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HETEROSIS FOR YIELD RELATED ATTRIBUTES IN SOYBEAN (*GLYCINE MAX* L. MERRILL)

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ABSTRACT

In the present investigation, heterotic effects were studied over mid parent, better parent and check variety for yield and its components with an experimental material consisted of 10 diverse parental lines, which were selected on the basis high yield, oil content, resistant to disease and pests from different parts of India. These lines were, crossed as per diallel mating design (Model-1 Method-II), where crossing programme includes one-way crosses and parents. This method is used when reciprocal differences are not significant (Griffing, 1956). Crossing programme was taken during Kharif 2009 at BAU, Ranchi and SHUATS Allahabad, which results in 45 F_1s. These 45 F_1s along with parent's and checks, viz. Birsa Safed Soybean-2, JS-335 and JS80-21 were evaluated during Kharif 2010 in a randomized block design with three replications under four environments Considering overall performance, the superior F_1s were Hybrid $P_9 \times P_{10}$ for oil content and harvest index. Hybrid $P_8 \times P_{10}$ for protein content, hybrid $P_5 \times P_7$, $P_3 \times P_7$ for number of seeds per pod, hybrid $P_2 \times P_3$ for days to maturity, hybrid $P_3 \times P_8$ for 100 seeds weight, hybrid $P_8 \times P_9$, $P_3 \times P_8$, $P_4 \times P_8$ and $P_3 \times P_9$ for yield per plant for economic heterosis over best check "JS-335" in environment E_1, E_2, E_3 and E_4. These hybrids are, therefore, suggested to be utilized for developing high yielding soybean cultivars.

***Key words*:** Heterosis, Yield Related Attributes, Soybean (*Glycine max* L. Merrill).

Introduction

The phenomenon of heterosis has generally been associated with the increased yield and vigor obtained by crossing among selected inbred lines developed from heterozygous cross-pollinated crops. With the realization of the possibility of producing F_1 hybrids on a large scale, increasing attention has been given to achieve heterosis in self-pollinated crops. As far as the breeders of agriculturally important self-pollinated crops are concerned, the major considerations are, whether or not it is possible to obtain sufficient heterosis for characters of economic importance under conditions which also give high yields per unit area of land and whether or not it is possible to fix such heterosis in pure breeding lines (Hayes & Foster, 1976). The presence of heterosis in soybean for grain yield and its components has been reported by several workers Guleria, *et al.*, (2000), Pandini *et al.*, (2002), Sayad, *et al.*, (2005), Ramana and Satyanarayana (2005), Burton and Brownie (2006), Perez *et al.*, (2009), Sharmaand Maloo (2009), and Bhardwaj, *et al.*, (2010) Selection of parental cross combinations should be exploited on the basis of manifestation of heterosis for varietal improvement (Zubair *et al.*, 1989). The presence of heterosis can only be utilized in soybean for development of high yielding pure line varieties. Most of the detailed genetic information regarding the expression of heterosis in self-pollinated crops has originated from diallel crosses of selected parents and their F_1 hybrids. The present study was carried out to estimate the extent of heterosis in 10 parental half-diallel for exploitation of existing genetic variability to develop high yielding soybean cultivars.

Materials and Methods

The experimental materials for the present study consist of 10 diverse parental lines, which were selected on the basis high yield, oil content, resistant to disease

and pests from different parts of India. These lines were, crossed as per diallel mating design (Model-1 Method-II), where crossing programme includes one-way crosses and parents. This method is used when reciprocal differences are not significant (Griffing, 1956). Crossing programme was taken during Kharif 2009 at BAU, Ranchi and SHIATS Allahabad, which results in 45 F_1s. These 45 F_1s along with parent's and checks, viz. Birsa Safed Soybean-2, JS-335 and JS80-21 were evaluated during Kharif 2010 in a randomized block design with three replications under four environments. Spacing were maintained 45cm and10 cm between row to rows and plant to plant with basal fertilizer dose of NPK (@ (20kg N + 60 kg P + 40kg K) per hectare. Agronomic practices were used as recommended for soybean crop. The four environments were E_1-Early sowing (20-6-2010) & E_2-Late sowing (20-7-2010) at Ranchi (BAU) whereas, E_3-Timely sown (5-7-2010) & E_4- Late sown (27-7-2010) at Allahabad (SHIATS). Data were recorded for days to 50% flowering, days to maturity, number of pods per plant, 100 grain weight, grain yield per plant, harvest index, protein content (%) and Oil content (%). High level of hybrid vigor was observed for number of pods per plant and grain yield per plant and 100 seeds weight protein content and oil content.

Results and Discussion

Analysis of variance among F_1hybrids and their parents were highly significant differences for all the traits. Mean values and economic heterosis percentage for grain yield per plant is summarized in Table 1. Table 2 and 3 reveals the results regarding Heterosis (Ha), Heterobeltiosis (Hb) and Economic heterosis (Hc) for Days to 50% flowering, Days to maturity, Number of pods/plants, 100 Seeds weight, Grain yield/ plant, Harvest index, Protein content and Oil content.

Heterosis is a complex genetic phenomenon. Its extent depends on the magnitude of non-additive gene action and genetic diversity among parents. A close perusal of estimates of economic heterosis revealed that the environment E_2 was found more suitable as in this environment highest estimates of economic heterosis were observed, this is possibly due to favourable environment to the plant for its growth and development, which has reflected in the form of high yield and economic heterosis. Hybrids, which depicted high heterosis value for grain yield, were a cross between high x high gca effects of parent. Further the ratio of gca to sca was lesser than unity, which suggests that additive gene effect was important in the control of grain yield per plant. Similar findings have also been reported by Nelson and Bernard (1984), Burton and Brownie (2006), Jockovic, (1995),

Table 1: Five best hybrids identified on the basis of *per se* performance and economic heterosis in environment E_1, E_2, E_3 and E_4 for grain yield per plant

Sl. No.	Hybrid	*Per se* performance grain yield/ plant(g)	Economic heterosis (%)
E1			
1	P_8xP_9 (JS97-52 x AMS99-33)	15.57	44.58**
2	P_4xP_8 (BAUS-40 x JS97-52)	14.80	37.46**
3	P_3 XP_8 (NRC-77 x JS97-52)	14.67	36.22**
4	P_3XP_9 (NRC-77 x AMS99-33)	14.57	35.29**
5	P_2 XP_5 (RAUS -5 x JS20-06)	13.87	28.79**
6	JS-335+		
E2			
1	P_8xP_9 (JS97-52 x AMS99-33)	15.10	54.08**
2	P_3xP_8 (NRC-77 x JS97-52)	13.90	41.84**
3	P_4xP_8 (BAUS-40 x JS97-52)	13.73	40.14**
4	P_2xP_5 (RAUS -5 x JS20-06)	13.40	36.73**
5	P_3xP_9 (NRC-77 x AMS99-33)	13.30	35.71**
6	JS-335+		
E3			
1	P_4xP_8 (BAUS-40 x JS97-52)	15.37	52.65**
2	P_3xP_8 (NRC-77 x JS97-52)	15.10	50.00**
3	P_8xP_9 (JS97-52 x AMS99-33)	14.80	47.02**
4	P_3xP_9 (NRC-77 x AMS99-33	13.70	36.09**
5	P_5xP_8 (JS20-06 x JS97-52)	13.07	29.80**
6	JS-335+		
E4			
1	P_3xP_8 (NRC-77 x JS97-52)	14.20	30.67**
2	P_8xP_9 (JS97-52 x AMS99-33)	14.13	30.06*8
3	P_3xP_9 (NRC-77 x AMS99-33)	13.60	25.15**
4	P_4xP_8 (BAUS-40 x JS97-52)	13.33	22.70**
5	P_2xP_3 (RAUS -5 x NRC-77)	12.93	19.02**
6	JS-335+		

*, ** Significant at 5 % and 1 % level of significance respectively
+ Best check

Gadag *et al.*, (1999), Duraiand Subbalakshmi (2007), Youngkoo and Roy (2008), Eduardo *et al.*, (2009) and Yang, and Gai (2009) for economic heterosis for yield and yield contributing characters in soybean.

Hybrid $P_9 \times P_{10}$ exhibited maximum significant economic heterosis over best check "JS-335" in environment E_1 (14.96 %), E_2 (13.86 %), E_3 (10.88 %), and E_4 (10.11%) for oil content and in environment E_1 (14.18 %), E_2 (23.31 %), E_3 (28.80 %), and E_4 (30.40%) for harvest index. For protein content hybrid $P_8 \times P_{10}$ exhibited maximum significant economic heterosis (7.73 %) over the best check "JS-335" in environment E_1 (7.73%), E_2 (6.51%), E_3 (6.69%), and E_4 (8.11%), whereas hybrid $P_3 \times P_7$ exhibited maximum significant negative economic heterosis for maturity over the best check "JS-335" in environment E_1 (-8.28%), E_2 (-8.11%), E_3 (-

Table 2: Heterosis (Ha), Heterobeltiosis (Hb) and Economic heterosis (Hc) for Days to 50% flowering, Days to maturity, Number of pods/plant and 100 Seeds weight.

