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GENETIC AND ENVIRONMENTAL VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN POD YIELD, YIELD COMPONENTS, OIL AND PROTEIN CONTENT OF PEANUT VARIETIES

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ABSTRACT

In this study, genetic and environmental variability, broad-sense heritability, genetic advance and correlation coefficients of pod yield, yield components, oil and protein content of ten registered peanut varieties were examined. Year (Y), location (L), year x location interaction (Y x L), genotype (G), genotype x year interaction (G x Y), genotype x location interaction (G x L) and genotype x year x location interaction (G x Y x L) were significant, but G x Y for shelling percentage was not significant. Genotypic and phenotypic variances were highest for pod yield followed by hundred pod weight, whereas all investigated traits of peanut varieties were significantly different. Broad sense heritability estimates ranged from moderate level to high. Heritability values were estimated to be maximum for shelling percentage (95.4%), hundred kernel weight (91.6%), hundred pod weight (88.3%), while moderate for pod number (63.8%), pod weight (60.4%), first quality pod ratio (63.3%), pod yield (63.2%), oil content (52.0%) and protein content (52.5%). High heritability for shelling percentage, hundred kernel weight and hundred pod weight indicated that these characteristics were affected less than the others by the environmental conditions. The magnitudes of genetic advance were observed to be very high (>50%) for hundred pod weight, 100 kernel weight, pod weight and pod yield; moderate (20-50%) for pod number, first quality pod ratio, shelling percentage and low (<20%) for oil and protein content. Significant and positive relationships were found the pod yield and pod number, pod weight, hundred pod weight and hundred kernel weight.

Keywords: Groundnut, genotypic and phenotypic variance, genetic advance

INTRODUCTION

Groundnut (*Arachis hypogaea* L.), which is generally planted in the tropics and semi-arid tropics, has found wide use in human nutrition (Kassa et al., 2009), animal husbandry (Savage and Keenan, 1994) and many branches of industry. Peanut is a legume crop and its seeds are highly nutritious due to its high oil and protein content. It is used in many areas such as peanut butter, roasted-salted peanuts and confectionery. Peanut seed contain 45-55% oil and 20-35% protein. Refined peanut oil is used in frying oil, salad oil, margarine, and mayonnaise, and for sauce production. Peanut oil is widely consumed in India, China and the USA. The antioxidant tocopherol substance found naturally in peanut oil increments the shelf life and stability of the oil (Akhtar et al., 2014; Zahran and Tawfeuk, 2019).

Peanut is one of the important oilseeds used in the oil and snack industry in the world. In Turkey, it is used completely as a snack. Peanut cultivation is carried out on an area of 55 thousand hectares in Turkey and 216 thousand tons of peanuts are produced annually (Anonymous, 2020). Peanut plant is very sensitive to changing environmental factors such as temperature, humidity and precipitation. Climate, soil, insect, disease and cultural practices differ from region to region. Therefore, genetic and environmental variability for yield, yield components, oil, and protein content should be estimated under different environmental conditions for successful breeding programs in peanuts. Yield and quality in peanuts are features that can be highly affected by environmental conditions (Prasad et al., 2000; Gulluoglu et al., 2018). Determining the response of cultivars and cultivar candidates to environmental conditions in terms of yield and quality characteristics is one of the important steps of plant breeding (Marfo and Padi, 1999; Ozturk and Yildirim, 2014). Seed yield and yield components of groundnut plant are influenced by several factors including environmental factors (temperature, rainfall, humidity, soil type, diseases and pests, etc.), genetic factors (cultivar or genotype), and interaction between genotype and environmental factors (Ku et al., 1998; Upadhyaya and Nigam, 1999; Dwivedi et al., 2000; Andersen and Gorbet, 2002; Isleib et al., 2008).

Genetic variations are significant for breeding strategies. The existence and magnitude of genetic variation allow the selection of new genotypes with different characteristics. Heritability indicates the degree to which characters are passed on to offspring. Genetic progression, on the other hand, describes the degree of progression reached in a particular variety by a given selection pressure. A high genetic progression value increases the probability of selecting plants with the most suitable traits. The objective of this study was to estimate the genotypic and phenotypic variance components, heritability, genetic advance and correlation coefficients for pod yield, yield components, oil and protein content of peanut genotypes.

