Genetic variability, heritability and genetic advance for pod yield and its related traits in F_3 populations of Spanish bunch groundnut (*Arachis hypogaea* L.)

Abstract

Thepresentinvestigationwascarriedout toestimate the genetic variability, heritability and genetic advance for pod yield and its related traits in F_3generation of four different crosses of Spanish bunch groundnut (*Arachis hypogaea* L.) at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh. The analysis of variance due to crosses weresignificant for all the characters suggesting presenceof large amount of genetic variability in the material studied. The analysis of variance due to progenies within crosses were significant for most of the characters except oil content (%) in all four crosses. Wide range of variation was maximumfornumber of immature pods per plant, number of mature pods per plant, pod yield per plant, biological yield per plant, kernel yield per plant and 100-mature kernel weight in all four crosses.The PCV and GCV values were low to moderate for all four crosses except for number of immature pods per plant. High heritability coupled with high genetic advance as per cent of mean was registered for number of mature pods per plant, number of immature pods per plant, biological yield per plant and harvest index in AK-335×ICGV-171024, for number of primary branches per plant, number of mature pods per plant, number of immature pods per plant, pod yield per plant, biological yield per plant and kernel yield per plant in GG-35 ×ICGV-06141, for number of immature pods per plant, kernel yield per plant and 100-mature kernel weight in TPG-41 ×TCGS-1694, for number of primary branches per plant, number of immature pods per plant, biological yield per plant and harvest indexin ICGV-171013×TG-90indicating that ~~these characters were governed by additive gene effects~~additive gene effects governed these characters and could be chosen as selection criteria for formulating breeding strategies in groundnut.

Comment [GA1]: Could you please provide insight into the possible reasons for the lack of change in oil content? In the summary If feasible, kindly include relevant supporting reference

Comment [GA2]: Change these sentences ‘’that these characters were governed by additive gene effects’’ to this ‘’additive gene effects governed these characters’’

Introduction

Comment [GA3]: Provide at least 2-3 reference for this section

Groundnut is one of the world's most important legume crop. It is commonly known as peanut, monkey-nut and goobernut.Groundnut is self-pollinated, allotetraploid with chromosome number 2n=40. *Arachis hypogaea* has twosub-species, *hypogaea*:Semi-

spreading or spreading in habit, branching alternate, inflorescence simple and absent on main axis, seed dormancy usually present, foliage dark green and first branch on cotyledonary lateral always vegetative. It includes two varieties, Virginia bunch and Virginia runner and Peruvian runner, *fastigiata*: Erect and bunch in habit, branching sequential, inflorescence usually present on the main axis and first branching on the cotyledonary laterals are reproductive, seed dormancy usually absents and foliage light green. It includes two varieties Valencia and Spanish.Inplantbreeding,assessment of genetic variability in the base population is the first step in any breeding programme. The variability parameters certainly determine the extent and quality of variability. Genetic diversity plays a pivotal role in survival and adaptability of a species. When a specific environment changes, slight genetic variation is necessary for it to adapt and survive. A species that has a large degree of genetic diversity among its population had more variation. Therefore, it is essential for a breeder to measure the variability with the help of parameters like phenotypic coefficient of variation, genotypic coefficient of variation, heritability and genetic advance. By keeping eye on above mentioned phenomenon, present investigation was conducted to estimate the genetic variability, heritability and genetic advance for pod yield and its related traits in F_3 generation of four different crosses of Spanish bunch groundnut.

MaterialandMethod

The present field experiment on Spanish bunch groundnut was conducted in the Main OilseedsResearchStation,JunagadhAgriculturalUniversity,Junagadh in Compact Family Block Design with two replications during summer, 2023.The experiment materials consist of four crosses *viz*.,AK-335 × ICGV-171024 (Cross 1), GG-35 × ICGV-06141 (Cross 2), TPG-41 ×TCGS-1694 (Cross 3) and ICGV-171013 × TG-90(Cross 4)in F_3 generation. Observationswere recorded from randomly selected10 plants from each progeny in each replication for days to appearance of first flower, days to maturity, number of primary branches per plant, plant height, number of mature pods per plant, number of immature pods per plant, pod yield per plant, biological yield per plant, harvest index, kernel yield per plant, shelling out turn, 100-mature kernel weight and oil content. The formula of Panse and Sukhatme (1995) wasused to calculate variation for allthe characters under study. The phenotypic and genotypic components of variances based on analysis of variance were estimated as per Burton (1952) approach. The heritability and genetic advance were estimated as per Allard (1960) approach.