S. N.	Cross	Env	Days to 50% flowering			Days to maturity			Number of pods/plant			100 Seeds weight		
			Ha	Hb	Hc	Ha	Hb	Hc	Ha	Hb	Hc	Ha	Hb	Hc
1	**P1 x P2**	E1	-3.57**	-5.59**	-5.59**	-3.52**	-4.83**	-6.80**	5.63	0.73	27.11	-6.37	-6.97	-2.76
	NSO-111	E2	5.22**	5.22**	2.92**	-2.01**	-2.76**	-4.80**	3.01	-3.65	10.26	-7.75*	-9.70*	-8.00
	x	E3	-0.68	-3.97**	-5.23**	-3.26**	-4.29**	-6.87**	17.98	11.25	40.71**	1.90	-2.11	7.83
	RAUS-5	E4	-0.71	-2.80**	-2.80**	-1.75**	-2.83**	-6.93**	1.11	-8.46	18.15	6.29	6.03	4.34
2	**P1xP3**	E1	-1.41	-2.10*	-2.10*	4.36**	4.04**	-0.89**	-8.74	-16.69	5.13	-12.71**	-16.04**	-6.23
	NSO-111	E2	2.96**	2.21	1.46	2.16**	1.22*	-0.60	-7.29	-15.96	-3.83	-12.10**	-15.33**	-10.81**
	x	E3	-4.61**	-5.23**	-5.23**	0.62*	-0.92**	-3.58**	-3.43	-3.68	8.50	-12.73**	-16.87**	-6.80
	NRC-77	E4	1.06	0.00	0.00	2.88**	1.26**	-3.01**	-12.80	-24.96**	-3.15	-15.37**	-18.83**	-13.45**
3	**P1xP4**	E1	3.57**	1.40	1.40	3.83**	2.42**	0.30	15.27	-0.29	25.82	-9.30	-11.45*	-4.08
	NSO-111	E2	3.32**	2.19**	2.19	3.57**	3.09**	0.30	15.16	0.46	14.96	-9.89**	-11.64**	-10.29*
	x	E3	-3.31**	-3.31**	-4.58**	0.93**	0.00	-2.69**	23.11*	16.75	30.83*	-12.98**	-16.12**	-8.25
	*** BAUS-40**	E4	0.00	-2.10	-2.10	0.93**	0.00	-2.41**	2.37	-8.46	18.15	-8.87*	-9.23*	-11.12**
4	**P1xP5**	E1	-7.19**	-9.79**	-9.79**	2.58**	0.30	0.00	-13.68	-23.51	-3.48	7.86	4.49	7.82
	NSO-111	E2	-4.87**	-5.22**	-7.30**	1.23*8	-0.30	-0.90	-11.97	-21.73*	-10.43	13.40**	9.79*	7.14
	x	E3	2.37**	0.00	-1.31	0.15	-0.61	-3.28**	-8.62	-13.05	-2.57	10.67**	8.04	15.11**
	JS20-06	E4	-5.07**	-8.39**	-8.39**	1.26**	1.26**	-3.01**	-11.87	-23.82**	-1.67	19.05**	16.12**	13.70**
5	**P1xP6**	E1	-4.63**	-6.29**	-6.29**	-1.10**	-1.86**	-6.51**	29.02*	10.01	38.83*	13.46**	11.61**	15.16**
	NSO-111	E2	-2.22*	-2.94*	-3.65**	-2.64**	-2.80**	-6.01**	23.75*	7.29	22.78*	12.22**	9.72*	7.07
	x	E3	1.00	0.00	-1.31	-1.24**	-2.45**	-5.07**	23.92*	19.22	33.60*	7.01	2.35	13.78**
	AMS4-63	E4	-3.91**	-5.59**	-5.59**	-0.63	-0.94*	-5.12**	4.67	-10.04	16.11	10.44**	6.04	12.82**
6	**P1xP7**	E1	0.73**	-3.50**	-3.50**	-3.20**	-5.07**	-5.92**	19.23	3.48	30.59	5.36	-1.26	1.88
	NSO-111	E2	3.42**	1.49	-0.73	-1.07*	-2.71**	-3.00**	12.98	1.82	16.52	6.38	2.27	-0.20
	x	E3	5.23**	0.00	-1.31	-2.60**	-2.75**	-5.07**	3.95	3.50	17.00	2.55	0.73	5.98
	PS1431-44	E4	2.19*	-2.10	-2.10	-2.47**	-4.24**	-4.82**	-6.60	-16.79*	7.41	2.87	2.66	0.52
7	**P1xP8**	E1	7.01**	1.40	1.40	-0.93**	-1.24**	-5.92**	14.90	7.98	36.26*	0.88	-8.71	-5.80
	NSO-111	E2	1.89	0.75	-1.46	-0.47	-0.93	-3.60**	10.95	3.19	18.09	5.48	-5.72	-8.00
	x	E3	2.70**	0.66	-0.65	0.15	-0.61	-3.28**	15.85	15.34	29.25*	18.64**	7.88	9.47
	JS97-52	E4	4.41**	-0.70	-0.70	0.00	-0.62	-3.61**	-1.52	-11.91	13.70	21.48**	9.93*	7.63
8	**P1xP9**	E1	8.82**	3.50**	3.50**	0.31	-0.31	-5.03**	67.60**	30.62*	64.84**	-2.74	-7.01	-4.05
	NSO-111	E2	2.66*	0.75	-1.46	-1.70**	-2.45**	-4.50**	52.21**	28.27**	46.78**	-3.19	-6.47	-8.73*
	x	E3	5.80**	2.65**	1.31	-2.48**	-3.37**	-5.97**	58.88**	34.92**	51.19**	-1.37	-5.28	-3.88
	AMS99-33	E4	2.26**	0.00	0.00	-1.56**	-2.47**	-4.82**	33.83**	3.01	32.96**	-2.08	-6.84	-8.79*
9	**P1xP10**	E1	5.11**	0.70	0.70	0.00	-2.37**	-2.37**	-7.64	-18.43	2.93	2.38	-3.49	-0.42
	NSO-111	E2	6.11**	3.73**	1.46	-1.53**	-3.30**	-3.30**	-17.48	-23.25*	-12.17	1.42	-5.08	-7.37
	x	E3	3.07**	0.00	-1.31	-4.39*	-5.67**	-5.67**	-13.04	-13.58	-3.16	-3.42	-7.18	-5.81
	BAUS-96	E4	0.72	-2.80**	-2.80**	-4.00**	-6.02**	-6.02**	-13.71	-23.67	-1.48	-1.08	-7.63	-9.56*

Continue 2 ....

10	**P2xP3**	E1	0.00	-1.42	-2.80**	3.23**	1.51**	-0.59	7.87	3.04	17.95	11.89*	8.30	20.96**
	RAUS -5	E2	-5.93**	-6.62**	-7.30**	1.07*	0.92	-0.90	8.3	4.71	4.35	2.20	0.53	5.89
	x	E3	0.00	-3.92**	-3.92**	5.51**	5.02**	0.00	-4.46	-9.69	14.23	11.54**	10.57*	23.96**
	NRC-77	E4	-0.36	-1.43	-3.50**	5.98**	5.47**	-1.20**	22.81*	16.02	21.39	7.89*	3.73	10.60*
11	**P2xP4**	E1	2.92**	2.92**	-1.40	1.51**	1.51**	-0.59	5.94	-4.40	9.43	6.54	4.67	13.38*
	RAUS-5	E2	2.58*	1.46	1.46	1.23**	0.92	-1.20*	16.27	7.85	7.48	-2.08	-2.25	-0.40
	x	E3	1.37	-1.99*	-3.27**	1.41**	1.25**	-3.28**	-7.53	-17.03	4.94	4.71	4.35	14.94**
	BAUS-40	E4	2.19*	2.19	-2.10	3.31**	1.23**	-1.20**	-5.61	-6.90	-2.59	8.34*	7.65	5.93
12	**P2xP5**	E1	2.21*	1.46	-2.80**	2.40**	1.48**	1.18**	0.95	-6.56	6.96	3.63	-0.23	4.29
	RAUS-5	E2	6.37**	5.97**	3.65**	-0.46	-1.21*	-1.80**	1.75	-3.66	-4.00	1.59	-3.65	-1.84
	x	E3	1.05	0.00	-5.88**	5.94**	5.61**	1.19**	3.82	-6.56	18.18	1.48	-0.18	9.95*
	JS20-06	E4	0.74	-0.73	-4.90**	6.20**	5.03**	0.60	2.14	-3.01	1.48	8.62*	5.69	4.01
13	**P2xP6**	E1	1.09	0.72	-2.80**	3.70**	1.51**	-0.59	-0.81	-11.84	0.92	-2.72	-4.92	-0.61
	RAUS-5	E2	3.70**	2.94*	2.19	2.47**	1.84**	-0.30	5.49	-2.79	-3.13	-0.80	-5.01	-3.22
	x	E3	-3.11**	-5.41**	-8.50**	6.75**	6.58**	1.49**	-1.03	-10.00	13.83	-4.48	-4.92	5.70
	AMS4-63	E4	-1.09	-1.45	-4.90**	6.54**	5.70**	0.60	-3.19	-8.67	-4.44	-1.54	-5.24	0.82
14	**P2xP7**	E1	5.97**	3.65**	-0.70	5.97**	3.65**	-0.70	36.57**	23.68	41.58**	17.93**	9.86	14.84*
	RAUS-5	E2	1.14	-0.75	-2.92**	-0.61	-1.51**	-1.80**	29.34**	24.26*	23.83*	9.08*	2.74	4.68
	x	E3	4.69**	2.84**	-5.23**	0.31	-0.92**	-3.28**	11.88	5.94	33.99*	4.90	2.55	12.96**
	PS1431-44	E4	-2.24*	-4.38**	-8.39**	2.96**	0.00	-0.60	11.89	9.91	15.00	11.35**	10.85*	9.09*
15	**P2xP8**	E1	11.70**	8.03**	3.50**	4.15**	2.42**	0.30	-24.29*	-25.44	-14.65	-16.50**	-24.87**	-21.46**
	RAUS-5	E2	-0.38	-1.49	-3.65**	3.38**	3.07**	0.90	-14.31	-14.83	-15.13	-16.17**	-26.46**	-25.08**
	x	E3	7.69**	6.21**	0.65	5.31**	4.98**	0.60	-10.15	-15.63	6.72	-4.71	-16.42**	-7.94
	JS97-52	E4	3.89**	4.38**	0.00	6.16**	4.35**	1.20**	-19.64*	-20.71*	-17.04	-8.41*	-17.30**	-18.62**
16	**P2xP9**	E1	8.27**	5.11**	0.70	4.47**	2.42**	0.30	0.00	-19.20	-7.51	-6.39	-11.05*	-7.02
	RAUS-5	E2	6.46**	4.48**	2.19	3.07**	3.07**	0.90	-1.37	-11.87	-12.17	-6.86	-11.85**	-10.19*
	x	E3	1.77*	1.41	-5.88**	2.66**	2.50**	-2.09**	-7.53	-25.16*	-5.34	-3.37	-10.71*	-1.64
	AMS99-33	E4	4.41**	3.65**	-0.70	5.20**	3.09**	0.60	13.50	-5.49	-1.11	-4.81	-9.65*	-11.09**
17	**P2xP10**	E1	4.48**	2.19**	-2.10*	0.45	-0.59	-0.59	1.47	-6.40	7.14	1.27	-5.12	-0.82
	RAUS-5	E2	3.05**	0.75	-1.46	1.06*	0.00	0.00	3.6	2.97	2.61	2.02	-6.39	-4.63
	x	E3	-0.35	-0.70	-7.84**	-0.31	-2.69**	-2.69**	-16.00	-21.25*	-0.40	1.68	-5.97	3.57
	BAUS-96	E4	0.00	-1.46	-5.59**	0.16	-3.01**	-3.01**	-0.64	-3.19	1.30	3.41	-3.14	-5.00
18	**P3xP4**	E1	7.19**	5.67**	4.20**	-0.46	-2.11**	-4.14**	-5.41	-10.90	-7.14	-6.95	-8.35	2.36
	NRC-77	E2	4.03**	3.65**	3.65**	0.15	-0.31	-2.10**	-12.59	-16.26	-22.09	-7.19*	-8.86*	-4.00
	x	E3	-5.92**	-6.54	-6.54**	1.89**	1.25**	-3.28**	-13.58	-18.25	-7.91	-6.09	-7.23	4.00
	BAUS-40	E4	5.42**	4.29**	2.10	0.95**	-1.54**	-3.92**	-7.22	-11.19	-9.63	3.62	-3.46	-9.36*
19	**P3xP5**	E1	-2.17*	-4.26**	-5.59**	0.15	-2.37**	-2.66**	-9.54	-12.48	-8.79	-0.69	-7.33	3.50
	NRC-77	E2	-0.37	-1.47	-2.19	-1.52**	-2.11**	-2.70**	-3.15	-5.23	-11.83	-0.35	-6.95	-1.99
	x	E3	-2.36**	-5.23**	-5.23**	2.67**	1.87**	-2.39**	-6.10	-10.88	0.40	0.96	-1.54	10.38*
	JS20-06	E4	-2.56**	-5.00**	-6.99**	2.24**	0.63	-3.61**	-0.05	-0.59	-6.48	-11.04**	-14.99**	3.27

