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Genetic study of advance breeding lines of soybean under Excess Monsoon Rainfall condition in Kymore Plateau zone of Madhya Pradesh

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Abstract - Soybean is the principal oilseed crop in India contributes 43 % oilseeds and 28 % edible oil production in the country. Rainfall and temperature are most important factors influencing the crop yield of soybean (Reddy, 2014). In recent years soybean productivity has been turn down due to impact of alteration in rainfall and climate. Prolong excessive rainfall in Madhya Pradesh rose major trouble to the growth and productivity of soybean. In *kharif* 2013, early and excessive monsoon rainfall occurred in M.P. and total rainfall recorded in Jabalpur from June 2013 to Oct 2013 was 2400 mm. Present experiment was carried out comprising of 50 promising soybean breeding lines sown during *kharif* 2013 in RBD with three replications at Seed Breeding Farm, JNKVV, Jabalpur, M.P. Observations were recorded for phenological traits & fourteen morphological traits. Statistical analysis revealed that seed yield per plant have highest phenotypic (PCV) and genotypic coefficient of variation (GCV) followed by number of pod per plant, number of seeds per plant. High heritability with high genetic advance was found for number of pods per plant, seed yield per plant biological yield per plant For tolerance to high and excessive rainfall, fifteen soybean breeding lines *viz*., JS 97-52, JS 95-60, JS 20-29, JS 20-34, JS 20-41, JS 20-50, JS 20-69, JS 20-71, JS 20-75, JS 20-82, JS 20-89, JS 20-98, JS 20-99, JSM 207 and JSM 302 were identified, these all have shown fair yield under excessive rainfall conditions.

Keywords- Soybean, Mutant Lines, Varieties and Genotypes

INTRODUCTION

Soybean [*Glycine max* (L.) Merill] is the leading oilseed crop in India contributes 43 % oilseeds and 28 % edible oil production in the country. Madhya Pradesh contribution has always been largest and substantial in respect of area and production of country's total. At present, in India soybean is being grown in 12.334 million hectare with 12.939 million tonnes of production and productivity of 1079 kg ha-1. In Madhya Pradesh, it is grown in 6.230 million hectare with 5.941 million tones of production and productivity of 950 kg ha-1 (SOPA, 2013).This fact has established Madhya Pradesh as synonym of SOYA STATE. Rainfall and temperature are most imperative features influencing the crop growth, reproductive stages and yield of soybean (Reddy, 2014). In recent years soybean productivity has been declining due to impact of climate change, high rainfall and fluctuations in seasonal temperature. Continued excessive rainfall in Madhya Pradesh raised major concerns to the growth and productivity of soybean. In 2013, around 47% area of the country has received excess rainfall comprising of central India (USDA, 2013). Therefore, it becomes crucial to know the status of variability, heritability, genetic advance, association, direct and indirect effect of various traits under study in these advance breeding lines for the assessment of genetic improvement and selection of lines which can with stand high rainfall conditions.

MATERIAL METHOD

Present investigation was carried out consisting of 50 advance breeding lines of soybean which includes mutant lines, varieties, and genotypes. The experiment was conducted during *kharif* 2013 in RBD with three replications at Seed Breeding Farm, JNKVV, Jabalpur, M.P. Observations were recorded for phenological traits & ten morphological traits. In *kharif* 2013, early and widespread monsoon rainfall occurred in M.P. and total rainfall recorded in Jabalpur from June 2013 to October 2013 was 2400 mm which was about twice of the average rainfall (Table 1).

RESULT & DISCUSSION

The phenotypic coefficient of variation (Table.2) was significantly higher in magnitude than that of genotypic coefficient of variation for all the characters under study. Number of pods per plant have highest phenotypic (PCV) and genotypic coefficient of variation (GCV) followed by seed yield per plant, number of seeds per plant, biological yield per plant, number of pod cluster and number of branches per plant. (Shrivastava and Shukla, 1998) Moderate GCV and PCV was recorded for plant height and

number of seeds per pod. Low PCV and GCV were found for 100 seed weight and phonological traits (Karad *et al.* 2005 and Parameshwar, 2006). Highest heritability (Table.2) was obtained for number of seeds per plant followed by number of pods per plant, seed yield per plant, biological yield per plant" and harvest index. Moderate heritability was recorded for the traits plant height, number of seeds per pod and phonological traits. The highest genetic advance as percentage of mean (at 5% Selection intensity) was recorded for number of pod per plant, number of branches, number of seeds per plant, seed yield per plant, biological yield per plant' medium for plant height and number of seeds per pod (Gohil *et al.* 2006). Indirect selection using one or more of the traits may be useful to the breeder to formulate appropriate plant ideotype for selection of the genotype which can tolerate high rainfall conditions. In present study, phenotypic correlation (Table 3) of seed yield per plant was positive and significant with vegetative phase, number of pods per plant, number of pod cluster per plant, number of seeds per plant, number of seeds per pod, biological yield per plant and harvest index (Aditya *et al.* 2011). This suggests while selecting for improvement in seed yield these characters should be kept in mind provided the characters showing significant association with yield. Present findings revealed that by making selection and improvement for a particular character simultaneous improvement in the associated character(s).