Comment [GA4]: Need to provide the full form for all the varieties used for the cross

Comment [GA5]: Mention there is a modification in that formula if yes specify

ResultandDiscussion

Analysis of variance (ANOVA)

Theanalysis of variancebetween crosses for thirteen characters are presented in Table 1. A scrutiny of the results indicated that mean squares due to crosses weresignificant for all the characters. The analysis of variancebetween progenies within crosses for thirteen characters are presented in Table 2, 3, 4 and 5. A scrutiny of the results also indicated that mean squares due to progenies within crosses were significant for most of the characters except oil content (%) in all four crosses.

Genetic Variability Parameters

The range, general mean, coefficient of range, phenotypic and genotypic coefficient of variation, heritability (in broad sense), genetic advance and genetic advance expressed as per cent of meanvalues of the four crosses in F_3 generation are presented in Table 6,7, 8 and 9.All four crosses had almost equal mean for days to appearance of first flower (35.76 for Cross 1, 35.51 for Cross 2, 35.61 for Cross 3 and 34.01 for Cross 4), days to maturity (102.57 for Cross 1, 104.58 for Cross 2, 104.03 for Cross 3 and 102.24 for Cross 4), number or primary branches per plant (3.45 for Cross 1, 3.65 for Cross 2, 3.81 for Cross 3 and 3.56 for Cross 4), plant height (17.51 for Cross 1, 17.28 for Cross 2, 16.66 for Cross 3 and 16.30 for Cross 4). Number of mature pods per plant mean was higher in Cross4(19.12) followed by Cross 3(18.14), Cross 1 (12.98) and Cross 2(12.09). Number of immature pods per plant mean was higher in Cross 3(7.86) followed by Cross 2(6.96), Cross 1 (4.57) and Cross 4(4.46). Pod yield per plant mean was higher in Cross 4 (22.95) followed by Cross 3(22.00), Cross 2(18.40) and Cross 1 (15.49). Biological yield per plant was higher in Cross 2(58.61) followed by Cross 4(52.88), Cross 3(52.66) and Cross 1 (50.66). Harvest index was higher in Cross 4(43.78) followed by Cross 3(42.07), Cross 1 (31.23) and Cross 2(31.23). Kernel yield per plant was higher in Cross 4(15.51) followed by Cross 3(15.03), Cross 2(11.67) and Cross 1 (9.86). All four crosses had almost equal mean for shelling out turn (63.61% for Cross 1, 63.58% for Cross 2, 68.36% for Cross 3 and 67.56% for Cross 4). 100-mature kernel weight was higher in Cross 4 (44.50) followed by Cross 3(41.73), Cross 1 (38.28) and Cross 2(38.20). All four crosses had almost equal mean of oil percentage (51.36% for Cross 1, 53.89% for Cross 2, 52.76% for Cross 3 and 50.62% for Cross 4).

The PCV and GCV values were lower for all four crosses for days to appearance of first flower (7.18 & 6.49 for Cross 1, 5.81 & 4.25 for Cross 2, 6.14 & 5.33 for Cross 3 and 5.67

