (2049 kg/ha). Among the five locations, the highest mean seed yield of 3167 kg/ha was produced at Chandpur followed by Mymensingh (2790 kg/ha) and Noakhali (2538 kg/ha). The lowest seed yield was recorded at Ishurdi (1363 kg/ha).

Keywords: Soybean, Performance, Promising lines, Environments

Introduction

Soybean (*Glycine max* (L.) Merr.) is a leguminous crop and has a high value in agriculture as a good source of protein and vegetable oil. It also improves soil fertility through fixing nitrogen. In Bangladesh, soybean is mostly used as poultry feed and for making nutritious food dishes and confectionary items such as soyadal, soyakhechuri, soyabread, soyamilk and so on (Mondal and Wahhab, 2001; Rahman, 2003). Soybean can also play a vital role in balancing the protein deficiency of our diet. Soybean has high protein, which is 1.5 -2.0 times than other pulses, 4 times than egg and wheat, 6 times than rice grain and 12 times than milk. Soybean contains 3% lesithine, which is helpful for brain development. It is also enriched in calcium, phosphorus, Vitamin A, B, C and D (Rahman, 1982).

Due to the rice based cropping patterns, the areas under oilseeds, pulses and some other crops has been declining since 1970. At present, the domestic oilseed production is only 0.63 million tons, which gives only 0.20 million tons of edible oil and can meet only 25-30% of our requirement (Hossain and Rahman, 2008). To fulfill the requirement, Bangladesh is to import 1.20 million tons of edible oil annually at a cost of nearly Tk. 40 billions. There is a possibility of producing 1.6-1.8 million tons of soybean from 0.7 million hectares of char land and from other seasonal fellow land in Bangladesh.

There is a significant variation in yield and yield contributing characters and other agronomic characteristics of soybean genotypes. These variations have been found to increase or decrease when grown under different climatic and soil conditions even within limited latitude and under different climatic conditions influenced by different latitudes (Whigham, 1975). Genetic factors alone cannot control these variations. Sources of seeds are also a cause for variations (Hung and Shanmugasundaram, 1979) which complicated the entire issue of genotypes expressivity, but it does not happen always (Rahman *et al.*, 1977). Development of high yielding variety requires information on variation among the breeding materials for yield and yield contributing characters. Therefore, the importance of evaluating advanced soybean lines at different agro-ecological conditions and screen out the good ones beyond descriptioni. So, the present experiment has been undertaken to evaluate the performance of eight selected promising soybean lines as compared to two check varieties in respect of maturity period, seed yield and yield contributing characters at five different locations.

Materials and Methods

Eight promising soybean lines namely BAU-S/5, BAU-S/21, BAU-S/54, BAU-S/64, BAU-S/69, BAU-S/70, BAU-S/80 and BAU-S/83 along with two check varieties Sohag and Bangladesh soybean-4 (BDS-4) were collected from the Department of Genetics and Plant Breeding, Bangladesh Agricultural University (BAU), Mymensingh. These materials were put into trial at Bangladesh Institute of Nuclear Agriculture (BINA) hqs. farm, Mymensingh, BINA sub-station farms at Ishurdi and Magura, and at Haimchar upazila of Chandpur and sadar upazila of Noakhali districts during rabi season of 2007-'08. The trial was laid out in a randomized complete block design with three replications. Spacing was 30 cm between rows and 5-7 cm between plants in a row. Unit plot size was 19.5 m^2 (5 m x 3.9 m). Sowing was done within the last week of December 2007 and first week of January 2008. Recommended production practices including application of fertilizers were followed to ensure normal plant growth and development. Data on various characters, such as plant height, number of primary branches and pods per plant, number of seeds per pod were taken from 10 randomly selected plants from each plot. Maturity period was counted when stem and pod of each plot turned into yellowish brown colour and almost all the leaves were shed in each plot. Seed yield of each plot was recorded and then converted into kg/ha. Appropriate statistical analyses were performed with the plot mean data of each character. Mean differences of different traits were tested by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Mean values for different characters of five individual locations and combined over locations of the trial are presented in Table 1. Except number of seeds per pod all other characters showed significant variations both in individual location and combined over locations.

