THE STUDY OF GENETIC VARIABILITY WITHIN THE COLLECTION OF PEANUTS GROWN ON THE SANDY SOILS OF SOUTHERN OLTENIA

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Abstract

The experiment studied the genetic variability of production and some productivity elements in peanuts grown on sandy soils at Research Development Station Plant Culture Sands Dabuleni during 2018-2020. Several genotypes of local and foreign peanuts were studied. The highest coefficient of variation was recorded at number of secondary branches per plant, number of immature pods, number of mature pods, number of gynophores forming pods, pod production and grain weight per plant. Pod yield per plant showed a highly significant and positive correlation with number of pod-forming gynophores, number of mature pods per plant, grains weight per plant, and days to 50 percent flowering. The number of mature pods per plant was positively correlated with pod yield per plant. Therefore, the number of branches per plant, the height of the main stem, the number of pods per plant, the weight of pods per plant, the number of days to 50 percent flowering, the percentage of shelling and the number of days to maturity are the most important characters that would could be used in selection to increase production.

Key words**: **peanuts, sandy soils, production, coefficient of variation

INTRODUCTION

Peanut, also known as groundnut, is an annual crop that belongs to the Fabaceae family. The genus Arachis contains about 80 species, produces leaves and stems that form above ground, and unlike other genera of flowering plants, this genus produces fruits below ground (Krapovickas and Gregory 1994). Peanuts are originally from South America and have spread throughout the world.The genus Arachis is divided into two subspecies based on the presence or absence of flowers on the main axis and mode of branching(Krapovickas and Gregory,1994), in subsp. hypogaea and subsp. fastiated.

The world cultivated area is 25.44 million ha, the world peanut production was 45.22 million tons, with an average yield of 1.77 t ha/1 (FAO 2013). The groundnut crop is considered the second most important cultivated food legume and the fourth largest edible oilseed crop in the world (Shilman et al. 2011). The seeds contain palmitic, oleic and linoleic acids, accounting for about 90% of the total fatty acids at maturity of the seeds (Sekhon et al. 1972). Peanut seeds with high oleic acid provide a lower rate of oxidation during storage, which results in greater acceptability for marketing (Mozingo et al. 2004). Peanuts are also a valuable source of vitamins E, K and B (the richest source of thiamin and niacin) and other essential minerals (Kassa et al. 2009). The resulting cakes after oil extraction have a high protein content and are mainly used for animal feed (Savage and Keenan 1994). Studies have shown that eating peanuts at least four times a week has a 37% reduced risk of coronary heart disease (Suchoszek-Lukaniuk et al. 2011) and anticancer activity with a 50% inhibition of the proliferation of

related leukemia cells (Hwang et al. et al. 2008).

Genetic variability is the prerequisite for initiating an efficient and successful breeding program.

The basic key to bringing about the genetic improvement of a crop is to use the available genetic variability. To exploit the available genetic variability, a lot of resources are needed to develop varieties through selection and hybridization to adapt to different environmental conditions. The effectiveness of selection depends on the nature, extent of genetic variability present in the breeding stock for the target trait. Estimation of genotypic coefficient of variation gives good implication for genetic potential in crop improvement by selection.

In most breeding programs improving the genetic potential of peanut for qualitative and quantitative traits is one of the major objectives. A large genetic diversity for these traits is required for a rich harvest. Typically, the use of only a few lines and/or cultivars in breeding programs reduces genetic variation, leading to a narrow genetic base in the peanut genetic pool (Gupta et al. 2015). Therefore, breeding programs must include germplasm with high genetic variability for the desired traits. Many studies have been conducted on genetic diversity (Swamy et al. 2003; Upadhyaya et al., 2006; Kassa et al. 2009; Bishi et al. 2013; Jiang et al. 2013; 2014; Garba et al. 2015). Mediterranean areas provide suitable climatic conditions for vegetative and reproductive growth of peanuts (Caliskan et al. 2008b). Especially under irrigated conditions, peanut production increases remarkably (Smartt 1994). In Mediterranean areas wheat is a very common crop, sown in autumn or spring and harvested in summer, and groundnut is an important alternative crop for second crop production (Isik and Gul 2004).

Coefficient of variation analysis is one of the effective techniques to look for the relationship between different yield characters and their direct and indirect effect on yield through correlation values.

The present study was undertaken to understand the variability and relationship between different characters and their contribution to increased production yield.