Continue 2 ....

20	**P3xP6**	E1	-5.38**	-6.38**	-7.69**	-0.47	-0.94**	-6.21**	-4.83	-11.78	-8.06	-18.12**	-22.47**	-13.41*
	NRC-77	E2	0.00	0.00	-0.73	-1.08*	-1.83**	-3.60**	-4.72	-9.35	-15.65	-12.75**	-17.77**	-13.38**
	x	E3	-6.31**	-7.84**	-7.84**	-0.32	-0.63	-5.67**	-3.11	-7.02	4.74	-18.37**	-18.72**	-8.87
	AMS4-63	E4	0.72	0.00	-2.10	0.64	-0.63	-5.42**	-2.74	-2.89	-9.63	-17.17**	-17.25**	-11.78**
21	**P3xP7**	E1	-0.74	-4.26**	-5.59**	-5.34**	-7.46**	-8.28**	-15.24	-19.86	-16.48	-8.19	-17.01**	-7.31
	NRC-77	E2	-0.38	-2.94*	-3.65**	-7.13**	-7.83**	-8.11**	-16.09	-16.64	-22.43	-3.40	-10.41**	-5.63
	x	E3	-2.42**	-7.84**	-7.84**	-2.64**	-4.28**	-6.57**	-4.12	-4.28	8.20	-15.59**	-18.18**	-8.28
	PS1431-44	E4	-3.32**	-6.43**	-8.39**	-2.82**	-6.06**	-6.63**	1.38	-2.57	-1.67	-18.49	-21.97**	-16.80**
22	**P3xP8**	E1	1.12	-3.55**	-4.90**	2.50**	2.50**	-2.96**	-3.66	-6.60	3.66	-3.46	-15.61**	-5.75
	NRC-77	E2	-2.62*	-4.41**	-5.11**	-0.46	-0.92	-2.70**	5.9	3.00	1.39	6.85	-7.59	-2.67
	x	E3	-1.34	-3.92**	-3.92**	0.78*	0.00	-4.18**	12.19	11.40	25.49	-9.82	-21.50**	-11.99*
	JS97-52	E4	0.37	-3.57**	-5.59**	0.32	-1.86**	-4.82**	11.73	6.91	8.89	-6.99	-18.90**	-13.54**
23	**P3xP9**	E1	-5.93**	-9.93**	-11.19**	0.94**	0.63	-4.73**	33.75*	12.13	16.85	5.39	-2.89	8.45
	NRC-77	E2	-3.40**	-5.88**	-6.57**	-2.30**	-2.45**	-4.20**	19.47	10.09	2.43	2.96	-4.06	1.06
	x	E3	1.02	-2.61**	-2.61**	4.09**	3.44**	-1.19**	9.94	-6.84	4.94	2.30*	-6.22	5.13
	AMS99-33	E4	-6.91**	-8.57**	-10.49**	2.53**	0.00	-2.41**	18.61	3.68	-3.52	-2.00	-10.38**	-4.45
24	**P3xP10**	E1	5.15**	1.42	0.00	2.13**	-0.59	-0.59	1.28	-2.37	1.74	-3.26	-12.08*	-1.80
	NRC-77	E2	3.79**	0.74	0.00	0.00	-0.90	-0.90	-2.63	-5.3	-6.78	-1.78	-11.22**	-6.49
	x	E3	-1.69*	-5.23**	-5.23**	2.92**	0.00	0.00	-17.08	-17.81	-7.41	-4.91	-12.77**	-2.21
	BAUS-96	E4	-1.83	-4.29**	-6.29**	2.50**	-1.20**	-1.20**	3.80	0.56	-0.19	-1.48	-11.49**	-5.63
25	**P4xP5**	E1	7.35**	6.57**	2.10*	1.50**	0.59	0.30	14.01	10.90	8.06	-7.92	-12.84*	-5.59
	BAUS-40	E2	5.93**	4.38**	4.38**	1.98**	0.91	0.30	5.79	3.52	-7.83	-3.78	-8.60*	-7.19
	x	E3	-3.05**	-5.30**	-6.54**	4.84**	4.67**	0.30	9.55	9.18	10.47	-7.59	-8.79*	-0.23
	JS20-06	E4	0.00	-1.46	-5.59**	2.80**	1.85**	-0.60	1.94	-1.91	-0.19	-3.88	-5.88	-8.57*
26	**P4xP6**	E1	1.82	1.45	-2.10*	-0.93**	-3.02**	-5.03**	12.23	10.34	1.65	-10.60*	-14.11**	-6.97
	BAUS-40	E2	-0.37	-0.73	-0.73	1.55**	1.23*	-1.50**	-1.75	-2.45	-16.87	-5.48	-9.34*	-7.95
	x	E3	-3.01**	-3.97**	-5.23**	2.82**	2.50**	-2.09**	-12.64	-13.93	-10.87	-17.44**	-18.11**	-8.96
	AMS4-63	E4	-4.73**	-5.07**	-8.39**	0.31	-0.93*	-3.31**	-15.09	-18.84	-17.41	-13.58**	-17.34**	-12.05**
27	**P4xP7**	E1	2.99**	0.73	-3.50**	-4.20**	-4.78**	-5.62**	30.69*	30.18	20.88	5.03	-3.74	4.27
	BAUS-40	E2	2.26*	-0.73	-0.73	-1.83**	-3.01**	-3.30**	16.11	11.93	2.78	6.03	0.02	1.56
	x	E3	-2.44**	-7.28**	-8.50**	-0.46	-1.53**	-3.88**	9.76	3.67	17.19	-4.66	-6.48	2.30
	PS1431-44	E4	-0.75	-2.92**	-6.99**	-3.67**	-4.55**	-5.12**	20.60*	20.11	22.22*	-2.96	-3.15	-5.55
28	**P4xP8**	E1	9.43**	5.84**	1.40	-2.92**	-4.53**	-6.51**	22.45	12.05	24.36	1.02	-10.52	-3.07
	BAUS-40	E2	4.48**	2.19	2.19	-1.23**	-1.23*	-3.90**	15.53	7.77	6.09	5.29	-7.51	-6.09
	x	E3	-9.46**	-11.26**	-12.42**	2.03**	1.87**	-2.39**	7.61	2.49	13.83	-1.36	-13.22**	-5.08
	JS97-52	E4	-3.01**	-5.84**	-9.79**	-3.10**	-3.40**	-5.72**	9.41	9.36	11.39	-1.21	-10.29*	-12.85**
29	**P4xP9**	E1	-1.50	-4.38**	-8.39**	-2.00**	-3.93**	-5.92**	27.25	12.33	3.48	-3.04	-9.39	-1.85
	BAUS-40	E2	-2.26*	-5.11**	-5.11**	1.54**	1.23*	-0.90	23.06	18.16	0.70	-1.70	-6.81	-5.38
	x	E3	-7.17**	-9.93**	-11.11**	0.31	0.31	-4.18**	26.04*	12.09	12.65	6.89	-0.91	8.39
	AMS99-33	E4	-2.21**	-2.92**	-6.99**	-1.85**	-1.85**	-4.22**	18.21	-0.45	1.30	5.05	0.31	-2.55

Continue 2 ....

