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Full Length Research Paper

Studies on genetic variability for morphological, water use efficiency, yield and yield traits in early segregating generation of groundnut (A*rachis hypogaea* L)

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Twenty eight F_2 populations were evaluated for genetic parameters of 23 characters of morphological, physiological, yield and yield attributes during spring 2009. TPT-4 x ICGV-91114 was distinct for its lowest mean value for days to maturity and highest mean values for number of well-filled and mature pods per plant, shelling percentage, 100- kernel weight. The F_2 involving JL-220 as one of the parents *viz*., JL-220 x ICGV-99029 for SCMR, JL-220 x TCGS-647 for SMK percentage, protein percentage, kernel yield per plant and pod yield per plant showed the highest *per se* performance. High genotypic coefficient of variation was observed for the number of secondary branches per plant. High heritability and high GAM was recorded for the number of secondary branches per plant, high heritability and moderate GAM were observed for days to 50% flowering. The leaf area index, number of well-filled and mature pods per plant, dry haulms yield per plant and harvest index showed moderate heritability and high GAM. This indicates that these characters are under additive genetic control and selection for genetic improvement will be worthwhile and may rapidly contribute to pod-and kernel yields.

Key words: Groundnut, genetic variability, heritability, genetic advance and genetic advance as percentage of mean.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a highly self pollinated crop and can be grown successfully in tropical and sub tropical areas. Genetic variability is the basic requirement for crop improvement as this provides wider scope for selection. Thus, effectiveness of selection is dependent upon the nature, extent and magnitude of genetic variability present in the material and the extent to which it is heritable. Crop improvement is a continuous process which takes care of the changing needs and new problems arising in crop productivity. Groundnut is the most important oilseed crop of India.

Though it leads in area and production in the world, its productivity is low due to various abiotic and biotic stresses. Furthermore, pod yield besides physiological traits (water use efficiency, transpiration rate, specific leaf area, stomatal conductance and photosynthetic rate) in groundnut are quantitatively inherited complex traits and is highly influenced by environmental factors. Water use efficiency is one such important trait which is correlated with specific leaf area. SPAD chlorophyll meter reading (SCMR) and photosynthetic rate and these traits have been suggested as surrogate traits in selecting for water use efficiency in groundnut (Nandini et al., 2011). The genetic variability has to be looked into for planning breeding approaches for the crop improvement. This necessitates a thorough knowledge of variability owing to genetic factors, actual genetic variation heritable in the progeny and the genetic advance that can be achieved through selection (Shinde et al., 2010).

Hence, in the present investigation, an attempt was made to assess the variability of important morphological, water use efficiency, pod yield and yield

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contributing traits, along with the indices of variability that is, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability in broad sense (h^2 bs), genetic advance (GA) and genetic advance as percent of mean (GAM). This study will facilitate an understanding behind expression of character and also role of environment therein.

MATERIALS AND METHODS

The experimental material comprised of 28 F_2 populations. The present investigation was carried out at Regional Agricultural Research Station Farm, Tirupati during *rabi* 2009. The 28 F_2s were grown in a randomized block design with three replications. Each entry was sown in three rows of 3 m length by adopting spacing of 30 x 10 cm. Observations were recorded on 30 competitive plants selected at random for 23 characters viz., days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, SPAD chlorophyll meter reading, at 60 DAS, specific leaf area (cm^2 g^{-1}), specific leaf weight (g cm^{-2}) at 60 DAS, leaf area index at 60 DAS, transpiration rate (mmol H_2O m^{-2} s^{-1}) at 60 DAS, photosynthetic rate (µmol Co_2 m^{-2} s^{-1}) at 60 DAS, stomatal conductance (mol H_2O m^{-2} s^{-1}), water use efficiency (%) at 60 DAS, number of well-filled and mature pods per plant, shelling percentage, sound mature kernel percentage, 100-kernel weight (g), dry haulm weight per plant (g), harvest index (%), oil percentage , protein percentage , kernel yield per plant (g) and pod yield per plant (g). The phenotypic and genotypic coefficients of variations were computed according to Burton (1952). The broad sense heritability was computed as suggested by Allard (1960) and genetic advance as a percentage of mean as per Johnson et al. (1955).

RESULTS AND DISCUSSION

The analysis of variance for 23 characters in F_2s revealed that significant differences were observed for all the characters among the genotypes except SPAD chlorophyll meter reading, specific leaf weight, photosynthetic rate, stomatal conductance and protein percentage indicating the presence of a high degree of variability.

