DETERMINATION OF SOME AGRONOMIC CHARACTERISTICS OF SOME PEANUT GENOTYPES USED IN THE BREEDING PROCESS

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Abstract

This study was conducted in the experimental field cultivated with peanuts at Research and Development Station for Plant Culture on Sands Dabuleni during the period 2023-2024.

The objective of this study was to determine some agronomic characteristics of some peanut genotypes used in the breeding process. In this study, five indigenous peanut genotypes and six foreign genotypes were used as plant material, arranged in randomized blocks with three replications. According to the average results over two years, the number of pods per plant of the peanut genotypes varied between 26.4-35.5 pods per plant, the weight of the pods per plant between 57.8-88.2 g per plant, the weight of 1000 grains between 657.5-951.5 g, the peeling percentage between 63-67.3 %, and the average pod production between 2539-5828 kg/ha.

Keywords: peanuts, production, selection

INTRODUCTION

Peanuts are cultivated worldwide in tropical and temperate regions, mainly for their seeds. The annual global production of peanuts is approximately 45 million tonnes (Carrin and Carelli, 2010 and FAO, 2015). Approximately two-thirds of the total peanut production is used for oil extraction, and the remaining one-third is used in confectionery products (Dwivedi et al.1996). For this reason, peanuts (Arachis hypogaea L.) are an important oilseed crop for vegetable oil production in the world (peanut oil accounted for 3.0% of global vegetable oil production) (FAO, 2015). Peanut seeds contain 44–56% oil, 22–30% protein and 15.0–18.0% carbohydrates. In addition, they are a good source of minerals (P, Ca, Mg and K) and vitamins (E, K and group B). For this reason, it is an important source of edible oil and protein for human nutrition in the world. Peanuts are also a cheap source of protein, a good source of essential vitamins, minerals and a component of many food products (Savage and Keenan, 1994 and Gulluogluet. al., 2016a).

Peanut production is a complex phenomenon, a function of genetic factors, influenced by climate, variety and cultivation technology.

Climate change increasingly threatens agricultural productivity in marginal areas, especially those with sandy soils characterized by low fertility, rapid drainage and poor structural stability (Velea et al., 2021). High temperatures, irregular rainfall patterns and prolonged droughts intensify water deficits and nutrient losses, directly limiting the growth and yield of crops such as wheat (Triticum aestivum L.), peanuts (Arachis hypogaea L.). This species exhibits varying sensitivities to climatic stress, exhibiting reduced biomass and reduced pod formation under heat stress conditions (Paraschivu et al., 2021; Dima et al., 2025).

Cultivar choice is one of the main factors that plays an important role in yield and quality of production.

Fatty acid composition plays an important role in the diet for a healthy life. The nutritional qualities of peanuts depend on the relative proportion of saturated and unsaturated fatty acids in the oil. A high proportion of polyunsaturated fatty acids is desirable, as it lowers plasma cholesterol and low-density lipoprotein (LDL) content, which may reduce the risk of coronary heart disease (Dwivedi et al., 1996 and Mzimbiri et al., 2014).

Andersen and Gorbet (2002) and Chowdhury et. al., (2015) reported that the nutritional and storage qualities of peanuts are determined by their fatty acid composition. The amount of saturated and unsaturated fatty acids in peanut oil ranges from 10.92% to 17.47% and from 81.13% to 94.81%, respectively. The major fatty acid components are oleic acid, linoleic acid, and palmitic acid in peanut oil. Peanut oil is rich in oleic and linoleic acids (Carrin and Carelli, 2010). The oleic acid content in peanut genotypes can vary from 21 to 85% and linoleic acid from 2 to 43%. The fatty acid composition of Virginia peanut varieties varies between 9.0-9.1% palmitic acids, 2.2-2.4% stearic, 56.4-60.3% oleic and 24.2-26.8% linoleic acids (Brown et al. 1975). The oil content of Virginia peanut varieties varied between 45.0-58.6% (Carrin and Carelli, 2010). The fatty acid composition of peanut oil varies depending on the genotype, seed maturity, climatic conditions and the interaction between these factors (Young, 1996).The agronomic and qualitative characteristics of peanut vary depending on the variety and cultivation technology.

The aim of this work was to determine some agronomic characteristics of some peanut genotypes grown on sandy soils in southern Oltenia and used in the breeding process.

