

Effect of duration of reproductive stages on yield in soybean

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Abstract

A study was done on duration of reproductive stages (R1 to R8) of soybean in relation to seed yield using 56 soybean varieties. Wide range of variability was observed for these traits. Significant negative correlation was revealed between seed yield and days taken to physiological maturity stage (R7). Possible use of these characters in breeding for yield improvement in soybean is suggested.

Media summary

Soybean varieties with high yield potential can be developed for sub tropical climate by selection based on reduced reproductive growth phases.

Key Words

Growth phases, R1 to R8, Varieties, Soybean,

Introduction

Soybean (*Glycine max* (L.) Merrill) originated in China many centuries ago and now is grown around the world because of its adaptation as well as its uses. In India it is one of the important oilseed crop with respect to area and production and is grown around a latitude range of 16° to 26° N and longitude range of 73° to 84° E. Soybean is mainly grown as a rainy season crop under rainfed conditions resulting in lower productivity in the country as compared to the world over. The wide range of growing areas resulted in development of many high yielding varieties and these show a lot of variations in the duration of reproductive stages when grown in different regions. Earlier attempts were made to study response of soybean at different growth stages to soil moisture, drought and maturity (Rakchum et al. 2003, Desclaux and Roumet 1996 and Egli 1994). An attempt has been made to study the duration of different reproductive stages and its effect on yield of 56 soybean varieties developed at different research institutes in India and grown at one place with uniform conditions.

Methods

A field trial was conducted with 56 soybean varieties in RBD (S.D.-24/7/02) at the institute's farm located at 18° N latitude and 78° longitude and altitude of 600 meters above mean sea level. The different growth stages of soybean have been defined (Fehr et al. 1971) as vegetative growth stages (V stages) and reproductive growth stages (R stages). The reproductive growth stages are R1- appearance of first flower, R2 - 50% flowering, R3 - pod initiation, R4 - full pod formation, R5 - seed initiation, R6 - full seed formation, R7 - physiological maturity and R8 - harvest maturity. Data on days required to attain all these stages in different varieties were recorded and analysed statistically. The difference in days to achieve different growth stages were calculated and correlated to yield.

Results

Significant differences were found between varieties for days to different reproductive stages (R1 to R8) and yield (Table 1). Varieties showed significantly higher and lower differences in R1 to R8 stages. Thirty-three varieties showed more yield than mean and was significant in case of five varieties, viz. JS80-21, GS 1, Punjab 1, PK 308 and JS 335. The difference between days to R7 and other stages showed significantly negative correlation with yield (Table 2). Nine varieties with significantly less difference in

achieving R7 gave more yield than mean (Punjab 1, JS 335, MACS 57, NRC 37, T 49, JS 90-41, IP, MAUS 47 and Monetta). MACS 330 showed the shortest reproductive phase.

Table 1. Mean values for yield and duration of reproductive stages in soybean.

Sr. No	Name	Seed yield (Kg/ha)	R1*	R2	R3	R4	R5	R6	R7	R8	
1	ALANKAR	1653	33	37	46	48	54	70	88	98	* *
2	ANKUR	1606	29 # #	34 #	40 #	49	54	67	84	95	
3	BRAGG	2367	32	34 #	41	52	56	72	88	96	*
4	CO 1	1436	42 * *	45 * *	51 * *	57 * *	60 * *	78 * *	91 * *	99 * *	
5	CO 2	2267	33	35	41	46 #	54	68	80 #	89 #	
6	GS 1	3386**	36 *	39 *	51 * *	56 *	58	74	86	95	
7	HARDEE	1111#	35	39 *	52 * *	56 * *	58	74	92 * *	101 * *	
8	HIMSO 1563	934##	29 # #	33 # #	40 #	49	54	66	86	90	
9	IMPR.PELI C	2047	35	40 * *	53 * *	55	57	76 * *	87	96	*
10	INDIRA SOY	2256	33	40 * *	52 * *	56 *	58	73	88	98	* *
11	JS 335	2678*	33	35	41	48	54	67	78 # #	87 # #	
12	JS 71 05	1256	25 # #	30 # #	36 # #	42 # #	48 # #	63 # #	80 # #	87 # #	

13	JS 72 280	2359	36	*	40	*	51	*	55	58	74	88	95					
				*		*		*										
14	JS 72 44	2506	34		36		48		54	57	76	*	88	96	*			
												*						
15	JS 75 46	1520	35		40	*	49		54	57	74		87	95				
						*												
16	JS 76 205	1661	34		36		48		52	55	69		84	87	#			
															#			
17	JS 79 81	147 ^{##}	32		34	#	48		55	57	70		86	95				
18	JS 80 21	3423 ^{**}	36	*	40	*	44		51	57	76	*	87	96	*			
				*		*						*						
19	JS 90 41	2067	32		34	#	42		52	55	68		78	#	87	#		
													#	#	#			
20	KALITUR	817 ^{##}	31	#	33	#	37	#	45	#	54	70	84	95				
					#	#	#	#	#	#								
21	KB 79	2072	32		34	#	43		48	54	68		82	95				
22	KHSb 2	1989	33		41	*	48		54	58	78	*	92	*	101	*		
						*						*	*	*	*			
23	LEE	1070 [#]	40	*	43	*	52	*	57	*	59	*	76	*	88	98	*	
				*	*	*	*	*	*	*	*	*	*	*	*	*		
24	MACS 124	2198	39	*	43	*	50	*	54		57		74		87	95		
				*	*	*	*	*	*									
25	MACS 13	2631	36	*	42	*	53	*	57	*	59	*	76	*	88	98	*	
				*	*	*	*	*	*	*	*	*	*	*	*	*		
26	MACS 330	1475	29	#	32	#	35	#	42	#	49	#	55	#	66	#	73	#
				#	#	#	#	#	#	#	#	#	#	#	#	#	#	
27	MACS 450	2242	33		35		47		52	55	69		84	91				