30	**P4xP10**	E1	8.21**	5.84**	1.40	1.05**	0.00	0.00	7.27	4.73	1.28	4.55	-3.64	4.37
	BAUS-40	E2	7.17**	3.65**	3.65**	1.07*	-0.30	-0.30	7.2	0	-1.57	6.44	-2.18	-0.68
	x	E3	-5.12**	-7.95**	-9.15**	-1.07**	-3.28**	-3.28**	3.14	-1.61	8.89	-6.76	-13.50**	-5.39
	BAUS-96	E4	0.00	-1.46	-5.59**	0.91**	-0.30	-0.30	-9.17	-10.28	-8.70	-1.30	-7.49	-10.13*
31	**P5xP6**	E1	-4.03**	-5.07**	-8.39**	3.98**	0.89**	0.59	5.70	1.13	-1.47	6.71	5.07	4.88
	JS20-06	E2	-3.35**	-4.41**	-5.11**	2.91**	1.51**	0.90	9.95	6.84	-4.87	12.64**	11.52**	3.97
	x	E3	-8.90**	-10.14**	-13.07**	2.35**	1.87**	-2.39**	-1.06	-2.19	1.28	-8.79*	-10.69*	-0.71
	AMS4-63	E4	-0.37	-2.17	-5.59**	6.31**	5.97**	1.51**	7.43	6.69	0.37	-1.57	-7.72	-1.81
32	**P5xP7**	E1	0.75	-0.74	-6.29**	1.79**	1.48**	1.18**	0.67	-1.69	-4.21	13.12*	9.31	5.75
	JS20-06	E2	-4.58**	-6.02**	-8.76**	1.36**	1.20*	0.90	1.35	-0.19	-8.35	16.48**	15.63**	5.66
	x	E3	-4.29**	-6.94**	-12.42**	3.40**	2.45**	0.00	-5.35	-10.31	1.38	2.96	2.32	9.02
	PS1431-44	E4	-3.03**	-3.76**	-10.49**	4.01**	2.12**	1.51**	-9.59	-12.66	-11.85	4.48	2.11	-0.41
33	**P5xP8**	E1	4.94**	2.22*	-3.50**	2.89**	0.30	0.00	-21.97	-26.73	-18.68	12.39*	4.74	1.32
	JS20-06	E2	-3.03**	-3.76	-6.57**	4.43**	3.32**	2.70**	-6.31	-10.78	-12.17	19.90**	10.38*	0.86
	x	E3	-3.81**	-4.14**	-9.15**	2.80**	2.80**	-1.49**	-9.68	-13.70	-4.15	5.89	-5.77	0.40
	JS97-52	E4	0.76	-0.75	-7.69**	6.25**	5.59**	2.41**	-10.78	-14.18	-12.59	14.67**	6.16	-1.15
34	**P5xP9**	E1	-0.76	-2.96**	-8.39**	3.51**	0.59	0.30	27.37	9.77	6.96	0.46	-0.90	-4.13
	JS20-06	E2	-3.05**	-4.51**	-7.30**	1.37**	0.60	0.00	28.04*	20.41	7.22	3.20	2.97	-5.91
	x	E3	0.70	0.00	-5.88**	6.71**	6.54**	2.09**	24.23	10.16	11.46	-4.10	-10.01*	-4.11
	AMS99-33	E4	3.73**	2.96**	-2.80**	4.05**	3.09**	0.60	16.74	1.57	-4.44	2.54	-0.06	-6.95
35	**P5xP10**	E1	9.77**	8.15**	2.10*	-3.41**	-3.55**	-3.55**	23.96	23.50	20.33	-12.51*	-14.95*	-17.73**
	JS20-06	E2	2.68*	0.75	-2.19	-3.92**	-4.20**	-4.20**	19.67	13.96	12.17	-12.74**	-15.74**	-23.01**
	x	E3	2.80**	2.08*	-3.92**	0.61*	-1.49**	-1.49**	16.04	11.07	22.92	-9.18*	-14.72**	-9.13
	BAUS-96	E4	9.77**	9.77**	2.10	-0.31	-2.41**	-2.41**	9.96	7.09	6.30	0.91	-3.51	-10.16*
36	**P6xP7**	E1	4.09**	1.45	-2.10*	0.31	-2.39**	-3.25**	56.90**	53.65**	42.67**	-12.88*	-17.07**	-17.22**
	AMS4-63	E2	1.13	-1.47	-2.19	1.22**	-0.30	-0.60	44.81**	38.64**	27.30*	-10.66**	-12.19**	-18.13**
	x	E3	4.23**	0.00	-3.27**	3.26**	1.83**	-0.60	24.64*	19.41	34.98**	-21.31**	-23.41**	-14.86**
	PS1431-44	E4	5.58**	2.90**	-0.70	0.00	-2.12**	-2.71**	18.93	14.13	15.19	-16.55**	-20.03**	-14.91**
37	**P6xP8**	E1	7.52**	3.62**	0.00	-1.10**	-1.56**	-6.80**	20.51	8.58	20.51	-9.26	-16.64**	-16.80**
	AMS4-63	E2	4.87**	2.94*	2.19	-1.55**	-1.85**	-4.50**	23.74*	14.66	12.87	-0.67	-9.39*	-15.52**
	x	E3	-1.02	-2.03*	-5.23**	0.47	0.00	-4.18**	19.52	15.48	28.26*	-14.84**	-25.61**	-17.30
	JS97-52	E4	5.62**	2.17	-1.40	-1.25**	-2.17**	-5.12**	15.13	10.00	12.04	-8.62*	-20.26**	-15.16**
38	**P6xP9**	E1	5.62**	2.17*	-1.40	4.57**	4.40**	-1.78**	66.25**	48.97**	32.60*	-14.80**	-17.23**	-17.38**
	AMS4-63	E2	3.40**	0.74	0.00	0.00	-0.61	-2.70**	48.39**	43.48**	20.52	-15.57**	-16.59**	-22.23**
	x	E3	0.00	-2.03*	-5.26**	3.45**	3.13**	-1.49**	45.22**	27.48*	32.02*	-24.64**	-30.66**	-22.91**
	AMS99-33	E4	4.03**	2.90**	-0.70	2.19**	0.93*	-1.51**	56.10**	36.63**	26.76*	-19.85**	-26.63**	-21.94**

Continue 2 ....

39	**P6xP10**	E1	7.06**	4.35**	0.70	0.76**	-2.37**	-2.37**	51.28**	45.27**	40.48**	-10.06	-13.88*	-14.04*
	AMS4-63	E2	5.30**	2.21	1.46	0.15	-1.50**	-1.50**	39.94**	29.68*	27.65*	-6.15	-10.25*	-16.32**
	x	E3	0.00	-2.03**	-5.24**	1.99**	-0.60	-0.60	30.07**	25.89*	39.33**	-17.49**	-24.02**	-15.54**
	BAUS-96	E4	7.75**	5.80**	2.10	0.31	-2.11**	-2.11**	34.23**	29.85**	28.89**	-25.13**	-32.67**	-28.36**
40	**P7xP8**	E1	9.65**	8.40**	-0.70	2.29**	0.00	-0.89**	27.76**	17.33	30.22	-7.64	-11.04	-19.74**
	PS1431-44	E2	6.92**	6.11**	1.46	0.61	-0.60	-0.90	26.14*	21.91	20.00	-2.53	-9.66*	-18.66**
	x	E3	8.19**	4.83**	-0.65	1.23**	0.31	-2.09**	30.34**	29.20*	46.05**	-19.83**	-28.27	-24.53**
	JS97-52	E4	7.69**	6.87**	-2.10	1.53**	0.30	-0.30	28.77**	28.18**	30.56**	-15.68**	-23.56**	-25.45**
41	**P7xP9**	E1	0.77	0.00	-8.39**	-0.77**	-3.28**	-4.14**	51.12**	32.94	23.44	9.18	6.93	0.64
	PS1431-44	E2	3.10**	3.10*	-2.92*	-0.91*	-1.81**	-2.10**	37.49**	27.46*	17.04	9.57*	9.01	-0.83
	x	E3	10.79**	8.45**	0.65	2.63**	1.53**	-0.90**	24.59*	5.42	19.17	-5.48	-10.78	-6.12
	AMS99-33	E4	7.52**	5.93**	0.00	-0.61	-1.52**	-2.11**	42.89**	20.73	21.85*	-3.41	-7.94	-10.21*
42	**P7xP10**	E1	3.05**	3.05**	-5.59**	-2.82**	-3.25**	-3.25**	-11.30	-13.07	-15.93	2.86	2.23	-6.62
	PS1431-44	E2	0.39	0.00	-5.84**	-4.36**	-4.50**	-4.50**	-7.59	-10.69	-12.09	10.04*	7.01	-3.65
	x	E3	8.63**	6.34**	-1.31	-2.11**	-3.28**	-3.28**	-20.67*	-21.50	-11.26	3.67	-2.07	3.03
	BAUS-96	E4	12.88**	12.03**	4.20	-3.93**	-4.22**	-4.22**	-12.12	-12.84	-12.04	0.42	-6.05	-8.37*
43	**P8xP9**	E1	4.28**	3.88**	-6.29	-0.94**	-1.25**	-6.51**	15.04	-5.94	4.40	13.63**	7.26	0.95
	JS97-52	E2	0.00	-0.76	-5.11**	-2.46**	-2.76**	-4.80**	6.39	-4.42	-5.91	20.37**	11.03*	1.01
	x	E3	0.35	-0.69	-5.88**	1.40**	1.25**	-2.99**	12.94	-3.74	6.92	15.28*8	8.89	1.73
	AMS99-33	E4	7.58**	5.19**	-0.70	-0.62	-0.93*	-3.31**	8.64	-8.55	-6.85	10.56*	4.88	-7.30
44	**P8xP10**	E1	8.88**	7.63**	-1.40	-1.52**	-4.14**	-4.14**	-16.23	-21.62	-13.00	4.38	-0.06	-8.72
	JS97-52	E2	4.25**	3.05*	-1.46	-0.46	-1.80**	-1.80**	-14.31	-14.31	-15.65	19.89**	14.10**	-2.92
	x	E3	-1.74*	-2.76**	-7.84**	0.00	-2.09**	-2.09**	-20.14	-20.28	-11.46	10.85*	4.64	-2.10
	BAUS-96	E4	6.11**	4.51**	-2.80	-1.83**	-3.31*	-3.31**	-11.42	-12.55	-10.93	7.96	4.36	-11.34**
45	**P9xP10**	E1	11.54**	10.69**	1.40	0.61*	-2.37**	-2.37**	3.40	-10.61	-13.55	-15.50**	-16.75**	-21.65**
	AMS99-33	E2	6.61**	6.20**	0.00	1.06*	0.00	0.00	-4.42	-14.13	-15.48	-9.43*	-12.36**	-20.27**
	x	E3	7.04**	7.04**	-0.65	-2.90**	-5.07**	-5.07**	14.23	-2.50	7.91	-12.45**	-12.52	-18.15**
	BAUS-96	E4	6.72**	5.93**	0.00	-4.88**	-6.02**	-6.02**	23.25*	4.85	4.07	-11.58**	-13.30**	-23.37**
	SE	E1	0.419	0.484	0.484	0.317	0.366	0.366	4.851	5.602	5.602	1.247	1.440	1.440
		E2	0.470	0.543	0.543	0.474	0.548	0.548	3.754	4.335	4.3335	0.469	0.541	0.541
		E3	0.357	0.412	0.412	0.324	0.374	0.374	3.829	4.422	4.422	0.428	0.556	0.556
		E4	0.439	0.507	0.507	0.347	0.401	0.401	3.346	3.863	3.863	0.430	0.496	0.496