Among the F_2s, TPT-4 x ICGV-91114 was distinct for its lowest mean value for days to maturity and highest mean values for number of well-filled and mature pods per plant, shelling percentage, 100- kernel weight (g?). Other F_2s, involving TIR-25 as one of parents showing the highest *per se* performance are TIR-25 x TCGS-647 for short statue, TIR-25 x ICGV-99029 for specific leaf weight, TIR-25 x JL-220 for stomatal conductance and water use efficiency and TIR-25 x ICGV-91114 for oil percentage. The F_2 involving JL-220 as one of the parents *viz*., JL-220 x ICGV-99029 for SCMR, JL-220 x TCGS-647 for SMK percentage, protein percentage, kernel yield per plant (g?) and pod yield per plant (g?) showed the highest *per se* performance during *rabi*. The offspring involving ICGV-91114 as one of the parent in the cross, ICGV-91114 x K-1375 came to flowering early and ICGV-91114 x TCGS-647 recorded the highest *per se* performance for the number of primary branches per plant and percentage (Table 1).

In the present study, the other population of the crosses *viz*., ICGV-99029 x TCGS-647 for both leaf area index and transpiration rate, ICGV-99029 x K-1375 for photosynthetic rate, TCGS-584 x ICGV-99029 for number of secondary branches per plant, dry haulms yield per plant (g) and harvest index and K-1375 x TCGS-647 for low specific leaf area.

The genotypic coefficient of variation ranged from 0.24 to 54.58%. High genotypic coefficient of variation was observed for the number of secondary branches per plant (54.58%). Moderate genotypic coefficient of variation was observed for specific leaf weight (21.42%) and dry haulms yield per plant (22.45%) (Table 2). High phenotypic coefficient of variation and high genotypic coefficient of variation was recorded for the number of secondary branches per plant, whereas moderate PCV and moderate GCV was observed for dry haulms yield per plant. High heritability values were observed for days to 50% flowering, plant height and number of secondary branches per plant, whereas moderate heritability was exhibited for the number of primary branches per plant, specific leaf area, specific leaf weight, leaf area index, water use efficiency, sound mature kernel percentage, harvest index and oil percentage. High genetic advance as percent of mean was observed for the number of secondary branches per plant, leaf area index, the number of well-filled and mature pods per plant, dry haulms yield per plant and harvest index and moderate GAM was recorded for days to 50% flowering, plant height, number of primary branches per plant and specific leaf area.

Broad sense heritability was estimated for all the characters and it ranged from 0.16% (specific leaf weight) to as high as 85.46% (days to 50% flowering). High heritability was observed for the characters viz, days to 50% flowering (85.46%), days to maturity (60.13%) and the number of secondary branches per plant (68.05%). Moderate heritability was observed for characters *viz.,* specific leaf area (33.38%), leaf area index (38.15%), and number of well-filled and mature pods per plant (57.47%), dry haulms yield per plant (51.96%), harvest index (44.82%) and oil percentage (45.63%). The low heritability was recorded for plant height (29.05%), number of primary branches per plant (32.99%), SPAD chlorophyll meter reading (5.78%), specific leaf weight (0.16%), transpiration rate (6.68%), photosynthetic rate (19.37%), stomatal conductance (4.36%), water use efficiency (1.89%), shelling percentage (9.17%), sound mature kernel percentage (20.21%), 100-kernel weight (29.24%), protein percentage (3.91%), kernel yield per plant (19.86%) and pod yield per plant (24.95%). These results were confirmed with the findings of Shinde et al. (2010) reported low heritability for number of primary branches per plant.

The range of genetic advance varied from 0.00 to

Table 1. *Per se* performance of F_2 s for 23 quantitative characters in groundnut.