MATERIALS AND METHODS

Study field description

The experiment was set up at three locations (Adana, Osmaniye and Kahramanmaras) and for two years (2018 and 2019) during the main crop peanut growing season. Adana, which is located in the Mediterranean region between 36°51'28.95" north latitude and 35°20'50.36" east longitude, has a slope of 1-2%. Its height above sea level is 12 m. Osmaniye, which is located in the Mediterranean region between 37°04'31" north latitude and 36°14'56" east longitude, has a slope of 1-2%. Its height above sea level is 130 m. Kahramanmaras, which is located in the Mediterranean region between 37°35'40.77" north latitude and 36°48'51.43" east longitude, has a slope of 3-5%. Its height above sea level is 491 m. The distance between Adana and Osmaniye, Osmaniye and Kahramanmaras is 102 km and 105 km, respectively.

The soils of the experimental field of all three locations have a clayey-loamy texture and the pH is slightly alkaline. Soils of the Adana location (18.54%) is more calcareous than those of the Osmaniye (9.47%) and Kahramanmaras (2.19%), and the organic matter contents of the soils is low at all locations (Table 1) (Anonymous, 2019a). The climate data for the experiment years and long years are given Table 2. All locations have a Mediterranean climate, with hot and dry summers and cold and rainy winters. The monthly average air temperature during the research period (April-October in 2018 and 2019) was 17.00 to 24.20°C in Adana, 16.30 to 23.10°C in Osmaniye and 14.20 to 21.30°C in Kahramanmaras. The total rainfall in 2018 and 2019 was 131.00 mm and 112.80 mm, 310.00 mm and 243.80 mm, 255.00 mm and 126.90 mm during the growing seasons in Adana, Osmaniye and Kahramanmaras, respectively (Anonymous, 2019b).

Table 1. Results of soil analysis of experimental areas at three locations.

Characteristics	L_1^*	Explanation	L_2^*	Explanation	L_3^*	Explanation
Texture (% Sat.)	58.30	Clay - loam	57.20	Clay - loam	59.40	Clay - loam
Salinity (%)	0.10	Unsalted	0.07	Unsalted	0.13	Unsalted
Organic matter %	1.58	Very Low	1.29	Very Low	2.65	Low
Lime $CaCO_3$ (kg da^{-1})	18.54	High limy	9.47	Medium limy	2.19	Limy
Total nitrogen (%)	0.09	Insufficient	0.06	Insufficient	0.08	Insufficient
Phosphorus (mg kg^{-1})	13.80	Sufficient	8.64	Low	5.78	Low
Potassium (mg kg^{-1})	576.50	High	68.50	Low	112.10	Low
pH	7.66	slightly alkaline	7.63	slightly alkaline	7.53	slightly alkaline

(*) L_1: Adana location; L_2: Osmaniye location; L_3: Kahramanmaras location

Experimental materials description

Ten peanut varieties (Arioglu-2003, Batem-5025, Batem-Cihangir, Brantley, Flower-22, Halisbey, NC-7, Osmaniye-2005, Sultan and Wilson) used as the plant material in the experiment were obtained from Department of Field Crops of Agricultural Faculty of Cukurova University. Some characteristics of peanut varieties used in this research are given in Table 3.

Field management and experimental design

The field experiments at all locations were regulated in randomized complete block design with 3 replications. Before sowing, experimental plots had been fertilized with 300 kg ha^{-1} diammonium phosphate (DAP) (18% N, 46% P_2O_5) at three locations. Then, 150 kg ha^{-1} of urea was used as top fertilizer. Before sowing, seed spraying was done against crown rot disease and underground pests. In addition, spraying was applied against thrips damage. At all locations, seeds of the peanut cultivars were sown in the last week of April and first week of May in 2018 and 2019 respectively, in four rows of 5 m in length, with a sowing density of 70x15 cm (Kurt et al., 2016). In Adana, 3 times tractor anchors, twice hand anchors and 7 times sprinkler irrigation were performed. Two tractor anchors, two hand hoes, and 9 times irrigation were made in Kahramanmaras, and 2 times tractor and 2 times hand hoe, and irrigation was done 7 times in Osmaniye.

Table 2. Climatological data for long years and experiment years of three locations.