On the basis of analysis and comparing the seed yield (Table 4) fifteen soybean genotypes *viz*., JS 97-52, JS 95-60, JS 20-29, JS 20-34, JS 20-41, JS 20-50, JS 20-69, JS 20-71, JS 20-75, JS 20-82, JS 20-89, JS 20-98, JS 20-99, JSM 207 and JSM 302 were identified, which has shown fair yield under high rainfall condition (Nigam *et al*, 2012). Highest seed yield per plant was recorded by JS 20-99 (59.80 g), JS 20-82 (54.19 g) and JSM 302 (52.42 g). These genotypes are able to provide considerable yield in excessive rainfall conditions. These lines are being used in the breeding crosses this year and also considered for further assessment in respect of economic and physiological traits.

CONCLUSIONS

Positive and significant traits viz., number of pods per plant, number of pod cluster per plant, number of seeds per plant, harvest index, biological yield per plant, and number of seeds per pod exhibited positive significant association with seed yield, these traits must be taken into consideration for further breeding under excessive rainfall conditions.

Fifteen soybean lines which were identified on the basis of seed yield performance under excessive rainfall conditions can be used in the breeding crosses and also considered for further assessment in respect of economic and physiological traits.

SUGGESTIONS FOR FURTHER WORK

1. Identified lines should be exploited and evaluate over years and locations to get a better scenario for breeding against excessive rainfall conditions.
2. Crop ideotype for excessive rainfall conditions can be developed using findings of the present study.

REFERENCES

[1]. Aditya, J.P., Bhartiya P and Bhartiya A (2011). Genetic variability, heritability and character association for yield and component characters in soybean [*G. max* (L.) Merrill]. *J. of Central European Agri*., **12**(1): 27-34.

[2]. Karad, S.R., Harer P.N., Kadam D.B. and Shinde R.B. (2005). Genotypic and phenotypic variability in soybean [*Glycine max* (L.) Merrill]. *J. of Maharashtra Agril. Univ.*, **30**(3): 365-367.

[3]. Nigam D., Khare D. and Shrivastava A.N. (2012). Excessive moisture tolerance in soybean. *Soybean Research*. *J*., **10**: pp 1-10.

[4]. Reddy S.I.V (2014). Impact of climate change on soybean production. SOYCON 2014, *Soybean Research J*., pp 203.

[5]. Shrivastava, M.K. and Shukla R.S. (1998). Genetic analysis for yield and its components in soybean under different environments. *Crop Res. (Hisar),* **16**(2): 196-201.

[6]. Parameshwar, M. G. (2006). Genetic investigations in soybean [*Glycine max* (L.) Merrill]. *M.Sc. (Ag.) Thesis*, University of Agriculture Sciences, Dharwad.

[7]. Excess Monsoon Rainfall Raise Concerns for India's 2013/14 Soybean Productivity, USDA http://www.pecad.fas.usda.gov/cropexplorer**,** www.sopa.org

Table 1 Meteorological data recorded at Jabalpur, Kharif 2013

Standard weeks	Months and Dates	Temperature		Sun Shine (hrs)	Rainfall (mm)	Relative Humidity		Wind Speed	Vapor Pressure (MM)		Rainy days
		Max.	Min.			Mor.	Eve.		Mor.	Eve.	
23	June 4-10	39.7	25	8.5	30.4	68	38	7.8	18.8	18.3	3
24	June 11-17	32.8	23.7	3.8	84	89	63	7.3	22.2	21.8	4
25	June 18-24	32.1	23.6	6.3	138.3	89	67	7.4	22.2	22.2	4
26	June 25 to July1	29.3	23.3	2	232.4	92	88	9.2	21.6	22.4	5
27	July 2-8	29.2	23.5	3.9	42.2	89	75	5.9	21.9	22.5	3
28	July 9-15	30.5	24	2.9	214.1	93	81	6.3	23.6	23.7	6
29	July16-22	31.1	24.3	3	150.7	95	79	5.8	23.6	25.4	5
30	July23-29	29.2	23.6	3	122.1	93	84	7.6	22.8	23.9	6
31	July 30 to Aug.5	30	23.9	3.5	38.9	93	78	7	22.7	24	5
32	Aug. 6-12	28.7	23.6	3.1	210.2	95	80	6.7	22.7	23.1	4
33	Aug. 13 –19	29.4	23.2	3	687.6	95	80	4.2	23	23	5
34	Aug. 20- 26	27.9	23.3	3.1	184.3	96	83	6.8	22.3	23.7	5
35	Aug.27to Sept.2	28.4	23.2	4.1	57.2	94	81	5.9	22.1	22.9	3
36	Sept. 3-9	31.4	23.1	7.2	86.8	92	64	4.4	21.6	21.2	2
37	Sept. 10-16	32.6	23.7	7.9	0	89	63	2.8	22.4	23	0
38	Sept. 17-23	26.6	20	3.5	11	80	62	3.6	19.4	18.8	2
39	Sept.24-30	31.6	23.4	5.9	6	90	57	3.5	21.6	20	2
40	Oct. 1-7	28.9	22.9	6.6	69	95	77	4.3	21.9	22.5	3
41	Oct. 8-14	29.7	21.8	5.5	18.4	93	72	3.9	20.7	20.4	2
42	Oct.15-21	30.1	18.4	8.3	0	95	50	18	18	15.9	0
43	Oct.22-28	29.4	18.8	6.8	16.4	94	60	4.2	17.6	17.5	1