Parents/crosses	Days to 50 per cent flowering	Days to maturity	Plant height	No. of primary branches per plant	No. of secondary branches per plant	SPAD chlorophyll meter reading at 60 DAS	Specific leaf area (cm^2 g^{-1}) at 60 DAS	Specific leaf weight (g cm^{-2}) at 60 DAS	Leaf area index at 60 DAS	Transpiration rate (mmol H_2O m^{-2} s^{-1}) at 60 DAS	Photosynthetic rate (µmol co_2 m^{-2} s^{-1}) at 60 DAS	Stomatal conductance ((mol H_2O m^{-2} s^{-1}) at 60 DAS	WUE (%) at 60 DAS
Crosses													
TPT-4 x TPT-25	24.00	104.33	23.48	4.43	0.35	40.73	143.62	0.70	0.74	8.47	25.22	1.96	0.29
TPT-4 x ICGV-91114	23.67	99.33	26.21	4.04	0.43	44.17	128.47	0.78	0.62	7.65	22.51	1.41	0.28
TPT-4 x TCGS-584	24.33	102.00	27.47	4.14	0.73	43.77	152.16	0.69	0.66	9.27	26.71	1.97	0.27
TPT-4 x JL-220	24.67	103.67	24.66	3.59	1.13	42.40	163.71	0.65	0.77	8.29	25.46	2.12	0.31
TPT-4 x ICGV-99029	23.67	108.33	27.84	5.48	1.97	40.37	156.40	0.65	0.76	8.00	25.39	2.26	0.31
TPT-4 x K-1375	25.67	108.33	30.25	4.63	0.94	46.00	120.08	0.83	0.60	7.87	24.10	1.38	0.29
TPT-4 x TCGS-647	26.33	112.00	27.49	4.83	1.11	46.00	154.71	0.65	0.79	9.10	25.82	1.93	0.28
TIR-25 x ICGV-91114	25.67	103.00	22.41	5.06	0.86	43.60	135.86	0.76	0.64	8.39	24.81	1.94	0.30
TIR-25 x TCGS-584	26.33	104.00	23.70	5.10	1.03	43.47	123.23	0.55	0.50	9.42	25.13	2.53	0.25
TIR-25 x JL-220	25.67	106.00	26.58	4.34	1.04	46.20	124.54	0.52	0.46	8.83	26.64	3.32	0.58
TIR-25 x ICGV-99029	26.00	113.00	27.80	5.27	1.06	28.50	129.67	0.86	0.56	8.58	26.52	1.99	0.32
TIR-25 x K-1375	25.67	108.67	27.85	4.46	1.07	45.37	123.00	0.86	0.44	7.81	25.31	1.31	0.31
TIR-25 x TCGS-647	27.00	110.00	19.50	5.57	0.49	44.73	149.60	0.67	0.60	8.36	27.74	1.68	0.31
ICGV-91114 X TCGS-584	25.00	100.00	27.11	5.05	0.60	48.73	120.55	0.83	0.63	8.31	23.84	1.47	0.31
ICGV-91114 X JL-220	25.33	102.67	23.03	4.39	0.92	34.23	145.31	0.69	0.68	9.35	24.57	2.07	0.31
ICGV-91114 X ICGV-99029	26.67	101.67	28.64	5.66	1.50	43.90	145.50	0.75	0.61	9.07	26.75	2.26	0.31
ICGV-91114 X K-1375	23.33	102.00	26.10	5.24	0.77	46.53	157.20	0.64	0.65	9.40	26.50	2.13	0.27
ICGV-91114 X TCGS-647	25.67	106.33	24.13	6.01	0.77	48.73	118.13	0.85	0.65	8.68	25.70	2.82	0.31
TCGS-584 X JL-220	24.67	103.67	27.99	5.29	0.90	43.10	164.86	0.65	0.75	8.18	22.18	2.12	0.27
TCGS-584 X ICGV-99029	27.00	109.67	36.42	5.93	3.36	32.47	159.74	0.67	0.64	8.82	24.50	2.38	0.26
TCGS-584 X K-1375	25.67	110.67	28.35	4.99	0.85	45.10	140.45	0.75	0.72	8.60	24.60	1.66	0.29
TCGS-584 X TCGS-647	25.33	109.00	24.22	5.32	2.14	47.43	126.77	0.80	0.65	7.73	24.17	1.84	0.32
JL-220 X ICGV-99029	26.67	106.67	25.83	4.81	0.60	50.00	125.43	0.77	0.72	8.30	24.86	1.63	0.28
JL-220 X K-1375	26.67	106.33	29.26	4.54	1.21	45.60	139.58	0.75	0.94	8.75	25.77	1.89	0.28
JL-220 X TCGS-647	27.67	111.67	28.96	5.09	1.29	45.57	153.79	0.76	0.91	9.64	27.10	2.56	0.27
ICGV-99029 x K-1375	31.33	114.33	29.49	5.56	2.02	42.63	129.20	0.73	0.56	9.35	28.30	1.94	0.27

Table 1. Contd.