Four lines i. e., BAU-S/54, BAU-S/64, BAU-S/69 and BAU-S/83 produced significantly taller plants than the other four lines and the check varieties, which showed similarity with the findings of Chandankar *et al.* (2002). BAU-S/64 produced the highest number of branches (6.1) in Chandpur while the lowest was found in the control variety Sohag (2.2) at Magura. Combined analysis over five locations showed that BAU-S/64 and BAU-S/69 produced higher number of branches per plant i. e., 4.7 and 4.1, respectively while the control variety Sohag produced only 2.8 branches per plant. Such variation was also observed by Saka *et al.* (1996).

Number of pods per plant, the important yield contributing character in legume, was the highest in BDS-4 (74) at Mymensingh and the lowest in BAU-S/21 (28) at Ishurdi. Combined means over locations showed that BDS-4 produced the highest number pods per plant (61) followed by BAU-S/64 and BAU-S/69 (51) while the lowest number in BAU-S/83 (38). These variations are in agreement with the findings of Raut *et al*. (2001). Number of seeds per pod, the another important yield component, showed insignificant difference among the lines in all the individual location except at Ishurdi. At Ishurdi, BAU-S/69, BAU-S/70 and BAU-S/80 produced the highest number of 2.9 seeds per pod while the lowest number was in BAU-S/54 (2.3).

BDS-4 took the shortest maturity period (99 days) at Noakhali while the highest of 149 days was recorded in BAU-S/69 at Ishurdi. Combined means over locations showed that BDS-4 had the shortest maturity period (108 days) followed by BAU-S/21 and BAU-S/80 (109 days) while BAU-S/5 needed the longest maturity period of 128 days. Such variations in maturity are in agreement with the findings of Danee *et al.* (2002).

BAU-S/69 produced the highest seed yield of 4144 kg/ha at Mymensingh while BAU-S/70 produced the lowest seed yield (1040 kg/ha) at Ishurdi. Combined means over locations showed that BAU-S/69 produced the highest seed yield of 2920 kg/ha followed by BAU-S/64 (2721 kg/ha). BAU-S/21, BAU-S/80 and BDS-4 produced statistically insignificant seed yield with each other i. e., 2485 kg/ha, 2523 kg/ha and 2552 kg/ha, respectively. These results are in agreement with the results of Saka *et al.* (1996) and Rahman *et al.* (1996).

Table 1. Mean performance of the soybean lines in individual location and combined over locations for different characters