& 4.78 for Cross 4). Vekariya *et al.* (2010) and Vasanthi *et al.* (2016) discovered comparable outcomes. Low PCV and GCV observed for days to maturity (7.18 & 6.49 for Cross 1, 5.81 &4.25 for Cross 2, 6.14 & 5.33 for Cross 3 and 5.67 & 4.78 for Cross 4). Similar results were achieved by Padmaja *et al.* (2013). Moderate PCV and GCV for number of primary branches per plant was observed in Cross 2(14.42 & 14.06) and in Cross 4(16.87 & 16.33), whereas in Cross 1(8.89 & 7.79) and in Cross 3(8.32 & 7.13) low PCV, GCV was observed. Low PCV and GCV for plant height (4.98 & 3.92 for Cross 1, 5.32 & 4.31 for Cross 2, 5.40 & 4.33 for Cross 3 and 5.83 & 4.88 for Cross 4). Similar results were achieved by Darvhankar *et al.* (2016). Moderate PCV and GCV for number of mature pods per plant (15.22 & 14.44 for Cross 1, 14.20 & 13.99 for Cross 2, 12.73 & 10.61 for Cross 3 and 12.86 & 10.03 for Cross 4). High PCV and GCV in Cross 1(25.88 & 25.23), Cross 3(21.61&21.18) and Cross 4(30.09&29.50), whereas in Cross 2 high PCV (21.09) and moderate GCV (19.72) were observed for number of immature pods per plant. Moderate PCV and GCV in Cross 2(12.88 & 11.25), Cross 4 (14.64 & 10.12), low PCV and GCV in Cross 1 (9.03 & 7.66) while moderate PCV (13.22) and low GCV (8.70) in Cross 3 were observed for pod yield per plant. Moderate PCV and GCV for biological yield per plant (18.47 & 17.55 for Cross 1, 18.13 & 15.75 for Cross 2, 12.52 & 10.60 for Cross 3 and 12.79 & 11.87 for Cross 4). Moderate PCV and GCV in Cross 1 (11.66 & 10.67), Cross 4 (14.06 & 13.07), low PCV and GCV in Cross 2(6.46 & 4.22) while moderate PCV (11.56) and low GCV (9.41) in Cross 3 were observed for harvest index. Moderate PCV and GCV in Cross 2(12.13&10.93), Cross 3(13.62&12.46) and Cross 4(16.40&13.21), whereas in Cross 1moderate PCV (10.71) and low GCV (9.77) were observed for kernel yield per plant. Low PCV and GCV for shelling out turn (3.70 & 2.76 for Cross 1, 4.26 & 2.76 for Cross 2, 5.75 & 3.86 for Cross 3 and 6.92 & 4.60 for Cross 4). Moderate PCV and GCV in Cross 1 (13.59 & 10.68), Cross 3(15.75 & 13.82) and Cross 4(16.19 & 13.35), whereas in Cross 2 moderate PCV (10.08) and low GCV (7.58) were observed for 100-mature kernel weight. Low PCV and GCV for oil content (2.86 & 1.46 for Cross 1, 2.56 & 1.34 for Cross 2, 2.99 & 1.25 for Cross 3 and 3.25 & 1.74 for Cross 4).

High heritability were observed for number of immature pods per plant (95.01%) followed by biological yield per plant (90.31%), number of mature pods per plant (89.96%), harvest index (83.79%), kernel yield per plant (83.32%), days to appearance of first flower (81.70%), days to maturity (79.07%), number of primary branches per plant (76.73%) and pod yield per plant (71.99%) in Cross 1, while in Cross 2 number of mature pods per plant (97.09%) followed by number of primary branches per plant (95.04%), number of immature pods per plant (87.42%), days to maturity (86.53%), kernel yield per plant (81.11%), pod

yield per plant (76.37%) and biological yield per plant(75.51%). The results are in conformity with findings of Ragiri *et al.* (2023) for number of mature pods per plant. While in Cross 3 number of immature pods per plant (96.06%), kernel yield per plant (83.68%), 100-mature kernel weight (77.05%), days to appearance of first flower (75.38%), days to maturity (75.17%), number of primary branches per plant (73.43%) and biological yield per plant (71.63%) while in Cross 4number of immature pods per plant (96.17%) followed by number of primary branches per plant (93.62%), harvest index (86.37%), biological yield per plant (86.16%), days to appearance of first flower (70.95%) and plant height (70.11%).