ICGV-99029 x TCGS-647	30.00	114.67	32.16	5.63	2.61	43.47	236.97	0.52	1.02	9.70	27.60	2.54	0.28
K-1375 x TCGS-647	30.33	123.00	30.39	5.46	0.93	49.50	108.46	0.86	0.55	9.14	27.98	1.57	0.29
Mean of F_2s	26.07	107.32	27.05	5.00	1.17	43.65	142.04	0.72	0.67	8.68	25.56	2.02	0.30
Range among F_2s	23.33-31.33	99.33-123.00	19.50-36.42	4.04-6.01	0.35-3.36	32.47-50.00	108.46-236.97	0.52-0.87	0.44-1.02	7.73-9.70	22.18-27.98	1.31-3.32	0.26-0.58
CD at 5% level	1.27	6.36	6.34	1.08	0.71	12.74	43.57	0.20	0.22	1.29	3.92	1.22	0.16

Parents/crosses	No. of well-filled and mature pods per plant	Shelling per cent	Sound mature kernel per cent (%)	100- kernel weight (g)	Dry haulm weight per plant	Harvest index	Oil per cent	Protein per cent	Kernel yield per plant (g)	Pod yield per plant (g)
Crosses										
TPT-4 x TPT-25	16.50	80.07	87.54	47.80	14.04	35.92	47.77	26.30	18.78	23.68
TPT-4 x ICGV-91114	24.21	80.77	87.80	51.83	18.11	44.80	47.80	26.63	18.38	22.09
TPT-4 x TCGS-584	13.30	77.54	88.86	44.94	16.48	47.68	47.80	26.40	12.98	16.57
TPT-4 x JL-220	10.90	76.22	85.77	46.22	9.61	33.41	47.77	26.57	14.07	18.30
TPT-4 x ICGV-99029	13.60	74.18	87.47	47.35	14.48	45.27	47.30	26.70	13.28	17.76
TPT-4 x K-1375	12.42	77.09	88.03	45.41	12.06	40.01	47.90	26.10	14.64	18.95
TPT-4 x TCGS-647	14.17	78.44	87.88	55.50	13.91	36.56	46.97	26.57	16.83	21.55
TIR-25 x ICGV-91114	16.17	80.30	88.75	46.53	14.62	42.42	48.40	26.47	16.16	20.07
TIR-25 x TCGS-584	12.45	77.89	86.31	39.66	13.27	46.85	48.10	26.47	14.05	17.68
TIR-25 x JL-220	17.14	79.37	91.65	46.10	13.35	34.64	48.10	26.40	17.25	21.88
TIR-25 x ICGV-99029	14.43	78.99	85.28	46.97	15.83	40.77	47.70	26.37	16.86	21.17
TIR-25 x K-1375	16.09	78.01	90.31	46.76	13.21	43.28	48.37	26.23	16.95	21.67
TIR-25 x TCGS-647	14.42	79.13	80.00	47.83	16.06	46.13	47.87	26.10	17.77	21.48
ICGV-91114 X TCGS-584	13.95	76.12	83.01	45.23	11.53	42.66	47.87	26.03	10.78	14.11
ICGV-91114 X JL-220	15.39	76.57	90.08	46.61	9.99	28.88	47.50	26.63	16.58	21.71
ICGV-91114 X ICGV-99029	13.70	76.20	88.59	47.42	17.11	46.96	47.33	26.60	16.61	21.94
ICGV-91114 X K-1375	14.10	80.38	90.73	51.13	15.22	46.24	47.53	26.60	13.54	16.97
ICGV-91114 X TCGS-647	11.05	77.29	87.46	45.31	14.92	39.27	47.40	26.73	13.76	20.15
TCGS-584 X JL-220	14.70	73.67	86.34	40.18	12.90	40.23	48.07	26.53	13.99	19.12
TCGS-584 X ICGV-99029	18.15	70.97	85.16	43.62	27.91	63.09	47.47	26.50	14.38	19.81
TCGS-584 X K-1375	15.60	78.40	85.16	45.40	17.88	52.04	47.47	26.40	13.42	17.05
TCGS-584 X TCGS-647	11.42	73.28	86.62	42.34	12.97	44.45	46.97	26.40	11.67	15.86
JL-220 X ICGV-99029	11.48	79.79	93.41	48.09	15.82	45.22	47.83	26.50	16.55	20.93
JL-220 X K-1375	12.41	80.25	89.37	47.78	10.36	32.64	48.13	26.47	15.15	18.97
JL-220 X TCGS-647	13.03	79.76	91.33	47.90	12.94	32.62	46.93	26.73	20.45	25.59
ICGV-99029 x K-1375	14.92	75.09	80.87	47.69	15.80	44.33	47.20	26.57	16.98	22.37