Advanced lines/varieties/ Locations	Plant height (cm)	No. of branches/ plant	No. of pods/plant	No. of seeds/pod	Days to maturity	Seed yield (kg/ha)
Isihurd						
BAU-S/5	74c	3.2abc	45ab	2.7ab	147b	1150ef
BAU-S/21	62def	2.5cd	28d	2.6ab	120e	1483b
BAU-S/54	77bc	2.7bcd	45ab	2.3b	140c	1283cd
BAU-S/64	87ab	3.7a	42abc	2.6ab	147b	1250cde
BAU-S/69	76c	3.4ab	30d	2.9a	149a	1500b
BAU-S/70	73cd	3.1abcd	32cd	2.9a	120e	1040f
BAU-S/80	53f	2.8bcd	44abc	2.9a	118f	1650a
BAU-S/83	92a	2.7bcd	34bcd	2.5b	147b	1200de
Sohag*	58ef	2.8bcd	34bcd	2.7ab	124d	1333c
BDS-4*	67cde	2.3d	48a	2.8a	114g	1737a
Magura						
BAU-S/5	72cd	3.7bc	45ab	2.8	121a	1950f
BAU-S/21	64d	2.6c	50ab	2.6	109e	2530c
BAU-S/54	97b	2.9ab	48ab	2.4	115c	2109e
BAU-S/64	99b	5.5a	52ab	2.7	119b	2450cd
BAU-S/69	105b	4.8ab	53ab	2.6	116c	2689b
BAU-S/70	81c	2.3c	55ab	2.6	106f	2767ab
BAU-S/80	59d	2.8c	56ab	2.6	107f	2856a
BAU-S/83	132a	5.6a	40b	2.6	112d	1995ef
Sohag*	69cd	2.2c	50ab	2.6	109e	2119e
BDS-4*	79c	4.4ab	61a	2.8	106f	2378d
Noakhali						
BAU-S/5	57ef	3.7b	38b	2.7	117a	1896e
BAU-S/21	52fg	2.6de	48ab	2.5	101de	2606cd
BAU-S/54	77a	3.6bc	42b	2.4	112b	2565cd
BAU-S/64	69bc	4.8a	47ab	2.7	109c	2815ab
BAU-S/69	71abc	5.1a	48ab	2.8	108c	2709bc
BAU-S/70	50fg	3.0cde	46ab	2.6	102d	2484d
BAU-S/80	66cd	3.2bcd	51ab	2.7	103d	2859ab
BAU-S/83	76ab	3.2bcd	39b	2.4	111b	2074e
Sohag*	44g	2.5e	50ab	2.6	100ef	2917a
BDS-4*	60de	3.3bc	58a	2.8	99f	2459d
Chandpur						
BAU-S/5	57e	3.5bc	40cd	2.5	118a	3100cd
BAU-S/21	49f	2.9bc	50bcd	2.5	103e	3270bc
BAU-S/54	77cd	4.2b	46bcd	2.5	116b	3120cd
BAU-S/64	83b	6.1a	58ab	2.8	117b	3409ab
BAU-S/69	90a	3.6bc	53abc	2.6	117b	3555a
BAU-S/70	61e	2.4c	46bcd	2.6	106d	3017de
BAU-S/80	46f	3.4bc	50bcd	2.6	104e	3083cd
BAU-S/83	81bc	4.0bc	37d	2.4	112c	2785e
Sohag*	49f	3.2bc	48bcd	2.5	104e	3089cd
BDS-4*	75d	3.7bc	65a	2.8	102f	3237bcd
Mymensingh						
BAU-S/5	61d	2.9	37bc	2.8	139a	2148e
BAU-S/21	67cd	4.0	37bc	2.7	113e	2533d
BAU-S/54	94ab	3.8	60ab	2.8	141a	2617d
BAU-S/64	105a	3.5	58abc	2.8	139a	3681b
BAU-S/69	108a	3.9	69a	2.9	139a	4144a
BAU-S/70	64d	3.7	43bc	2.6	117cd	2632d
BAU-S/80	52d	3.3	36bc	2.5	115de	2165e
BAU-S/83	81bc	4.1	41bc	2.9	126b	2571d
Sohag*	63d	3.3	42bc	2.6	116cde	2460d
BDS-4*	95ab	4.4	74a	2.9	119c	2947c

Table 1. Contd.

Advanced lines/varieties/ Locations	Plant height (cm)	No. of branches/ plant	No. of pods/plant	No. of seeds/pod	Days to maturity	Seed yield (kg/ha)
Combined means over locations						
BAU-S/5	64d	3.4cde	41b	2.7	128a	2049e
BAU-S/21	59e	2.9ef	43b	2.6	109f	2485c
BAU-S/54	84b	3.8bc	48ab	2.5	125c	2337d
BAU-S/64	89ab	4.7a	51ab	2.7	126b	2721b
BAU-S/69	90a	4.1b	51ab	2.8	126b	2920a
BAU-S/70	66d	2.9ef	44b	2.7	110e	2387d
BAU-S/80	55e	3.1def	47b	2.7	109f	2523c
BAU-S/83	92a	3.9bc	38b	2.6	122d	2125e
Sohag*	57e	2.8f	45b	2.6	111e	2383d
BDS-4*	75c	3.6bcd	61a	2.8	108g	2552c
Location means						
Ishurdi	72c	2.9b	38b	2.7	133a	1363e
Magura	86a	3.9a	51a	2.6	112c	2383d
Noakhali	62d	3.5a	47a	2.6	106e	2538c
Chandpur	67cd	3.7a	49a	2.6	110d	3167a
Mymensingh	79b	3.7a	49a	2.7	126b	2790b

* indicates check variety

Among the five locations, the highest mean seed yield of 3167 kg/ha was produced at Chandpur followed by Mymensingh (2790 kg/ha) and Noakhali (2538 kg/ha) with higher number of pods per plant. Ishurdi produced the lowest seed yield of 1363 kg/ha with the highest maturity period of 133 days. Over the five locations, BAU-S/69 was the best performer followed by BAU-S/64 than the other lines and the check varieties regarding seed yield and yield contributing characters.

It could be concluded that more trials both at research field and farmer's field with wider agro-ecological regions would give more precise information to select the best one.

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