Total rains mm during crop period: 2400.0 mm

Table 2: Parameters of genetic variability for phenological and yield components in advance breeding lines of soybean.

Traits	Mean	Range		PCV (%)	GCV (%)	h^2b (%)	GA as % of mean
		Min.	Max.				5%
Vegetative phase (days)	38.00	30.00	46.00	11.14	10.91	58.68	19.43
Reproductive phase (days)	59.15	48.30	70.00	18.15	14.64	56.55	19.12
Plant height (cm)	43.90	28.50	59.30	21.14	17.42	73.12	29.58
Number of branches plant^{-1}	2.70	0.50	4.89	24.55	29.17	76.54	53.15
Number of pod cluster plant^{-1}	18.95	5.21	32.68	26.49	25.36	71.35	51.32
Number of pods plant^{-1}	51.35	20.90	81.80	29.92	30.98	79.17	50.48
Number of seeds plant^{-1}	96.00	28.50	163.50	28.43	29.50	80.12	49.27
Number of seeds pods^{-1}	2.09	0.88	2.42	13.86	10.18	52.67	18.11
Biological yield plant^{-1} (g)	18.51	9.39	27.63	28.44	26.31	77.34	45.94
Harvest Index (%)	42.45	28.74	56.15	12.26	10.80	74.98	18.54
100 seed weight (g)	9.79	7.02	12.55	17.53	16.41	49.17	11.79
Yield plant^{-1} (g)	32.75	5.56	59.94	29.14	27.52	78.65	48.22

Table 3: Phenotypic (P) correlation for phenological and yield components in advance breeding lines of soybean.

Traits	Vegetative phase (days)	Reproductive phase (days)	Plant height (cm)	Number of branches plant^{-1}	Number of pod cluster plant^{-1}	Number of pods plant^{-1}	Number of seeds plant^{-1}	Number of seeds pods^{-1}	Biological yield plant^{-1} (g)	Harvest Index (%)	100 seed weight (g)	Yield plant^{-1} (g)
Vegetative phase (days)	**1**	0.428***	0.655***	0.519***	0.218	0.635***	0.589***	0.411***	0.742***	0.429**	-0.652	0.510***
Reproductive phase (days)		**1**	0.121	0.189	0.312**	-0.043	0.741***	0.520***	0.252	0.365**	-0.355	0.249
Plant height (cm)			**1**	0.522***	0.581***	0.641***	0.547***	0.325**	0.212	0.236	-0.028	0.289
Number of branches plant				**1**	0.633***	0.740***	0.286	0.245	0.441***	0.485***	-0.149	0.647***
Number of pod cluster plant					**1**	0.322**	0.316**	0.325**	0.514***	0.328**	0.193	0.451***
Number of pods plant^{-1}						**1**	0.714***	0.342**	0.689***	0.412***	0.272	0.488***
Number of seeds plant^{-1}							**1**	0.639***	0.341**	0.519***	-0.222	0.565***
Number of seeds pods^{-1}								**1**	0.432***	0.433***	-0.199	0.487**
Biological yield plant^{-1} (g)									**1**	0.386***	0.091	0.792***
Harvest Index (%)										**1**	0.215	0.733***
100 seed weight (g)											**1**	0.114
Yield plant^{-1} (g)												**1**

Significant Levels 0.05 0.01 0.005 0.001, If correlation r = 0.2813 0.3541 0.3815 0.4339

Table : 4 Identified soybean advanced breeding lines for excessive rainfall conditions

S.No.	Breeding lines/ Variety/ JSM lines	Seed yield per plant (g)
1	JS 20-99	59.80
2	JS 20-82	54.19
3	JSM 302	52.42
4	JS 20-71	49.13
5	JS 20-34	48.40
6	JS 20-29	46.06
7	JS 97-52	41.77
8	JS 20-98	41.58
9	JS 20-50	40.81
10	JSM 207	40.36
11	JS 20-69	38.64
12	JS 20-41	37.77
13	JS 20-89	30.52
14	JS 95-60	28.42
15	JS 20-75	21.50