MATERIALS AND METHODS

The research was carried out at Research Development Station Plant Culture Sands Dabuleni during 2018-2020. The existing germplasm collection comprised 30 domestic and foreign peanut genotypes. Genotypes were sown in late April–early May in all three years in randomized blocks with three replications. Each genotype was sown in two-row arrangements of 3 m length, with a row spacing of 70 cm and 20 cm between plants per row. Care was taken to ensure a uniform sowing depth and groundnut cultivation technology was used on sandy soils. The climatic conditions during the vegetation period were recorded at the weather station of Research Development Station Plant Culture Sands Dabuleni.

Observations and determinations were recorded on five randomly selected plants in each variety: number of days to 50% flowering, number of days to maturity, height of main stem, number of primary branches, number of secondary branches, number of gynophores per stem main, number of gynophores forming pods, number of mature pods per plant, number of immature pods per plant, total number of pods per plant, weight of pods per plant, weight of 100 grains, percentage of shelling. The results were processed as means by the analysis of variance method and the range of variability, coefficient of variation and correlation coefficients between different characters were calculated.

RESULTS AND DISCUSSIONS

The mean monthly temperature, total precipitation, multiannual average temperature and multiannual precipitation (April to October) were shown in Table 1. The mean temperature had a similar trend during the growing seasons in the three years. The highest temperatures were recorded in July-August and the lowest in

April for the three consecutive years. The long-term averages (1956-2020) indicate that the temperature during the vegetation period was 180C. The amount of precipitation during the growing season decreased from 516 mm in 2018 to 289 mm in 2019 and 347 mm in 2020. The long-term average (1956-2020) shows similar humidity in the three years.

The results regarding the variability in the peanut genotypes studied are presented in table 2: the mean of the observed characters, the range of variability and the coefficient of variation.

In the present study, analysis of variance showed significant differences between genotypes for all characters studied: number of days to 50% flowering, number of days to maturity, percentage of shelling, 100-grain weight, pod production per plant, grain weight per plant and number of mature pods per plant. The highest coefficient of variation was recorded at number of secondary branches per plant, number of immature pods, number of mature pods, number of gynophores forming pods, pod production and grain weight per plant. Pod production is a complex character governed by several contributing traits. Therefore, it is important to understand the association of different characters with grain yield to enhance the utility of the selection criterion to be followed in obtaining varieties. Invariably, pod production was significantly positively correlated with grain weight per plant, number of mature pods per plant, number of pod-bearing gynophores, number of secondary and primary branches per plant, and days to 50% flowering and negatively correlated significantly with the height of the main stem, percentage shelling, the number of days to maturity. Chishti et al. (2000) reported positive significant correlations between pod yield and number of mature pods per plant, pod weight, 100-grain weight, and a significant negative correlation between pod yield and days to maturity. Deshmukh et al. (1986) also reported a significant positive correlation between pod yield and number of pods per plant.

Analysis of the phenotypic correlation coefficient(Table 3) showed that the greatest direct positive effect was on the number of mature pods per plant and the number of pod-forming gynophores, the weight of grains per plant and the weight of 100 grains, the number of secondary branches per plant and the number of primary branches, and the number of immature pods per plant was correlated with the number of pod-forming gynophores, the number of main branches. Regarding pod production, the percentage of shelling, the number of days to maturity, the height of the main stem were negatively correlated with the yield of pods per plant. For increasing pod production, a selection criterion should be number of mature pods per plant and grain weight per plant. The results are consistent with those obtained by Siddiquey et al., 2006 in which 100-grain weight was found to have a significant positive effect on pod yield.

Table 1. Climatic elements registered at the Meteorological Station of RDSPCS Dabuleni during the peanut vegetation period (2018-2020)

Year	Specification	Month							Average/ Sum
		April	May	June	July	August	September	October	
2018	Average monthly temperature (^{0}C)	17.8	20.7	22.5	26.6	25.1	20.5	13.4	21.0
	Precipitation (mm)	17.0	106.6	195.2	148.7	30.0	12.6	5.8	516.0
Multiannual average temperature(^{0}C)		11.9	17.1	21.6	23.2	22.5	17.8	11.4	18.0
Multiannual precipitation(mm)		47.04	62.98	70.47	55.74	33.15	46.80	42.50	359.0
2019	Average monthly temperature (^{0}C)	12.7	17.4	23.4	23.8	25.4	20.0	13.5	19.0
	Precipitation (mm)	53.4	55.4	87.2	54.8	12.0	10.0	16.2	289.0
Multiannual average temperature(^{0}C)		11.9	17.1	21.6	23.1	22.6	17.8	11.4	18.0
Multiannual precipitation(mm)		47.14	62.86	70.73	55.73	32.82	46.22	42.09	358.0
2020	Average monthly temperature (^{0}C)	12.9	17.7	22.0	24.5	24.9	21.0	13.6	20.0
	Precipitation (mm)	11.6	59.2	55.8	73.0	51.0	40.2	56.2	347.0
Multiannual average temperature(^{0}C)		11.93	16.93	21.53	23.24	22.6	17.94	11.5	18.0
Multiannual precipitation(mm)		46.82	62.88	70.43	55.19	36.88	45.3	42.52	360.0