Genetic advance expressed as percentage of mean was the highest for number of immature pods per plant (50.66%) followed by biological yield per plant (34.36%), number of mature pods per plant (28.20%) and harvest index (20.12%) in Cross 1, in Cross 2 it was high in number of immature pods per plant (37.97%) followed by number of mature pods per plant (28.40%), number of primary branches per plant (28.23%), biological yield per plant (28.20%), kernel yield per plant (20.27) and pod yield per plant(20.26) while in Cross 3 it was high for number of immature pods per plant (42.76%) followed by 100-mature kernel weight (24.99%) and kernel yield per plant (23.49%) and in Cross 4it was high for number of immature pods per plant (59.60%) followed by number of primary branches per plant (32.54%), harvest index (25.02%), biological yield per plant (22.71%), 100-mature kernel weight (22.66%) and kernel yield per plant (21.93%). Other character showed moderate to low values.

Comment [GA6]: Provide at least 2-3 reference to support to this results

High heritability along with high genetic advance was observed in number of primary branches per plant, number of mature pods per plant, number of immature pods per plant, biological yield per plant and harvest index in Cross 1 and Cross 4. Thus, it can be concluded that this Cross 1 and Cross 4 for number of primary branches per plant, number of mature pods per plant, number of immature pods per plant, biological yield per plant and harvest index were mainly under the influence of additive gene action and improvement in this traits would be possible through selection in the subsequent generations to isolate high yielding genotypes with desirable characteristics.

High heritability along with high genetic advance was observed in primary branches per plant, number of mature pods per plant, number of immature pods per plant, pod yield per plant, biological yield per plant and kernel yield per plant in Cross 2. Hence, this represents the preponderance of additive gene action on the expression of these characters.

High heritability along with high genetic advance was observed in number of immature pods per plant, kernel yield per plant and 100-mature kernel weight in Cross 3.

Hence, this represents the preponderance of additive gene action on the expression of these characters.

Table 1: Analysis of variance (mean squares) between crosses for different thirteen characters in F_3populations of four groundnut crosses

Source	df	Days to appearance of first flower	Days to maturity	Number of primary branches per plant	Plant Height (cm)	Number of mature pods per plant	Number of immature pods per plant	Pod yield per plant (g)
Replications	1	23.88*	72.16**	1.76**	9.79*	33.63*	2.19*	135.02*
Crosses	3	33.31*	63.63**	1.13**	13.49*	634.68**	146.90**	588.07**
Error	3	2.15	1.71	0.03	0.80	1.50	0.14	6.02
Chi-square		NS	NS	NS	NS	S	S	S

Comment [GA7]: Provide full of df in the foot notes

Table 1:*Contd*….

Source	df	Biological yield per plant (g)	Harvest Index (%)	Kernel yield per plant (g)	Shelling out turn (%)	100-mature kernel weight (g)	Oil content (%)
Replications	1	2070.14**	130.59	24.68*	148.54*	277.12**	16.92*
Crosses	3	583.83*	2210.41**	366.92**	323.11*	459.82**	102.81**
Error	3	23.38	25.73	1.16	12.08	3.66	0.66
Chi-square		S	S	S	S	NS	NS

*,** Significant at p=0.05 and 0.01 levels, respectively.

Comment [GA8]: Provide full of df in the foot notes

Table 2: Analysis of variance (mean squares) between progenies within cross for different thirteen characters in F_3populations ofAK-335 × ICGV-171024

Source	df	Days to appearance of first flower	Days to maturity	Number of primary branches per plant	Plant Height (cm)	Number of mature pods per plant	Number of immature pods per plant	Pod yield per plant (g)
Replications	1	10.09*	12.61*	0.57**	0.99	6.94**	0.07	6.02**
Progenies	24	19.59**	14.02**	0.17**	1.23**	7.42**	2.72**	3.36**
Error	24	1.97	1.64	0.02	0.29	0.39	0.07	0.55

Table 2:*Contd*….

Source	df	Biological yield per plant (g)	Harvest Index (%)	Kernel yield per plant (g)	Shelling out turn (%)	100-mature kernel weight (g)	Oil content (%)
Replications	1	563.87**	114.55**	0.90*	15.45*	102.77**	1.83
Progenies	24	166.60**	24.36**	2.04**	8.62**	43.77**	2.73
Error	24	8.49	2.15	0.19	2.45	10.36	1.60

*,** Significant at p=0.05 and 0.01 levels, respectively.