ICGV-99029 x TCGS-647	14.16	69.05	87.75	45.52	19.65	53.60	47.40	26.53	13.87	19.65
K-1375 x TCGS-647	12.85	79.58	88.26	48.28	23.41	57.02	46.80	26.20	11.82	20.46
Mean of F_2s	14.38	77.30	87.49	46.62	15.12	43.11	47.63	26.45	15.27	19.91
Range among F_2s	10.90-24.21	69.05-80.77	80.00-93.41	39.66-55.50	9.61-23.41	28.88 - 63.09	46.80-48.40	26.03-26.73	10.78-20.45	14.11-25.59
CD at 5% level	3.35	7.32	6.42	5.97	5.34	11.73	0.65	0.51	5.00	5.07

Table 2. Estimates of genetic parameters for 23 quantitative characters in 28 F_2 s of groundnut.

Character	Mean	PCV	GCV	H (BS)	GA	GAM
Days to 50 per cent flowering	26.07	7.78	7.19	85.46	3.57	13.69
Days to maturity	107.32	5.73	4.44	60.13	7.62	7.10
Plant height (cm)	27.05	17.01	9.17	29.05	2.75	10.18
Number of primary branches per plant	5.00	16.09	9.24	32.99	0.55	10.94
Number of secondary branches per plant	1.17	66.17	54.58	68.05	1.08	92.75
SPAD chlorophyll meter reading at 60 DAS	43.65	18.37	4.42	5.78	0.96	2.19
rea (cm^2 g^{-1})	142.04	22.96	13.26	33.38	22.42	15.79
Specific leaf weight (g cm^{-2}) at 60 DAS	1.70	528.04	21.42	0.16	0.03	1.79
Leaf area index at 60 DAS	0.67	25.99	16.05	38.15	0.14	20.42
Transpiration rate (mmol H_2O m^{-2} s^{-1}) at 60 DAS	25.56	9.70	2.51	6.68	0.34	1.34
Photosynthetic rate (µmol Co_2 m^{-2} s^{-1}) at 60 DAS	8.68	10.13	4.46	19.37	0.35	4.04
Stomata conductance (mol H_2O m^{-2} s^{-1})	2.02	37.74	7.88	4.36	0.07	3.39
Water use efficiency (%) at 60 DAS	0.30	32.99	4.54	1.89	0.00	1.29
Number of well-filled and mature pods per plant	14.38	21.82	16.54	57.47	3.71	25.83
Shelling per cent	77.30	6.07	1.84	9.17	0.89	1.15
Sound mature kernel per cent	87.49	5.02	2.26	20.21	1.83	2.09
100-kernel weight (g)	46.62	9.30	5.03	29.24	2.61	5.60
Dry haulm weight per plant (g)	15.12	31.14	22.45	51.96	5.04	33.33
Harvest index (%)	43.11	22.37	14.98	44.82	8.90	20.66
Oil per cent	47.63	1.13	0.76	45.63	0.50	1.06
Protein per cent	26.45	1.19	0.24	3.91	0.03	0.10
Kernel yield per plant (g)	15.27	22.34	9.96	19.86	1.40	9.14
Pod yield per plant (g)	19.91	17.96	8.97	24.95	1.84	9.23

22.4. High genetic advance was recorded for specific leaf area (22.42) whereas the lowest genetic advance was recorded for protein percentage (0.00). Genetic advance, expressed as a percentage of the population mean ranged from 0.10% to 92.75% (Table 1). High genetic advance, expressed as a percentage of the population mean was observed for a number of secondary branches per plant (92.75%), leaf area

Table 3. Comparative statement based on estimates of different genetic parameters for 23 characters in F_2 generation of groundnut.