	Months	Total rainfall (mm)			Average temperature (°C)			Average humidity (%)		
		L_1^*	L_2^*	L_3^*	L_1	L_2	L_3	L_1	L_2	L_3
Long years	April	50.27	81.93	59.02	18.50	17.78	16.45	63.46	63.46	52.08
	May	52.38	101.55	51.89	21.75	20.75	20.30	67.94	67.94	53.71
	June	25.09	27.90	8.25	26.28	25.33	26.03	67.60	67.60	46.43
	July	5.71	10.21	1.12	29.23	28.28	29.63	68.85	68.85	44.20
	August	6.26	8.23	0.95	29.50	28.83	29.50	69.58	69.58	48.76
	September	25.73	37.47	14.35	26.73	25.65	25.78	64.58	64.58	45.41
	October	29.52	65.17	37.90	22.43	21.10	19.63	58.17	58.17	48.18
	Total/Mean	194.96	332.46	59.02	24.92	23.96	23.90	65.74	65.74	48.40
	Experiment years									
2018	April	33.00	41.00	46.80	20.10	18.90	18.40	61.20	62.60	45.30
	May	29.20	64.80	52.90	24.40	23.10	21.70	62.80	65.70	52.60
	June	23.40	111.20	39.40	26.40	25.10	25.40	70.20	74.70	49.10
	July	0.00	1.80	0.30	29.10	27.80	28.60	69.80	73.30	46.20
	August	0.00	0.00	0.00	29.60	28.60	29.10	68.80	70.90	43.80
	September	22.80	0.00	0.60	27.90	26.90	27.20	63.60	64.80	38.40
	October	22.60	91.20	115.00	22.90	21.90	19.80	58.60	58.00	51.50
	Total/Mean	131.00	310.00	255.00	25.77	24.61	24.31	65.00	67.14	46.70
2019	April	59.40	46.60	78.40	17.00	16.30	14.20	67.00	69.80	61.80
	May	2.60	2.50	4.00	24.10	23.30	23.10	57.60	56.60	44.00
	June	13.80	72.30	6.20	27.10	26.00	27.20	68.70	71.00	48.00
	July	28.00	52.90	0.10	28.40	27.10	28.40	68.80	72.50	47.20
	August	0.00	8.20	0.10	29.60	28.50	29.50	68.00	69.80	47.70
	September	0.00	14.50	1.50	27.30	26.10	26.30	62.10	61.30	41.20
	October	22.80	46.80	36.60	24.20	23.10	21.30	61.60	61.60	55.10
	Total/Mean	112.80	243.80	126.90	25.38	24.34	24.28	64.83	66.08	49.28

(*) L_1: Adana location; L_2: Osmaniye location; L_3: Kahramanmaras location

Table 3. Groundnut cultivars and their some properties.

Varieties	Market type	Origin	Kernel size	Growing period
Arioglu-2003	Virginia	Turkey	Large	Semi-spreading
Batem-5025	Virginia	Turkey	Large	Semi-spreading
Batem-Cihangir	Virginia	Turkey	Large	Semi-spreading
Brantley	Virginia	USA	Large	Spreading
Flower-22	Virginia	Chine	Large	Semi-spreading
Halisbey	Virginia	Turkey	Large	Semi-spreading
NC-7	Virginia	USA	Large	Spreading
Osmaniye-2005	Virginia	Turkey	Large	Semi-spreading
Sultan	Virginia	Turkey	Large	Semi-spreading
Wilson	Virginia	USA	Large	Semi-spreading

Data collection

Peanut plants at all locations were harvested by machine after the physiological maturity period in October. Harvested plants were turned upside down and left to dry. After three days of drying, peanut pods were collected by hand. Pod number and weight was found by counting and weighing all pods of 20 harvested plants and dividing them by the number of plants (Gulluoglu et al., 2017). First quality pod ratio was determined by counting the large, plump and two-seeded pod of 20 plants harvested from each plot and proportioning to the total number of pods. One hundred randomly-selected pods with four replications were weighed and the average of a hundred pods' weight was determined. Pod yield was determined from an area 1.4 m wide and 4 m long of the center two rows of each plot (Gulluoglu et al., 2018). Shelling percentage for each cultivar was calculated from a 200 g randomly selected pod sample as the proportion of shelled seed weight to the total weight of the unshelled pods (Arioglu et al., 2018; Daudi et al., 2021). Additionally, a hundred seed weight for each cultivar was determined as an average weight of four samples of 100 randomly selected kernels per plot (Arioglu et al., 2018; Daudi et al., 2021). The oil and protein contents of the seeds were studied according to the Association of Official Analytical Chemists (AOAC, 2010).