6.57%), and E_4 (-6.63%). Hybrid $P_1 \times P_9$ has maximum significant economic heterosis for number of pods per plant over the best check "JS-335" in environment E_1 (64.84%), E_2 (46.78%), E_3 (51.19%), and E_4 (32.96%). For hybrid $P_2 \times P_3$ exhibited maximum significant economic heterosis for 100 seed weight in environment E_1 (20.96%), E_2 (5.89%), E_3(23.96%), and E_4 (10.60%), whereas, hybrid $P_3 \times P_8$ exhibited maximum significant economic heterosis over best check "JS-335" in environment E_1 (36.22 %), E_2 (41.84 %), E_3 (50.00%), and E_4 (30.67%) for yield per plant, Bhosle *et al.*, (2005), Pandini *et al.*, (2002), Feng *et al.* (2004), Sayad, *et al.*, (2005), Ramanaand Satyanarayana (2005), Burton and Brownie (2006), Perez, *et al.*, (2009), Sharma and Maloo (2009), Yang and Gai (2009), reported economic heterosis for yields, number of pods per plant, 100-seed weight, protein content and oil content in soybean. In the light of above findings and in the view of earlier workers, the superiority hybrids in terms of yield, oil, protein and other attributes, it would be desirable to develop and promotes its cultivation at farmers field so that they can get high yield with better nutritionalvalue even in early maturing group.

Relative heterosis or mid parent (MP) and heterobeltiosis or better parent (BP) heterosis are important parameters as they provide information about the presence of dominance and over dominance type of gene action in the expression of various traits. For grain yield/ plant hybrid $P_2 \times P_5$ (RAUS-5 × JS20-06) exhibited maximum positive heterobeltiosis on environment E_1 (50.18 %) closely followed by $P_5 \times P_8$ (JS20-06 × JS97-52) 49.81%, $P_1 \times P_{10}$ (NSO-111 × BAUS-96) 48.80 %, $P_4 \times P_8$ (BAUS-40 × JS97-52) 40.51 % and $P_1 \times P_5$ (NSO-111 × JS20-06) 37.94 % (Table 3). Similarly in environment E_2 hybrid $P_2 \times P_5$ (RAUS-5 × JS20-06) 64.75 % exhibited maximum positive heterobeltiosis followed by $P_1 \times P_{10}$ (NSO-111 × BAUS-96) 49.12%, $P_1 \times P_2$ (NSO-111 × RAUS-5) 45.90 %, $P_2 \times P_5$ (RAUS-5 × JS20-06) 41.80% and $P_5 \times P_8$ (JS20-06 × JS97-52) 41.51 %. In environment E_3 hybrid $P_1 \times P_{10}$ (NSO-111 × BAUS-96) 65.14 % exhibited maximum positive heterobeltiosis followed by $P_4 \times P_8$ (BAUS-40 × JS97-52) 53.16%, $P_1 \times P_7$ (NSO-111 × PS1431-44) 42.44 %, $P_1 \times P_2$ (NSO-111 × RAUS-5) 41.94% and $P_2 \times P_5$ (RAUS-5 × JS20-06) 40.32%, whereas in environment E_4 hybrid $P_5 \times P_8$ (JS20-06 × JS97-52) 42.75% exhibited maximum positive heterobeltiosis followed by hybrid $P_1 \times P_{10}$ (NSO-111 × BAUS-96) 40.27%, $P_4 \times P_8$ (BAUS-40 × JS97-52) 39.86%, $P_2 \times P_7$ (RAUS-5 × PS1431-44) 36.08 %, and $P_2 \times P_5$ (RAUS-5 × JS20-06) 35.29% respectively.

Table 3: Heterosis (Ha), Heterobeltiosis (Hb) and Economic heterosis (Hc) for Grain yield/ plant, Harvest index, Protein content and Oilcontent.

S. N.	Cross	Env	Grain yield/plant			Harvest Index			Protein content			Oil content		
			Ha	Hb	Hc	Ha	Hb	Hc	Ha	Hb	Hc	Ha	Hb	Hc
1	**P1 x P2 NSO-111 x RAUS-5**	E1	45.09**	30.69**	12.07*	5.88	2.68	8.51	3.64**	2.55**	-2.26**	-1.68**	-3.30**	1.39*
		E2	55.46**	45.90**	21.09**	8.83**	5.48	15.79**	2.95**	1.73**	-4.46**	-1.68*	-3.31**	2.03*
		E3	51.07**	41.94**	16.56*	17.69**	12.41**	30.40**	4.56**	3.94**	-3.81**	-1.44	-2.85**	0.98
		E4	27.52**	20.35*	-14.72*	8.30	3.01	9.60	3.86**	3.39**	-3.58**	-1.87**	-3.66**	0.37
2	**P1xP3 NSO-111 x NRC-77**	E1	-17.33**	-38.41**	-13.62*	14.08**	12.86**	12.06*	-6.34**	-9.30**	-7.73**	8.82**	2.92**	7.92**
		E2	-19.93**	-37.89**	-18.03**	14.18**	4.79	15.04**	-5.92**	-8.82**	-8.74**	8.10**	2.76**	8.44**
		E3	-26.99**	-45.16**	-21.19**	13.24**	6.21	23.20**	-6.22**	-10.08**	-9.32**	7.96**	3.59**	7.67**
		E4	-15.53**	-35.79**	-22.39**	16.08**	11.28*	18.40**	-6.39**	-10.78**	-8.19**	7.28*	3.10**	7.41**
3	**P1xP4 NSO-111 x * BAUS-40**	E1	22.30**	4.11	1.86	2.58	-0.71	-1.42	-9.06**	-14.33**	-7.64**	-0.33	-0.56	4.27**
		E2	9.89	-7.37	-1.70	-7.91	-12.33**	-3.76	-8.98**	-14.68**	-8.40**	-0.46	-0.95	4.53**
		E3	19.85**	3.32	2.98	-5.76	-9.66*	4.80	-8.81**	-14.45**	-9.66**	2.15**	1.85*	5.86**
		E4	2.65	-11.89	-22.70**	-3.05	-4.51	1.60	-8.22**	-14.17**	-8.02**	0.69	-0.03	4.15**
4	**P1xP5 NSO-111 x JS20-06**	E1	46.95**	37.94**	8.05	13.53**	7.86	7.09	4.31**	3.55	-1.30**	-11.01**	-11.94**	-7.68**
		E2	22.07**	17.83*	-7.82	-2.66	-12.33**	-3.76	4.84**	4.74**	-1.63**	-10.13**	-12.12**	-7.27**
		E3	45.06**	36.29**	11.92	12.82**	6.21	23.20**	5.49**	5.49**	-2.37**	-10.05**	-10.58**	-7.06**
		E4	31.74**	18.82*	-7.06	1.46	-1.42	11.20*	5.40**	5.40**	-1.71**	-11.04**	-11.94**	-8.25**

Continue 3 ....