Character	Genetic parameters	Gene effects	Influence of environment
Days to 50 per cent flowering	High h^2(b) and moderate GAM	Additive	Low
Days to maturity	High h^2(b) and low GAM	Non additive	Low
Plant height	Low h^2(b) and moderate GAM	Additive and non additive	High
Number of primary branches per plant Specific leaf area	Moderate h^2(b) and moderate GAM	Additive and non additive	Medium
Number of secondary branches per plant	High h^2(b) and high GAM	Additive	Low
SPAD chlorophyll meter reading Transpiration rate Photosynthetic rate Stomatal conductance Water use efficiency Shelling per cent Sound mature kernel per cent 100- kernel weight Protein per cent Kernel yield per plant Pod yield per plant	Low h^2(b) and low GAM	Non additive	High
Specific leaf weight Oil per cent	Moderate h^2(b) and low GAM	Non-additive	High
Leaf area index Number of well-filled and mature pods per plant Dry haulms yield per plant Harvest index	Moderate h^2(b) and high GAM	Additive	Medium

Index (20.42%), number of well-filled and mature pods per plant (25.83%), dry haulms yield per plant (33.33%) and harvest index (20.66%). Moderate genetic advance, expressed as a percentage of the population mean was observed for days to 50% flowering (13.69%), plant height (10.18%), number of primary branches per plant (10.94%) and specific leaf area (15.79%). Low genetic advance, expressed as a percentage of the population mean was recorded for characters *viz.,* days to maturity (7.10%), SPAD chlorophyll meter reading (2.19%), specific leaf weight (1.79%), transpiration rate (1.34%), photosynthetic rate (4.04%), stomatal conductance (3.39%), water use efficiency (1.29%), shelling percent-tage (1.15%), sound mature kernel percentage (2.09%), 100-kernel weight (5.60%), oil percentage (1.06%), protein percentage (0.10%), kernel yield per plant (9.14%) and pod yield per plant (9.23%).

High heritability and high GAM was recorded for the number of secondary branches per plant, high heritability and moderate GAM observed for days to 50% flowering (Table 3). Moderate heritability and high GAM was showed for leaf area index, number of well-filled and mature pods per plant, dry haulms yield per plant and harvest index, whereas moderate heritability and moderate GAM was recorded for number of primary branches per plant and specific leaf area and low heritability and moderate GAM for plant height. This indicates that these characters are under additive genetic control and selection for genetic improvement will be worthwhile and may rapidly contribute to pod yield. Wang et al. (1987) also noticed low heritability values for these characters. Low heritability for pod yield per plant was reported by Reddi et al. (1986a) and Swamy Rao et al. (1988). Earlier Nandini et al. (2011) reported moderate to high degree of heritability and genetic advance for pods per plant in groundnut.

High heritability and low GAM were expressed for days to maturity, moderate heritability and low GAM was observed for specific leaf weight and oil percentage, whereas low heritability and low GAM was recorded for SPAD chlorophyll meter reading, transpiration rate, photosynthetic rate, stomatal conductance, water use efficiency, shelling percentage, sound mature kernel percentage, 100-kernel weight, protein percentage, kernel yield per plant and pod yield per plant indicating the preponderance of non-additive gene action in inheritance of these characters. Hence, selection for these characters is not effective in early segregating generations and has to be carried out in later generations. Earlier Nagabhushanam et al. (1982), Vasanthi and Raja Reddy (2002) and Seethala Devi (2004) reported low genetic advance as a percentage of mean for pod yield per plant.

Among the 23 characters, high GCV, high heritability and high GAM was observed for the number of secondary branches per plant in F_2 generations during *rabi*. It is clearly indicated that this trait was governed by additive gene action, hence, selection would be rewarding. Earlier Korat et al. (2009) reported high GCV and high PCV for number of secondary branches per plant, moderate PCV and moderate GCV for dry haulms yield, high heritability and high GAM for the number of secondary branches per plant. Abhay Dasshora Nagda (2002) reported high heritability and low GAM for days to maturity. Thus, from the present investigation, it can be concluded that high genetic advance was not always associated with high heritability for the characters studied. In addition like this, variation in base population should be taken into consideration rather than heritability alone for isolating superior types. Thus, results suggested that chances for improvement in number of secondary branches per plant, number of well filled and mature pods per plant, harvest index, specific leaf weight and dry haulms yield would be fairly high as magnitude of genotypic coefficient of variation for these characters the presence of wide spectrum of genetic variation suggesting that they merit maximum emphasis in selection for improvement of pod yield.

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