Statistical analysis

All obtained data were subjected to analysis of variance (ANOVA) by using MSTATC statistical software. According to the method proposed by Burton and Devane (1953) and Johnson et al. (1955), genotypic and phenotypic variances and their corresponding coefficients of variation were estimated using the respective mean square expectations. In addition, broad-sense Heritability (H), genetic advance (GA) were calculated using the procedure of Hanson et al. (1956) and Allard (1999). Correlation coefficients were conducted following the procedure developed by Wright (1921).

RESULTS AND DISCUSSION

The variance analysis for pod yield, pod number, pod weight, first quality pod ratio, 100-pod weight, shelling percentage, 100-kernel weight, oil and protein content of peanut varieties over 2 years (2018 and 2019) and 3 locations (Adana, Osmaniye and Kahramanmaras) indicated that there were significant variations among the cultivars (G), years (Y), locations (L), Y x L interactions, G x Y interactions, G x L interactions and G x Y x L interactions for all traits except shelling percentage (Table 4). G x Y interaction for shelling percentage was not significant. The existence of G x Y, G x L and G x Y x L interactions for investigated characteristics in this study indicates that the effect of years and locations was different for peanut genotypes. Thus, additional attention to the response of cultivars is needed in peanut production systems where un-predictable environmental factors (temperature, rainfall, relative humidity) changed from one place of the region to another or from year to year.

Table 4. Combined analysis of variance results (mean square) for investigated traits of peanut varieties over 2 years and 3 locations.

Source	DF	PN	PW	FPR	HPW	PY	SP	HKW	OC	PC
Year (Y)	1	1224.9**	318.9**	1463.9**	3761.7**	4048425.2**	41.7**	147.9**	264.7**	270.9**
Location (L)	2	1448.2**	584.9**	1549.5**	40268.5**	12947.9**	144.7**	3043.2**	456.1**	709.7**
Y x L	2	5123.9**	2131.8**	386.2**	35695.4**	138137.5**	403.8**	1543.7**	341.2**	250.4**
Genotype (G)	9	158.5**	561.9**	457.9**	15111.5**	40717.7**	193.3**	1631.2**	35.9**	17.8**
G x Y	9	49.8**	169.5**	58.7*	366.2**	13771.4**	5.8ns	45.2*	8.0**	7.6**
G x L	18	50.0**	58.8**	184.7**	1737.2**	4678.6**	9.1*	136.2**	19.1**	4.6**
G x Y x L	18	42.5**	88.3**	104.8**	547.2**	3485.5**	8.7*	49.2**	11.8**	3.7**
Error	108	7.4	19.8	22.8	107.8	265.3	4.3	20.8	0.9	0.3

DF= Degree of freedom, PN= Pod number (no. plant^{-1}) , PW= Pod weight (g plant^{-1}), FPR= First quality pod ratio (%), HPW= Hundred pod weight (g), PY= Pod yield (kg ha^{-1}), SP= Shelling percentage (%), HKW= Hundred kernel weight (g), OC= Oil content (%), PC= Protein content (%)
ns, *, ** = not significant, significant at 5% and 1% level, respectively.

The estimated variance components (σ^2g, σ^2gy, σ^2gl, σ^2gyl, σ^2e and σ^2p), phenotypic (PCV) and genotypic (GCV) coefficients of variation, Heritability (H) and Genetic Advance (GA) in Table 5 were calculated using the data in Table 4. Error variances for all traits were smaller than those of the other components. Genotype-year (σ^2gy) interaction did not occur for first quality pod ratio, hundred pod weight, shelling percentage, hundred kernel weight and oil content, but it was very high for pod yield (1142.8) followed by pod weight (16.6). The fact that the σ^2gy value is zero for first quality pod ratio, hundred pod weight, shelling percentage, hundred kernel weight and oil content shows that the year effect is not important and more emphasis should be placed on locations in genotype-environment interaction studies. Genotype-location (σ^2gl) and genotype-year-location (σ^2gyl) interaction variances were high in terms of pod yield and hundred pod weight. Genotypic and phenotypic variances were high for pod yield, hundred pod weight and hundred kernel weight. The genetic variance was higher than error variance, for pod weight, hundred pod weight, pod yield, shelling percentage, hundred kernel weight and oil content. This is an indication that these features were less affected by environmental conditions (Hamidou et al., 2012; Oteng-Frimpong et al., 2017). For all tested parameters, the Phenotypic Variance Coefficient (PCV) is higher than the Genotypic Variance Coefficient (GCV). This fact shows the great importance of environmental conditions on the expression of the trait. Similar results of higher PCV were observed by Patil and Bhapkar (1987), Mahalaxmi et al. (2005), John et al. (2006), Kadam et al. (2007) and Jakkeral et al. (2014). The magnitude of GCV and PCV for the investigated traits in the current study was between 0.9 and 1.1 for pod yield, and 10.2 and 10.8 for 100-pod weight, respectively. It indicates that there is no wide genetically based variation. Studies conducted by Patil and Bhapkar (1987), Patil et al. (2014) indicated that genotypes by environmental interactions were significant for pod yield and yield components. Kebede and Tana (2014) reported a highly significant effect of genotypes, environments, and their interactions on pod yield. Kushwah et al. (2017) stated that the coefficient of phenotypic and genotypic variation was high for pod yield and kernel yield per plant, number of pods and kernels per plant, and hundred kernel weight.