Table 3: Analysis of variance (mean squares) between progenies within cross for different thirteen characters in F_3populations ofGG-35 × ICGV-06141

Source	df	Days to appearance of first flower	Days to maturity	Number of primary branches per plant	Plant Height (cm)	Number of mature pods per plant	Number of immature pods per plant	Pod yield per plant (g)
Replications	1	16.83*	11.45**	0.15**	8.33**	1.66**	1.35*	41.25**
Progenies	24	10.73**	19.13**	0.54**	1.40**	5.80**	4.04**	9.91**
Error	24	3.24	1.38	0.01	0.29	0.09	0.27	1.33

Table 3:*Contd*….

Source	df	Biological yield per plant (g)	Harvest Index (%)	Kernel yield per plant (g)	Shelling out turn (%)	100-mature kernel weight (g)	Oil content (%)
Replications	1	321.05**	1.48	11.91**	17.85	69.20**	1.87
Progenies	24	198.07**	5.99*	3.63**	10.40*	23.19**	2.42
Error	24	27.63	2.41	0.38	4.24	6.43	1.38

*,** Significant at p=0.05 and 0.01 levels, respectively.

Table4: Analysis of variance (mean squares) between progenies within cross for different thirteen characters in F_3populations ofTPG-41 × TCGS-1694

Source	df	Days to appearance of first flower	Days to maturity	Number of primary branches per plant	Plant Height (cm)	Number of mature pods per plant	Number of immature pods per plant	Pod yield per plant (g)
Replications	1	0.75	14.99*	0.65**	1.75*	13.30**	0.47	36.37*
Progenies	24	13.75**	15.02**	0.17**	1.33**	9.04**	5.65**	12.12*
Error	24	1.93	2.13	0.03	0.29	1.63	0.11	4.80

Table 4:*Contd*….

Source	df	Biological yield per plant (g)	Harvest Index (%)	Kernel yield per plant (g)	Shelling out turn (%)	100-mature kernel weight (g)	Oil content (%)
Replications	1	411.36**	31.16	8.22**	24.52	32.25	7.00
Progenies	24	74.66**	39.33**	7.70**	22.40*	76.43**	2.92
Error	24	12.34	7.99	0.68	8.48	9.91	2.06

*,** Significant at p=0.05 and 0.01 levels, respectively.

Table 5: Analysis of variance (mean squares) between progenies within cross for different thirteen characters in F_3populations ofICGV-171013 × TG-90

Source	df	Days to appearance of first flower	Days to maturity	Number of primary branches per plant	Plant Height (cm)	Number of mature pods per plant	Number of immature pods per plant	Pod yield per plant (g)
Replications	1	2.65	38.23**	0.49**	1.12	16.21*	0.72**	69.43**
Progenies	24	10.66**	16.82**	0.70**	1.55**	9.73**	3.53**	16.68**
Error	24	1.81	3.41	0.02	0.27	2.37	0.07	5.88

Table 5:*Contd*….

Source	df	Biological yield per plant (g)	Harvest Index (%)	Kernel yield per plant (g)	Shelling out turn (%)	100-mature kernel weight (g)	Oil content (%)
Replications	1	844.02**	60.60**	7.14	126.96**	83.89*	8.20
Progenies	24	85.18**	70.64**	10.66**	31.54*	87.20**	3.50
Error	24	6.33	5.17	2.27	12.20	16.65	1.94

*,** Significant at p=0.05 and 0.01 levels, respectively.