5	**P1xP6**	E1	25.21**	1.11	13.00*	-9.03*	-14.47**	-3.55	-0.78	-1.09*	-5.73**	0.78	-0.31	4.52**
	NSO-111	E2	17.19**	-3.06	7.82	-17.92**	-21.74**	-5.26	0.05	0.00	-6.00**	2.45**	-0.44	5.06**
	x	E3	23.35**	0.87	14.57*	-5.72	-7.89	12.00*	-0.54	-1.96**	-6.61**	2.05**	0.41	4.36**
	AMS4-63	E4	16.05*	-3.85	-7.98	-6.96	-9.29	1.60	0.68	0.00	-5.46**	1.08	-0.72	3.43**
6	**P1xP7**	E1	43.22**	33.46**	6.19	-1.11	-4.29	-4.96	0.09	-2.26**	-2.26**	4.23**	-0.34	4.49**
	NSO-111	E2	36.44**	30.08**	4.42	0.72	-4.11	5.26	0.22	-2.58**	-3.08**	3.38**	-1.08	4.39**
	x	E3	48.68**	42.44**	12.25	-1.46	-6.90	8.00	0.67	-2.33**	-3.90**	3.44**	-0.34	3.58**
	PS1431-44	E4	24.78**	12.55	-11.96	-18.02**	-22.67**	-7.20	0.40	-2.91**	-3.07**	2.65**	-1.00	3.15**
7	**P1xP8**	E1	5.93	-3.00	-19.81**	3.91	3.55	3.55	0.97*	-0.55	-5.21**	-5.36**	-8.75**	3.07**
	NSO-111	E2	6.89	-3.40	-12.93	-4.73	-6.00	6.02	1.48**	0.18	-5.91**	-5.13**	-8.27**	3.67**
	x	E3	10.24	4.98	-16.23*	4.59	2.07	18.40**	1.52**	1.19*	-6.36**	-6.23**	-9.74**	1.42
	JS97-52	E4	30.37**	25.11**	-14.42*	16.35**	15.04**	22.40**	1.37**	1.19*	-5.63**	-6.68**	-10.17**	1.15
8	**P1xP9**	E1	17.14**	-7.12	8.98	4.70	-1.27	10.64*	10.94**	10.38**	5.21**	-11.08**	-14.99**	-2.28**
	NSO-111	E2	16.67**	-6.00	11.90	-5.41	-6.67	5.26	10.53*8	10.48**	3.86**	-11.75**	-15.30**	-2.79**
	x	E3	20.84**	-2.27	14.24*	-1.35	-3.31	16.80**	10.97**	10.32**	3.31**	-10.25**	-13.88**	-2.62**
	AMS99-33	E4	12.18	-9.79	-6.75	-6.09	-10.27*	4.80	11.91**	11.66**	4.61**	-10.82**	-14.14**	-3.35**
9	**P1xP10**	E1	57.63**	48.80**	15.17**	3.38	-1.92	8.51	7.53**	4.66**	5.38**	-9.50**	-9.90**	-5.53**
	NSO-111	E2	53.85**	49.12**	15.65*	-4.83	-5.48	3.76	7.10**	4.33**	3.34**	-7.78**	-8.08**	-3.00**
	x	E3	67.83**	65.14**	19.21**	1.42	-1.38	14.40**	10.29**	8.72**	3.56**	-9.35**	-9.66**	-6.10**
	BAUS-96	E4	45.54**	40.27**	-4.91	-15.64**	-18.31**	-7.20	9.53**	7.18**	4.44**	-7.75**	-8.51**	-4.69**
10	**P2xP3**	E1	13.42**	-8.61*	28.17**	10.49*	6.04	12.06*	-1.65**	-5.72**	-4.08**	1.93**	-2.04**	-0.69
	RAUS -5	E2	23.10**	0.26	32.31**	16.60**	10.22*	13.53**	-2.41**	-6.51**	-6.43**	-0.25	-3.65**	-1.69*
	x	E3	1.17	-20.51**	14.24*	6.56	4.55	10.40**	-2.51**	-7.06**	-6.27**	-0.04	-2.74**	-1.79*
	NRC-77	E4	24.16**	-1.52	19.02**	24.79**	23.77**	20.80**	-2.32**	-7.30**	-4.61**	-1.30	-3.42**	-3.06**
11	**P2xP4**	E1	16.69**	9.49	7.12	13.57**	6.71	12.77*	-4.79**	-11.19**	-4.25**	2.75**	1.28	5.70**
	RAUS-5	E2	10.07	-1.92	4.08	6.32	4.38	7.52	-6.16**	-13.01**	-6.60**	1.96**	0.76	5.29**
	x	E3	16.94**	6.64	6.29	11.70**	11.28*	18.40**	-4.60**	-11.00**	-6.02**	3.56**	2.39**	5.80**
	BAUS-40	E4	18.38**	6.99	-6.13	14.06**	10.08	13.60*	-4.49**	-11.07**	-4.69**	4.46**	3.28**	6.06**
12	**P2xP5**	E1	56.98**	50.18**	28.79**	16.36**	7.38	13.48**	9.32**	8.96**	2.34**	-1.89**	-2.49**	0.09
	RAUS-5	E2	69.62**	64.75**	36.73**	17.32**	8.76	12.03*	9.80**	8.59**	1.80**	-0.25	-0.83	1.19
	x	E3	40.32**	40.32**	15.23*	15.38**	13.64**	20.00**	9.63**	8.97**	0.85	-0.41	-1.25	1.42
	JS20-06	E4	41.98**	35.29**	5.83	14.18**	5.67	19.20**	10.02**	9.52**	2.13**	-0.70	-1.54	0.52
13	**P2xP6**	E1	22.88**	8.59	21.36**	9.09*	5.66	19.15**	6.28**	5.50**	-0.09	-2.16**	-2.72**	-0.22
	RAUS-5	E2	25.04**	9.17	21.43**	4.03	-3.73	16.54**	6.97**	5.65**	-0.69	0.16	-1.05	0.96
	x	E3	26.90**	9.33	24.17**	4.93	-1.97	19.20**	5.31**	3.20**	-1.69**	1.87*	1.67	2.67**
	AMS4-63	E4	26.70**	10.26	5.52	16.15**	7.86	20.80**	6.53**	5.32**	-0.43	0.72	0.67	1.14
14	**P2xP7**	E1	28.84**	24.19**	6.50	1.43	-4.70	0.71	1.84**	-1.56**	-1.56**	4.11**	1.17	2.57**
	RAUS-5	E2	44.17**	41.80**	17.69*	14.50**	12.41*	15.79**	0.49	-3.45**	-3.94**	2.80**	-0.02	2.01*
	x	E3	33.74**	31.05**	7.62	2.68	1.52	7.20	2.95**	-0.69	-2.29**	3.42**	1.04	2.03*
	PS1431-44	E4	42.80**	36.08**	6.44	9.63*	-1.33	18.40**	2.97**	-0.85	-1.02*	2.70**	0.87	1.24

Continue 3 ....

15	**P2xP8**	E1	14.34*	12.27	-3.72	-1.38	-4.03	1.42	-0.19	-0.65	-7.29**	-5.52**	-10.36**	1.25
	RAUS-5	E2	14.73*	10.19	-0.68	-2.44	-6.67	5.26	-1.12	-1.21*	-9.43**	-5.22**	-9.83**	1.91*
	x	E3	17.38*	15.73	-4.97	-4.44	-6.52	3.20	-0.9	-1.20*	-9.15**	-5.42**	-10.21**	0.90
	JS97-52	E4	23.35**	21.21*	-14.11*	4.00	0.00	4.00	-1.10**	-1.38**	-8.36**	-5.49**	-10.63**	0.64
16	**P2xP9**	E1	-23.78**	-34.04**	-22.60**	-9.45*	-12.03**	-1.42	1.67**	1.10*	-4.60**	-4.10**	-9.76**	3.73**
	RAUS-5	E2	-11.11	-24.57**	-10.20	-4.53	-8.67	3.01	1.80**	0.55	-5.48**	-3.64**	-8.99**	4.46**
	x	E3	-15.47**	-28.05**	-15.89*	0.35	-5.96	13.60**	1.19**	0.00	-6.36**	-1.15	-6.44**	5.80**
	AMS99-33	E4	-13.03*	-26.71**	-24.23**	6.77	-2.74	13.60*	2.52**	1.82**	-4.61**	-1.99**	-7.30**	4.35**
17	**P2xP10**	E1	3.98	-1.08	-15.17**	-10.16*	-12.18**	-2.84	-5.41**	-8.88**	-8.25**	6.18**	4.90**	8.99**
	RAUS-5	E2	19.92**	15.98	-3.74	3.20	0.69	9.02	-3.95**	-7.53**	-8.40**	4.92**	3.52**	8.52**
	x	E3	4.14	-3.63	-20.86**	1.86	0.00	9.60	-2.32**	-4.27**	-8.81**	6.43**	5.27**	8.67**
	BAUS-96	E4	-42.68**	-52.79**	-15.34*	-18.63**	-24.11**	18.40**	-3.28**	-5.78**	-8.19**	7.25**	6.16**	8.77**
18	**P3xP4**	E1	-28.48**	-39.29**	-14.86**	14.18**	11.68*	8.51	-9.53	-12.08**	-5.21**	6.52**	0.97	5.38**
	NRC-77	E2	-27.14**	-34.28**	-13.27	20.47**	15.91**	15.04**	-8.96**	-12.05**	-5.57**	6.56**	1.76*	6.34**
	x	E3	-30.61**	-41.24**	-15.56*	14.62**	12.03*	19.20**	-9.20**	-11.24**	-6.27**	8.26**	4.17**	7.64**
	BAUS-40	E4	22.12**	19.48*	-20.25**	12.98**	4.23	12.80*	-9.67**	-11.46**	-5.12**	6.21**	2.79**	5.56**
19	**P3xP5**	E1	-43.91**	-56.29**	-38.70**	-11.03*	-14.60**	-17.02**	-2.04**	-5.80**	-4.17**	-3.56**	-7.86**	-5.43**
	NRC-77	E2	-37.86**	-50.52**	-34.69**	9.62	7.38	-1.50	-3.71**	-6.76**	-6.68**	-2.55**	-5.33**	-4.53**
	x	E3	-46.63**	-58.06**	-39.74**	-14.51**	-14.84**	-12.80*	-3.94**	-7.90**	-7.12**	-2.50**	-5.91**	-3.36**
	JS20-06	E4	-23.53**	-34.01**	-42.94**	12.35**	9.30	-14.40**	-2.31**	-6.88**	-4.18**	-3.29**	-6.15**	-4.18**
20	**P3xP6**	E1	-37.59**	-43.93**	-21.36**	-4.05	-10.69*	0.71	-3.93**	-7.25**	-5.64**	6.99**	2.25**	4.88**
	NRC-77	E2	-30.91**	-36.34**	-15.99*	3.18	-9.32*	9.77	-3.31**	-6.25**	-6.17**	9.04**	6.59**	6.13**
	x	E3	-45.17**	-50.92**	-29.47**	-11.11**	-18.42**	-0.80	-5.36**	-7.98**	-7.20**	8.13**	5.41**	6.03**
	AMS4-63	E4	-39.66**	-45.94**	-34.66**	-7.63	-13.57**	-3.20	-4.75**	-8.62**	-5.97**	6.94**	4.60**	5.09**
21	**P3xP7**	E1	11.55*	-12.58**	22.60**	11.19**	8.76	5.67	-8.86**	-9.64**	-8.07**	16.29**	14.97**	9.97**
	NRC-77	E2	14.42*	-7.99	21.43**	9.45*	5.30	4.51	-8.89**	-9.16**	-9.08**	15.34**	14.54**	10.45**
	x	E3	12.20*	-13.13**	24.83**	14.06**	13.18**	16.80**	-8.72**	-9.83**	-9.07**	15.06**	14.58**	10.38**
	PS1431-44	E4	6.93	-11.93*	6.44	1.47	-8.00	10.40	-9.18**	-10.53**	-7.94**	13.39**	12.97**	9.34**
22	**P3xP8**	E1	22.22**	-2.87	36.22**	7.91	6.38	6.38	1.03*	-3.58**	-1.91**	9.54**	0.11	13.07**
	NRC-77	E2	27.72**	7.47	41.84**	8.09	-2.00	10.53*	1.61	-2.74**	-2.66**	8.48**	-0.12	12.88**
	x	E3	34.22**	4.38	50.00**	15.47**	10.87*	22.40**	1.27**	-3.19**	-2.37**	8.62**	0.48**	12.91**
	JS97-52	E4	38.09**	8.12	30.67**	12.70**	9.23	13.60*	0.48	-4.39**	-1.62**	6.13**	-1.66*	10.73**
23	**P3xP9**	E1	5.05	-3.53	35.29**	-1.02	-7.59	3.55	-2.52**	-6.06**	-4.43**	5.37**	-4.47**	9.82**
	NRC-77	E2	8.13	2.84	35.71**	4.41	-5.33	6.77	-2.43**	-5.39**	-5.31**	4.83**	-4.16**	10.01**
	x	E3	4.45	-5.30	36.09**	5.04	-3.31	16.80**	-2.57**	-6.05**	-5.25**	1.16	-6.69**	5.51**
	AMS99-33	E4	11.63*	3.55	25.15**	10.45*	1.37	18.40**	-3.47**	-7.79**	-5.12**	5.26**	-2.45**	9.81**
24	**P3xP10**	E1	-0.43	-22.74**	8.36	-3.07	-8.97	0.71	-3.95**	-4.44**	-2.78**	4.95**	-0.31	3.58**
	NRC-77	E2	-1.95	-22.16**	2.72	2.26	-5.56	2.26	-3.18**	-3.68**	-3.60**	3.38**	-1.43	3.34**
	x	E3	3.57	-23.04**	10.60	0.76	-2.92	6.40	-1.82**	-4.54**	-3.73**	1.31	-2.47**	0.68
	BAUS-96	E4	18.37**	-7.61	11.66	13.64**	5.63	20.00**	-4.09**	-6.63**	-3.92**	1.85**	-1.32	1.10