Table 5. Genetic parameters for investigated traits of peanut varieties.

Traits	Mean	Variance components [a]						Coefficient of variation (%)[b]		H [c] (%)	GA[d] Mean (10%)
		σ^2g	σ^2gy	σ^2gl	σ^2gyl	σ^2e	σ^2p	PCV	GCV		
PN	32.2	5.6	0.8	1.2	11.7	7.4	8.8	9.2	7.3	63.8	30.6
PW	57.5	23.4	16.6	6.5	22.8	19.8	38.7	10.8	8.4	60.4	71.7
FPR	68.7	17.7	0	13.3	27.3	22.8	28.0	7.6	6.1	63.3	45.4
HPW	264.4	728.6	0	198.3	146.4	107.8	825.2	10.8	10.2	88.3	485.0
PY	4189.7	1430.7	1142.8	198.8	1073.4	265.3	2262.1	1.1	0.9	63.2	60.1
SP	67.5	10.4	0	0.1	1.4	4.3	10.8	4.8	4.7	95.4	27.1
HKW	110.6	83.3	0	14.5	9.4	20.8	90.8	8.6	8.2	91.6	132.4
OC	52.9	1.1	0	1.2	3.6	0.9	2.2	2.8	2.0	52.0	3.8
PC	27.1	0.5	0.4	0.1	0.3	1.2	0.9	3.6	2.6	52.5	3.4

a = genotypic variance (σ^2g), genotype – year variance (σ^2gy), genotype – location variance (σ^2gl), genotype – year – location variance (σ^2gyl), error variance (σ^2e), phenotypic variance (σ^2p)
b = phenotypic coefficient of variability (PCV), genotypic coefficient of variability (GCV)
c = broad-sense heritability (H)
d = genetic advance (GA) at 10% selection intensity
PN= Pod number (no. plant^{-1}) , PW= Pod weight (g plant^{-1}), FPR= First quality pod ratio (%), HPW= 100-pod weight (g), PY= Pod yield (kg ha^{-1}), SP= Shelling percentage (%), HKW= 100-kernel weight (g), OC= Oil content (%), PC= Protein content (%)

Broad sense heritability estimates ranged from 52.0% (oil content) to 95.4% (shelling percentage) (Table 5). The heritability estimates for pod number (63.8%), pod weight (60.4%), first quality pod ratio (63.3%), and pod yield (63.2%), oil (52.0%) and protein content (52.5%) were at moderate levels (50-65%). On the other hand, heritability degrees were estimated to be at high levels (>65%) for 100 pod weight (88.3%), shelling percentage (95.4%) and 100-kernel weight (91.6%). High value of broad sense heritability for 100-pod weight, shelling percentage and 100-kernel weight is due to the high share of the genotypic variance component (Yildirim et al., 1979). These characters are highly heritable in peanut plant. The magnitude of the genotypic variance indicates that are significant variations within peanut varieties in terms of pod and seed weight and kernel ratio. High values of broad-sense heritability were reported for seed weight (87-93%), 100-pod weight (88-91%), pod yield (71-74%) and 100-kernel weight (87-96%) by Tossim et al. (2020). Rao et al. (2014) reported high heritability for shelling percentage (92.2%), pod number (76.9%), kernel weight (97.4%) and pod yield (95.5%). High heritability for hundred kernel weight, pod number, and pod yield was reported by Savaliya et al. (2009), John et al. (2007) and Khote et al. (2009).