28	MACS 57	2447	35		39	*	44		50		54		71		80	#	87	#
29	MACS 754	2647	33		36		47		52		55		72		85		95	
30	MACS 58	2378	33		38		47		53		56		72		84		95	
31	MAUS 2	1192	40	*	43	*	48		57	*	60	*	74		88		95	
				*		*				*		*						
Sr. No	Name	Seed yield (Kg/ha)	R1*		R2		R3		R4		R5		R6		R7		R8	
32	MAUS 32	1611	37	*	41	*	50	*	55		57		74		88		95	
				*		*												
33	MAUS 47	2003	29	#	33	#	37	#	45	#	52	#	65		74	#	80	#
				#	#	#	#	#	#	#	#	#	#		#	#	#	#
34	MONETTA	1925	32		32	#	40	#	43	#	52	#	63	#	74	#	80	#
					#	#	#	#	#	#	#	#	#	#	#	#	#	#
35	NRC 2	1678	32		36		45		51		54		68		84		89	#
36	NRC 12	1495	27	#	31	#	39	#	49		54		67		84		90	
				#	#	#	#	#										
37	NRC 37	2397	32		36		47		53		55		69		82		89	#
38	NRC 7	1106 [#]	29	#	31	#	37	#	42	#	49	#	67		80	#	87	#
				#	#	#	#	#	#	#	#	#	#		#	#	#	#
39	PK 1024	1042 [#]	29	#	32	#	39	#	47		52	#	68		86		93	
				#	#	#	#	#			#	#	#		#		#	
40	PK 1029	2214	32		34	#	44		52		56		68		86		95	
41	PK 262	1362	34		37		47		54		57		68		87		95	

42	PK 308	2856*	32		37		51	*	55		58		74		87		96	*
43	PK 327	1486	33		36		47		53		57		67		87		95	
44	PK 416	1773	29	#	32	#	39	#	45	#	52	#	62	#	80	#	87	#
45	PK 471	2350	35		40	*	47		50		54		68		86		93	
46	PK 472	2014	35		37		45		52		55		69		86		95	
47	PK 564	2248	29	#	32	#	38	#	43	#	52	#	67		82		87	#
48	PUNJAB 1	2914**	35		40	*	49		53		56		69		82		87	#
49	PUSA 16	2325	31	#	35		44		50		55		69		86		95	
50	PUSA 20	2081	32		34	#	47		53		56		68		86		95	
51	PUSA 22	1428	32		34	#	43		49		54		68		82		87	#
52	PUSA 24	223###	32		34	#	44		49		55		68		87		91	
53	PUSA 37	2609	33		36		48		53		56		68		84		93	
54	SHILAJEE T	2020	29	#	32	#	39	#	42	#	54		67		82		87	#
55	SHIVLIK	2439	35		39	*	52	*	54		57		76	*	87		98	*
56	T 49	2264	39	*	45	*	58	*	60	*	66	*	75	*	90	*	98	*
	Mean	1922.9	32.8		36.3		45.2		50.9		55.4		70.0		84.4		92.4	

	4	9	7	9	8	5	0	3	7
SE	286.95	0.87 0	0.83 1	1.59 5	1.60 6	1.21 5	1.64	1.53 4	1.44 3
CD 5%	730.99	2.21	2.12	4.06	4.09	3.10	4.18	3.91	3.67
CD 1%	973.48	2.95	2.82	5.41	5.45	4.12	5.56	5.21	4.89

R1 to R8 - Days to appearance of first flower, 50% flowering, pod initiation, full pod formation, seed initiation, full seed formation, Physiological maturity and harvest maturity respectively. *, ** Significantly more than mean at 5% and 1% respectively, #, ## Significantly less than mean at 5% and 1% respectively.

Table 2. Correlation of yield with duration of reproductive stages.

	R1	R2	R3	R4	R5	R6	R7	R8
R1	0.20	0.25	0.21	0.09	-0.01	0.16	-0.17	-0.04
R2		0.26	0.11	-0.05	-0.18	0.01	-0.30*	-0.15
R3			0.26	-0.22	-0.24	-0.08	-0.36**	-0.22
R4				0.19	-0.12	0.06	-0.30*	-0.14
R5					0.22	0.18	-0.22	-0.05
R6						0.26	-0.42**	-0.22
R7							-0.02	-0.22
R8								0.08

*, ** Significant at 5% and 1% respectively. Figures on the diagonal are correlation of R1 to R8 stages with yield and figures above diagonal are the correlation of yield with respective difference in duration of R8 stages.

Conclusion

Variability is seen to be pronounced in soybean varieties for days to different reproductive stages. There is correlation of yield with days to reproductive stages in soybean. This variability can be exploited to breed varieties with shorter reproductive stages to increase yield.

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