Continue 3 ....

25	**P4xP5**	E1	19.16**	7.28	4.95	13.62**	11.45*	3.55	-0.86**	-7.25**	0.00	-0.95	-1.77**	2.52**
	BAUS-40	E2	11.81	-2.88	3.06	23.69**	16.67**	15.79**	-1.66**	-7.90**	-1.11**	1.48*	-0.30	4.18**
	x	E3	15.48*	5.32	4.97	12.64**	10.53*	17.60**	-0.68	-6.82**	-1.61**	0.96	0.65	4.00**
	JS20-06	E4	12.38	6.29	-6.75	10.37*	5.67	19.20**	-1.23**	-7.64**	-1.02*	-1.80**	-2.09**	0.55
26	**P4xP6**	E1	1.33	-4.99	6.19	-2.07	-10.69*	0.71	-2.87**	-8.78**	-1.65**	2.59**	1.71**	6.15**
	BAUS-40	E2	-10.49	-12.54*	-2.72	-16.72**	-24.22**	-8.27	-2.04**	-8.14**	-1.37**	3.09**	0.66	5.18**
	x	E3	14.60**	7.58	22.19**	4.56	-1.97	19.20**	-3.71**	-8.43**	-3.31**	5.29**	3.89**	7.35**
	AMS4-63	E4	9.36	4.81	0.31	12.27**	7.86	20.80**	-2.96**	-8.68**	-2.13**	4.65**	3.52**	6.31**
27	**P4xP7**	E1	-8.20	-16.77**	-18.58**	17.56**	17.56**	9.22	-3.93**	-7.41**	-0.17	4.43**	0.07	4.44**
	BAUS-40	E2	-13.50*	-24.04**	-19.39**	10.61*	10.61*	9.77	-4.47**	-7.98**	-1.20**	6.75**	2.64	7.25**
	x	E3	-26.53**	-34.22**	-34.44**	-2.29	-3.76	2.40	-3.45**	-6.74**	-1.53**	7.92**	4.27**	7.74**
	PS1431-44	E4	-7.95	-12.94	-23.62**	4.66	-2.67	16.80**	-4.04**	-7.32**	-0.68	7.76**	4.66**	7.48**
28	**P4xP8**	E1	52.32**	40.51**	37.46**	6.62	2.84	2.84	4.72**	-2.74**	4.86**	-13.33**	-16.62**	-5.82**
	BAUS-40	E2	42.81**	32.05**	40.14**	0.00	-6.00	6.02	4.87**	-2.87**	4.28**	-13.61**	-16.87**	-6.04**
	x	E3	70.11**	53.16**	52.65**	9.96*	7.97	19.20**	4.68**	-2.09**	3.39**	-12.86**	-16.36**	-6.02**
	JS97-52	E4	57.17**	39.86**	22.70**	5.02	4.62	8.80	4.56**	-2.39**	4.61**	-12.00**	-15.87**	-5.27**
29	**P4xP9**	E1	6.76	-2.11	14.86**	1.73	-6.96	4.26	3.13**	-3.30**	4.25**	-8.89**	-13.08**	-0.09
	BAUS-40	E2	-0.91	-6.29	11.56	-4.26	-10.00*	1.50	-2.03**	-5.83**	2.23**	-4.97**	-5.12*8	-0.41
	x	E3	3.06	-4.53	11.59	-4.93	-10.60*	8.00	3.36**	-2.49**	2.97**	-7.75**	-11.73**	-0.19
	AMS99-33	E4	7.54	-0.59	2.76	4.73	-1.37	15.20**	3.23**	-3.26**	3.67**	-8.10**	-12.13**	-1.09
30	**P4xP10**	E1	16.96**	4.75	2.48	-5.92	-13.46**	-4.26	-2.66**	-5.88**	1.48**	-2.97**	-3.18**	1.05
	BAUS-40	E2	23.33**	6.73	13.27	-1.45	-5.56	2.26	1.53**	-4.79**	1.11*	-9.17**	-13.23**	0.17
	x	E3	12.50	-4.32	-4.64	-10.37*	-11.68*	-3.20	0.42**	-4.49**	0.85	-2.13**	-2.17*	-0.53
	BAUS-96	E4	16.37*	3.15	-9.51	-7.01	-11.27*	0.80	-0.50	-5.02**	1.79**	-2.35	-2.46**	1.08
31	**P5xP6**	E1	-1.95	-16.62**	-6.81	-2.46	-12.58**	-1.42	6.21**	5.77**	0.17	-0.88	-0.92	1.70*
	JS20-06	E2	-4.13	-18.35**	-9.18	-0.72	-14.29**	3.76	5.89**	5.74**	-0.60	2.20**	1.55	2.41**
	x	E3	-9.64	-22.16**	-11.59	-5.00	-12.50**	6.40	6.05**	4.54**	-0.42	-0.12	-1.15	1.52
	AMS4-63	E4	-1.94	-10.90	-14.72*	-3.91	-4.26	8.00	7.86**	7.13**	1.28**	-0.04	-0.84	1.24
32	**P5xP7**	E1	16.47**	15.56*	-8.05	3.50	1.53	-5.67	-4.57**	-7.47**	-7.47**	4.27**	0.72	3.38**
	JS20-06	E2	32.19**	30.51**	4.76	31.73**	24.24**	23.31**	-4.83**	-7.58**	-8.05**	4.84**	2.54*8	3.41**
	x	E3	9.47	7.26	-11.92	-1.95	-2.33	0.80	-4.75**	-7.58**	-9.07**	4.08**	0.86	3.58**
	PS1431-44	E4	-7.45	-7.45	-27.61**	-18.21**	-20.67**	-4.80	-3.76**	-6.92**	-7.08**	3.02**	0.34	2.44**
33	**P5xP8**	E1	53.85**	49.81**	23.84**	10.86*	4.96	4.96	0.70	-0.09	-6.16**	-6.04**	-10.33**	1.28
	JS20-06	E2	51.52**	41.51**	27.55**	10.11*	-2.00	10.53*	0.28**	-0.91	-7.11**	-3.74**	-8.93**	2.93**
	x	E3	60.33**	58.06**	29.80**	12.03**	7.97	19.20**	-1.70**	-2.01**	-9.32**	-5.30**	-9.37**	1.84*
	JS97-52	E4	52.30**	42.75**	11.66	1.85	-2.13	10.40	0.92*	0.73	-6.06**	-5.77**	-10.17**	1.15

Continue 3 ....