The magnitudes of genetic advance were observed to be high (> 20%) for pod number, pod weight, first quality pod ratio, 100-pod weight, pod yield, shelling percentage and 100-kernel weight and low (< 10%) for oil and protein content (Table 5). The high magnitude of genetic advance was reported earlier by Mahalaxmi et al. (2005) and Jakkeral et al. (2014) for pod yield and its components. A high level of genetic advance helps in determining the appropriate character for selection. Heritability estimation along with genetic progression provides insight into the genetic makeup of the population. High or moderate heritability accompanied by high genetic advance for pod number, pod weight, first quality pod ratio, 100-pod weight, pod yield, shelling percentage and 100-kernel weight suggested that selection can be effective for these traits based on phenotypic expression. These results explain the additive gene action and indicate phenotypic selection to be effective (Kushwah et al., 2017). Similar results of moderate to high heritability coupled with moderate to high genetic advance were observed earlier for these traits by Azad and Hamid (2000), Dashora and Nagda (2002), Mahalaxmi et al. (2005), Cholin et al. (2010), Shinde et al. (2010) and Jakkeral et al. (2014). The low magnitude of heritability and low magnitude of genetic advance was observed for oil and protein content. This indicated that there was narrow genetic variability within peanut varieties for oil and protein content. Due to the narrow genetic diversity, the success of these varieties in peanut breeding (selection or hybridization) for oil and protein ratio will be low.

Simple correlation coefficients calculated among examined characteristics are shown in Table 6. Significant and positive correlations of pod yield with pod number (0.35), pod weight (0.95), 100-pod weight (0.56) and 100-kernel weight (0.56) were found. Pod number exhibited significant positive correlation with pod weight (0.40), 100-pod weight (0.46), shelling percentage (0.25), 100-kernel weight (0.36), oil content (0.36) and protein content (0.21). There were positive and significant correlations between pod weight, 100-pod weight, shelling percentage and 100-kernel weight. The first quality pod ratio was positively and significantly correlated with 100-kernel weight and protein content. The correlations between oil content and 100-pod weight, shelling percentage, 100-kernel weight were found to be positive and significant.

Table 6. Simple correlation coefficients for investigated traits of peanut varieties.

Traits +	PN	PW	FPR	HPW	PY	SP	HKW	OC
PW	0.40**	-						
FPR	0.08	-0.30**	-					
HPW	0.46**	0.57**	0.12	-				
PY	0.35**	0.95**	-0.28**	0.56**	-			
SP	0.25**	0.20**	0.02	0.06	0.13	-		
HKW	0.36**	0.54**	0.22**	0.95**	0.56**	0.12	-	
OC	0.36**	0.13	-0.19**	0.37**	0.14	0.25**	0.28**	-
PC	0.21**	-0.23**	0.32**	-0.15	-0.22**	0.04	-0.08	0.05

*, ** Significant at 5% and 1% level respectively.
+ = Pod number (PN), pod weight (PW), first quality pod ratio (FPR), 100-pod weight (HPW), pod yield (PY), shelling percentage (SP), 100-kernel weight (HKW), oil content (OC), protein content (PC)

Pod yield is a complex character that can be directly or indirectly affected by many characteristics. For this reason, taking into account the important characters that affect the yield in the selection will significantly increase the success. There was positive and significant correlations between pod yield, kernel yield, pod number per plant and hundred kernel weight (Rao et al., 2014). Chishti et al. (2000) reported positive and significant correlations between pod yield and pod number, pod weight, 100-kernel weight and oil content. Deshmukh et al. (1986) reported a positive and significant correlation between pod yield and the number of pods in peanut plants. Pod number per plant, pod weight, 100-pod weight and 100-kernel weight contributed significantly to pod yield. It is concluded that successful selection can be made on these characteristics for pod yield.

CONCLUSIONS

In this study, genetic variability, broad-sense heritability, genetic advance, and correlation coefficients among 10 peanut cultivars over 2 years and 3 locations were estimated for nine agro-morphological and quality traits. Genotypic and phenotypic variances were high for pod yield, hundred pod and kernel weight. Broad-sense heritability were estimated to be high for hundred pod weight, shelling percentage and hundred kernel weight. The magnitudes of genetic advance were observed to be high for pod number, pod weight, first quality pod ratio, hundred pod weight, pod yield, shelling percentage and hundred kernel weight. Significant and positive associations of pod yield with pod number, pod weight, hundred pod and kernel weight were found. Pod number, pod weight, hundred pods, and kernel weight were found to be the most significant characteristics that should be considered during selection.

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