Table 6: Range, general mean, coefficient of range,phenotypic and genotypic coefficient of variation, heritability ($h^2_{(bs)}$), genetic advance and genetic advance expressed as per cent of mean for 13 characters in AK-335 × ICGV-171024 of Spanish bunch groundnut (summer)

Sr. No.	Characters	Range	General Mean	Coefficient of Range	PCV (%)	GCV (%)	$h^2_{(b.s.)}$ (%)	GA	GA as (%) of mean
1	**Days to appearance of first flower**	31.05-42.14	35.76	15.15	7.18	6.49	81.70	5.53	12.08
2	**Days to maturity**	97.60-107.14	102.57	4.66	2.73	2.43	79.07	4.56	4.44
3	**No. of primary branches per plant**	2.85-3.91	3.45	15.67	8.89	7.79	76.73	0.49	14.06
4	**Plant Height (cm)**	16.05-19.05	17.51	8.56	4.98	3.92	61.98	1.11	6.35
5	**No. of mature pods per plant**	8.86-17.09	12.98	31.70	15.22	14.44	89.96	3.66	28.20
6	**No. of immature pods per plant**	2.17-7.44	4.57	54.83	25.88	25.23	95.01	2.31	50.66
7	**Pod yield per plant (g)**	12.64-19.69	15.49	21.82	9.03	7.66	71.99	2.07	13.39
8	**Biological yield per plant (g)**	37.29-78.95	50.66	35.84	18.47	17.55	90.31	17.41	34.36
9	**Harvest Index (%)**	24.94-39.78	31.23	22.92	11.66	10.67	83.79	6.28	20.12
10	**Kernel yield per plant (g)**	7.54-12.73	9.86	25.59	10.71	9.77	83.32	1.81	18.38
11	**Shelling out turn (%)**	59.49-66.72	63.61	5.73	3.70	2.76	55.71	2.70	4.25
12	**100-mature kernel weight (g)**	28.06-47.38	38.28	25.62	13.59	10.68	61.73	6.62	17.28
13	**Oil content (%)**	48.19-53.71	51.36	5.42	2.86	1.46	26.15	0.79	1.54

Table 7: Range, general mean, coefficient of range,phenotypic and genotypic coefficient of variation, heritability ($h^2_{(bs)}$), genetic advance and genetic advance expressed as per cent of mean for 13 characters in GG-35 × ICGV-06141 of Spanish bunch groundnut (summer)

Sr. No.	Characters	Range	General Mean	Coefficient of Range	PCV (%)	GCV (%)	$h^2_{(b.s.)}$ (%)	GA	GA as (%) of mean
1	**Days to appearance of first flower**	31.55-40.60	35.51	12.54	5.81	4.25	53.57	2.92	6.41
2	**Days to maturity**	99.13-114.96	104.58	7.40	3.06	2.85	86.53	5.71	5.46
3	**No. of primary branches per plant**	2.84-5.00	3.65	27.61	14.42	14.06	95.04	1.03	28.23
4	**Plant Height (cm)**	15.53-18.20	17.28	7.90	5.32	4.31	65.44	1.24	7.18
5	**No. of mature pods per plant**	5.83-13.94	12.09	41.06	14.20	13.99	97.09	3.43	28.40
6	**No. of immature pods per plant**	4.82-10.64	6.96	37.69	21.09	19.72	87.42	2.64	37.97
7	**Pod yield per plant (g)**	13.50-21.64	18.40	23.17	12.88	11.25	76.37	3.73	20.26
8	**Biological yield per plant (g)**	37.89-74.66	58.61	32.67	18.13	15.75	75.51	16.53	28.20
9	**Harvest Index (%)**	28.92-35.61	31.73	10.37	6.46	4.22	42.70	1.80	5.68
10	**Kernel yield per plant (g)**	9.05-13.66	11.67	20.30	12.13	10.93	81.11	2.37	20.27
11	**Shelling out turn (%)**	60.92-68.30	63.58	5.71	4.26	2.76	42.03	2.34	3.68
12	**100-mature kernel weight (g)**	30.74-43.53	38.20	17.21	10.08	7.58	56.57	4.48	11.74
13	**Oil content (%)**	51.30-55.32	53.89	3.77	2.56	1.34	27.31	0.78	1.44

Table 8: Range, general mean, coefficient of range,phenotypic and genotypic coefficient of variation, heritability ($h^2_{(bs)}$), genetic advance and genetic advance expressed as per cent of mean for 13 characters in TPG-41 × TCGS-1694 of Spanish bunch groundnut (summer)