34	**P5xP9**	E1	3.48	-13.72**	1.24	4.23	-6.33	4.96	6.13**	5.89**	-0.09	1.54**	-3.90**	10.47**
	JS20-06	E2	8.97	-9.71	7.48	13.11**	0.67	13.53**	5.80**	5.65**	-0.69	1.13	-5.01**	9.02**
	x	E3	-1.50	-16.15**	-1.99	-1.79	-9.27*	9.60	5.96**	5.34**	-1.36**	-0.14	-4.72**	7.74**
	AMS99-33	E4	-12.50*	-23.15**	-20.55**	-13.59**	-15.07**	-0.80	6.44**	6.19**	-0.51	-0.16**	-4.80**	7.16**
35	**P5xP10**	E1	38.77**	37.94**	8.05	-2.84	-12.18**	-2.84	3.30**	-0.17	0.52	-8.13**	-8.69**	-5.12**
	JS20-06	E2	33.62**	33.04**	4.08	-2.68	-11.81**	-4.51	2.16**	-0.58	-1.52**	-6.23**	-8.02**	-3.56**
	x	E3	49.46**	38.31**	13.58*	4.91	1.46	11.20*	5.14**	3.65**	-1.27**	-7.79**	-8.02**	-5.05**
	BAUS-96	E4	18.07*	10.20	-13.80*	-18.02**	-18.31	-7.20	6.31**	4.03**	1.37**	-6.74**	-6.91**	-4.62**
36	**P6xP7**	E1	20.06**	2.77	14.86**	4.14	-5.03	7.09	4.41**	1.65**	1.65**	-1.68**	-4.99**	-2.55**
	AMS4-63	E2	15.45*	-0.61	10.54	-2.39	-11.18**	7.52	4.34**	1.46**	0.94*	0.32	-1.26**	-1.69*
	x	E3	18.42**	0.29	13.91*	3.20	-4.61	16.00**	2.32**	0.69	-0.93*	0.79	-1.34	-0.76
	PS1431-44	E4	16.40**	5.77	1.23	0.00	-3.33	16.00**	3.69**	0.94**	0.77	0.24	-1.60	-1.14
37	**P6xP8**	E1	1.91	-11.36*	-0.93	-7.33	-12.58**	-1.42	12.34**	11.00**	5.12**	-7.62**	-11.86**	-0.45
	AMS4-63	E2	3.72	-6.12	4.42	-10.61**	-13.66**	4.51	13.07**	11.58**	4.88**	-5.03**	-10.68**	0.95
	x	E3	6.85	-9.04	3.31	2.76	-1.97	19.20**	12.09**	10.14**	4.92**	-6.77**	-11.65**	-0.73
	JS97-52	E4	11.40	-4.49	-8.59	4.44	0.71	12.80*	12.70**	11.73**	5.63**	-7.16**	-12.16**	-1.09
38	**P6xP9**	E1	12.16**	9.50	28.48**	-4.10	-4.40	7.80	5.42**	5.22**	-0.35**	-4.32**	-9.48**	4.06**
	AMS4-63	E2	13.44**	9.71	30.61**	-3.54	-6.83	12.78*	5.29**	5.29**	-1.03*	-2.42**	-8.88**	4.58**
	x	E3	10.92*	9.35	27.81**	-1.65	-1.97	19.20**	2.92**	2.05**	-2.80**	-1.48*	-6.92**	5.26**
	AMS99-33	E4	13.41*	9.20	12.88*	1.40	-0.68	16.00**	5.53**	5.05**	-0.68	-3.62**	-8.80**	2.66**
39	**P6xP10**	E1	3.44	-12.47*	-2.17	-0.95	-1.89	10.64*	0.76	-2.24**	-1.56**	2.14**	1.48*	5.45**
	AMS4-63	E2	14.23*	-3.06	7.82	1.64	-3.73	16.54**	1.64**	-0.95*	-1.89**	3.81**	1.20	6.10**
	x	E3	-0.72	-19.83**	-8.94	-0.35	-5.26	15.20**	3.38**	3.38**	-1.53**	1.72*	0.43	3.67**
	BAUS-96	E4	8.82	-7.05	-11.04	0.71	0.00	13.60*	3.91**	2.36**	-0.26	0.16	-0.82	1.62*
40	**P7xP8**	E1	17.18**	14.98*	-4.95	2.21	-1.42	-1.42	1.13**	-2.69**	-2.69**	-4.73**	-12.03**	-0.63
	PS1431-44	E2	4.99	-0.75	-10.54	-5.67	-11.33*	0.00	1.30**	-2.76**	-3.26**	-5.81**	-12.72**	-1.36
	x	E3	20.25**	19.50*	-4.64	11.61**	7.97	19.20**	-0.18	-3.45**	-5.00**	-8.83**	-15.34**	-4.87**
	JS97-52	E4	10.04	3.14	-19.33**	-2.14	-8.67	9.60	0.84*	-2.65*	-2.82**	-10.94**	-17.20**	-6.76**
41	**P7xP9**	E1	-36.48**	-46.70**	-37.46**	-3.81	-12.03**	-1.42	5.40**	2.43**	2.43**	-4.42**	-12.44**	0.65
	PS1431-44	E2	-38.23**	-48.29**	-38.44**	-1.42	-7.33	4.51	5.49**	2.58**	2.06**	-4.98**	-12.57**	0.34
	x	E3	-41.46**	-50.99**	-42.72**	-10.71**	-17.22**	0.00	5.47**	2.93**	1.27**	-7.00**	-13.88**	-2.62**
	AMS99-33	E4	-41.22**	-48.37**	-46.63**	-16.89**	-18.00**	-1.60	6.35**	3.08**	2.90**	-6.77**	-13.31**	-2.41**
42	**P7xP10**	E1	-15.19*	-16.34*	-33.44**	2.44	-5.77	4.26	1.04*	0.69	1.39**	-5.25**	-9.02**	-5.47**
	PS1431-44	E2	-12.07	-13.56	-30.61**	12.32**	7.64	16.54**	1.60**	1.38**	0.86	-5.39*8	-9.18**	-4.79**
	x	E3	-9.13	-14.29	-32.45**	6.02	2.92	12.80*	5.65**	3.96**	2.29**	-2.88**	-6.12**	-3.09**
	BAUS-96	E4	-19.75**	-25.10**	-41.41**	-10.27*	-12.67**	4.80	3.46**	2.22**	2.05**	-2.75**	-5.44**	-3.11**

Continue 3 ....

43	**P8xP9**	E1	44.58**	23.22**	44.58**	1.00	-4.43	7.09	11.06**	9.94**	3.73**	-17.69**	-18.41**	-6.20**
	JS97-52	E2	47.32**	29.43**	54.08**	2.00	2.00	15.04**	10.76**	9.30**	2.74**	-17.21**	-17.84**	-5.70**
	x	E3	49.49**	25.78**	47.02**	2.42	-1.99	18.40	8.86**	7.87**	1.02*	-17.88**	-18.14**	-7.43**
	AMS99-33	E4	51.43**	25.82**	30.06**	5.07	-0.68	16.00	11.66**	11.20**	4.18**	-18.66**	-18.67**	-8.42**
44	**P8xP10**	E1	30.37**	26.22**	4.33	4.38	-0.64	9.93	11.55**	6.98**	7.73**	-5.37**	-9.16**	2.60**
	JS97-52	E2	20.49**	12.08	1.02	4.08	2.00	15.04**	11.78**	7.53**	6.51**	-4.23**	-7.69**	4.32**
	x	E3	33.19**	24.90**	-0.33	9.09*	8.70	20.00	13.99**	12.01**	6.69**	-4.02**	-7.92**	3.46**
	BAUS-96	E4	31.98**	31.39**	-10.12	3.68	-0.70	12.80	13.58**	10.95**	8.11**	-5.29**	-9.56**	1.84*
45	**P9xP10**	E1	-11.29*	-26.39**	-13.62*	2.55	1.90	14.18**	4.23**	0.95*	1.65**	5.05**	0.00	14.96**
	AMS99-33	E2	-10.03	-25.71**	-11.56	11.56**	9.33*	23.31**	3.68**	1.04*	0.09	3.69**	-0.80	13.86**
	x	E3	-7.45	-26.06**	-13.58*	11.81**	6.62	28.80	6.59**	5.69**	0.68	2.52**	-1.94*	10.88**
	BAUS-96	E4	-6.09	-22.26**	-19.63**	13.19**	11.64*	30.40	7.50**	5.43**	2.73**	2.41**	-2.19**	10.11**
	SE	E1	0.526	0.607	0.607	2.082	2.404	2.404	0.154	0.178	0.178	0.112	0.130	0.130
		E2	0.576	0.665	0.665	1.930	2.229	2.229	0.149	0.172	0.172	0.135	0.156	0.156
		E3	0.564	0.651	0.651	1.831	2.114	2.114	0.147	0.170	0.170	0.150	0.173	0.173
		E4	0.570	0.658	0.658	1.952	2.254	2.254	0.152	0.175	0.175	0.138	0.160	0.160

For days to 50% flowering on pooled basis among hybrids minimum value was exhibited by hybrid $P_5 \times P_7$ (43.4 days), followed by hybrid $P_5 \times P_6$ (44.1days), $P_4 \times P_9$ (44.2days) and hybrid $P_3 \times P_9$ (44.3days), whereas, for maturity minimum value was found in hybrid $P_3 \times P_7$ (103.3days), followed by hybrid $P_1 \times P_2$ (104.4days), $P_3 \times P_6$ (105.7 days) and hybrid $P_6 \times P_8$ (105.8 days). For number of pods per plant maximum value was depicted by hybrid $P_1 \times P_9$ (53.8). For 100 grain weight maximum value was depicted by hybrid $P_2 \times P_3$ (14.31 g), followed by hybrids $P_1 \times P_6$ (13.96), $P_1 \times P_5$ (13.78), $P_2 \times P_7$ (13.71) and $P_2 \times P_4$ (13.46). Maximum value for grain yield per plant on pooled basis was recorded in hybrid $P_8 \times P_9$ (14.90 g), which was statistically at par with hybrids $P_3 \times P_8$ (14.43 g), $P_4 \times P_8$ (14.31 g) and $P_3 \times P_9$ (13.79 g), whereas, among parents, it varied from 7.16 (P_1) to 13.91 g (P_3) with best check JS-335 (10.38g). The data of harvest index among hybrids, the highest value was found in hybrid $P_9 \times P_{10}$ (54.08 %), followed by hybrid $P_1 \times P_6$ (51.92%) and $P_1 \times P_3$ (51.08 %). Highest mean value for protein content was recorded in hybrid $P_8 \times P_{10}$ (41.75 %), followed by hybrid $P_6 \times P_8$ (40.93%), whereas, maximum oil content was found in hybrid $P_9 \times P_{10}$ (22.05 %), followed by hybrid $P_3 \times P_8$ (22.04 %), $P_3 \times P_7$ (21.58 %), $P_3 \times P_9$ (21.34 %), $P_5 \times P_9$ (21.30%) and $P_1 \times P_3$ (21.16 %). Among parents, it varied from 18.64% (P_3) to 22.33 % (P_9) with best checks JS80-21(19.61%).

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