Table 2. Variability and coefficient of variation in the studied peanut genotypes (2018-2020)

The character studied	Mean	Range		Coefficient of variation(%)
		Minim	Maxim	
Main stem height(cm)	30,1	21,2	41,5	15,2
Number of primary branches	8,0	6,0	15,0	23,0
Number of second branches	7,0	3,0	25,0	71,8
Number of gynophores on the main stem	13,0	10,0	19,0	18,8
Number of pod-forming gynophores	50,0	30,0	83,0	27,0
Number of matured pods per plant	48,0	25,0	75,0	31,2
Number of imatured pods per plant	7,0	2,0	18,0	49,0
Total number of grains per plant	32,0	13,0	68,0	20,8
Grains weight per plant(g)	25,3	17,0	38,0	24,5
100 grains weight(g)	36,2	23,0	50,1	20,1
Number of days to maturity	120,0	113,0	125,0	2,5
Number of days to 50% flowering	35,0	31,0	45,0	12,1
Shelling (%)	67,0	50,0	85,0	11,1
Pod yield per plant(g)	34,2	22,0	60,0	23,8

Table 3. Phenotypic correlation coefficients between different characters

The character studied	Main stem height (cm)	Number of primary branches	Number of second branches	Number of gynophores on the main stem	Number of pod-forming gynophores	Number of matured pods per plant	Number of imatured pods per plant	Total number of grains per plant	Grains weight per plant (g)	100 grains weight (g)	Number of days to maturity	Number of days to 50% flowering	Shelling (%)	Pod yield per plant (g)
Main stem height(cm)	1,0													
Number of primary branches	-0,44**	1,0												
Number of second branches	-0,485**	0,675**	1,0											
Number of gynophores on the main stem	0,427**	-0,280**	-0,255*	1,0										
Number of pod-forming gynophores	-0,163	0,055	0,201*	0,330**	1,0									
Number of matured pods per plant	-0,114	-0,06	0,133	0,425**	0,955**	1,0								
Number of imatured pods per plant	-0,200*	0,227*	0,275**	-0,212*	0,416**	0,135	1,0							
Total number of grains per plant	-0,020	-0,068	-0,026	0,093	0,310**	0,340**	-0,005	1,0						
Grains weight per plant	0,110	0,247*	0,093	-0,238*	-0,610**	-0,605**	-0,186	0,245*	1,0					
100 grains weight	0,412**	-0,317**	-0,182	0,185	-0,205*	-0,180	-0,140	-0,215*	0,143	1,0				
Number of days to maturity	0,035	0,175	0,003	-0,295**	-0,251*	-0,285**	0,040	-0,022	0,100	0,060	1,0			
Number of days to 50% flowering	-0,625**	0,523**	0,728**	-0,510**	0,061	-0,0007	0,225*	0,015	0,188	0,285**	0,021	1,0		
Shelling (%)	-0,021	0,080	0,233*	0,215*	0,573**	0,620**	0,031	0,026	1,0	0,165	0,051	-0,220*	1,0	
Pod yield per plant(g)	-0,210	0,235	0,314	0,130	0,661	0,710	0,040	0,269	0,795	-0,073	-0,140	0,222	-0,360	1,0

*, ** Significant at P=0.05 and P = 0.01 level respectively

CONCLUSIONS

To study genetic variability parameters, 30 indigenous and foreign peanut genotypes were evaluated for 14 characters.

Analysis of variance showed significant differences among genotypes for all characters studied, indicating that adequate variability was found among genotypes studied for these characters.

The highest coefficient of variation was recorded at number of secondary branches per plant, number of immature pods, number of mature pods, number of gynophores forming pods, pod production and grain weight per plant.

The number of mature pods per plant had a distinctly significant positive correlation with the number of pod-forming gynophores.

Pod yield per plant showed a positive correlation with number of pod-forming gynophores, number of mature pods per plant, grain weight per plant, and number of days to 50 percent flowering.

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