Sr. No.	Characters	Range	General Mean	Coefficient of Range	PCV (%)	GCV (%)	$h^2_{(b.s.)}$ (%)	GA	GA as (%) of mean
1	**Days to appearance of first flower**	31.50-43.13	35.61	15.58	6.14	5.33	75.38	4.35	9.53
2	**Days to maturity**	99.90-110.09	104.03	4.85	2.81	2.44	75.17	4.53	4.36
3	**No. of primary branches per plant**	3.12-4.25	3.81	15.40	8.32	7.13	73.43	0.48	12.59
4	**Plant Height (cm)**	14.03-17.17	16.66	10.04	5.40	4.33	64.16	1.19	7.14
5	**No. of mature pods per plant**	13.75-24.80	18.14	28.66	12.73	10.61	69.41	3.30	18.21
6	**No. of immature pods per plant**	4.98-13.21	7.86	45.26	21.61	21.18	96.06	3.36	42.76
7	**Pod yield per plant (g)**	18.16-29.49	22.00	23.77	13.22	8.70	43.28	2.59	11.79
8	**Biological yield per plant (g)**	39.76-64.41	52.66	23.67	12.52	10.60	71.63	9.73	18.48
9	**Harvest Index (%)**	37.28-53.74	42.07	18.09	11.56	9.41	66.24	6.64	15.78
10	**Kernel yield per plant (g)**	11.16-18.99	15.03	25.98	13.62	12.46	83.68	3.53	23.49
11	**Shelling out turn (%)**	61.51-75.00	68.36	9.88	5.75	3.86	45.07	3.65	5.34
12	**100-mature kernel weight (g)**	31.17-53.32	41.73	26.23	15.75	13.82	77.05	10.43	24.99
13	**Oil content (%)**	50.33-54.73	52.76	4.19	2.99	1.25	17.37	0.56	1.07

Table 9: Range, general mean, coefficient of range,phenotypic and genotypic coefficient of variation, heritability ($h^2_{(bs)}$), genetic advance and genetic advance expressed as per cent of mean for 13 characters in ICGV-171013 × TG-90 of Spanish bunch groundnut (summer)

Sr. No.	Characters	Range	General Mean	Coefficient of Range	PCV (%)	GCV (%)	$h^2_{(b.s.)}$ (%)	GA	GA as (%) of mean
1	Days to appearance of first flower	29.57-38.85	34.01	13.56	5.67	4.78	70.95	3.65	8.29
2	Days to maturity	97.64-114.23	102.24	7.83	3.11	2.53	66.24	4.34	4.25
3	No. of primary branches per plant	2.96-5.06	3.56	26.22	16.87	16.33	93.62	1.16	32.54
4	Plant Height (cm)	14.58-18.00	16.39	10.50	5.83	4.88	70.11	1.38	8.42
5	No. of mature pods per plant	15.18-24.13	19.12	22.77	12.86	10.03	60.85	3.08	16.12
6	No. of immature pods per plant	2.11-6.60	4.46	51.49	30.09	29.50	96.17	2.66	59.60
7	Pod yield per plant (g)	18.92-33.22	22.95	27.42	14.64	10.12	47.85	3.31	14.43
8	Biological yield per plant (g)	43.84-69.22	52.88	22.46	12.79	11.87	86.16	12.01	22.71
9	Harvest Index (%)	37.57-66.82	43.78	28.02	14.06	13.07	86.37	10.95	25.02
10	Kernel yield per plant (g)	11.39-20.73	15.51	29.07	16.40	13.21	64.91	3.40	21.93
11	Shelling out turn (%)	60.56-72.87	67.56	9.22	6.92	4.60	44.22	4.26	6.30
12	100-mature kernel weight (g)	33.45-59.08	44.50	27.70	16.19	13.35	67.94	10.09	22.66
13	Oil content (%)	48.87-53.65	50.69	4.67	3.25	1.74	28.75	0.98	1.93

Comment [GA9]: Provide full form for these in the foot note

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