MATERIAL AND METHOD

The study was carried out during 2023-2024 at RDSCPS Dăbuleni and was used as breeding material for four indigenous peanut genotypes and seven foreign peanut genotypes.

The experiment was set up in randomized blocks with three repetitions. The experimental variant included three rows spaced 70 cm and 20 cm between plants per row. The seeds were sown on April 26, 2023 and May 5, 2024. During the growth and development period, the peanut cultivation technology developed by RDSPCS Dăbuleni was applied. The plants were harvested manually on September 28, 2023 and September 25, 2024.

At harvest, observations and determinations were made regarding the number of pods/plant, pod weight per plant, 100 pod weight, percentage of mature pods, percentage of peeling, 1000 grain weight, pod production/ha.

RESULTS AND DISCUSSIONS

Table 1 presents the climatic data for the peanut growing season (April-October) for the period 2023-2024.

The average monthly air temperature during the research period (April-October) ranged between 11.1-14.9 0C in 2023 and 15.2-12.5 0C in 2024, and the total precipitation was 371.7 mm in 2023 and 237.6 mm in 2024.

Atmospheric precipitation is one of the determining factors on plant life. It is important for its annual amount, but especially for the amount recorded during the plant growing season and how it is distributed over the months.

The analysis of the data in Table 1 highlights a non-uniformity of the precipitation recorded monthly, with the non-uniformity increasing during the summer.

During the experimental period (2023-2024) the average amount of precipitation during the peanut growing season was 304.65 mm.

Table 1. Climatic elements recorded at the Meteorological Station of RDSPCS Dăbuleni during the peanut growing season (2023-2024)

Year	Specification	Month							Average /Sum
		IV	V	VI	VII	VIII	IX	X	
2023	Monthly average air temperature^{0}C	11,1	16,8	21,2	25,4	25,4	21,2	14,9	19,4
	Monthly maximum temperature (^{0}C)	23,5	29	37,6	42	41,6	36,5	33,3	41,6
	Monthly manimum temperature (^{0}C)	0	7,4	11,4	10,2	10,6	9	-0,8	-0,8
	Rainfall (mm)	57,8	81,6	81,4	73,6	22,3	46,8	8,2	371,7
	Multiannual average air temperature (^{0}C) (1956-2024)	11,8	16,9	21,5	23,3	22,7	17,9	11,5	17,9
	Precipitaţii Multiannual sum rainfall (mm) (1956-2024)	67,1	66,9	70,6	61,6	55	58,5	63,7	443,4
2024	Monthly average air temperature^{0}C	15,2	16,7	25,2	26,5	25,8	19,2	12,5	20,1
	Monthly maximum temperature (^{0}C)	34,1	28,6	39,2	40,9	40,3	33,1	29,5	40,9
	Monthly manimum temperature (^{0}C)	2,7	7,4	12,1	10,2	10,5	4,2	-2,0	-2,0
	Rainfall (mm)	36,0	114,0	27,0	22,6	1,4	30,0	6,6	237,6
	Multiannual average air temperature (^{0}C) (1956-2024)	11,9	16,9	21,6	23,3	22,7	18,0	11,5	17,9
	Precipitaţii Multiannual sum rainfall (mm) (1956-2024)	46,9	63,4	69,3	53,8	36,0	44,7	42,5	356,6
Media 2023-2024	Monthly average air temperature^{0}C	13,1	16,7	23,2	25,9	25,6	20,2	13,7	19,7
	Monthly maximum temperature (^{0}C)	28,8	28,8	38,4	41,4	41,0	34,8	31,4	41,4
	Monthly manimum temperature (^{0}C)	1,3	7,4	11,7	10,2	10,5	6,6	-1,4	-1,4
	Rainfall (mm)	46,9	97,8	54,2	48,1	11,8	38,4	7,4	304,65
	Multiannual average air temperature (^{0}C) (1956-2024)	11,8	16,9	21,5	23,3	22,7	17,9	11,5	17,9
	Precipitaţii Multiannual sum rainfall (mm) (1956-2024)	57,0	65,1	69,9	57,7	45,5	51,6	53,1	400,0

It can be seen in Table 2 that there were differences between peanut genotypes for the number of pods per plant in 2023, 2024 and the two-year average. The number of pods per plant in the studied lines varied between 29.3-36.8 pods per plant in 2023, between 23.5-34.3 pods per plant in 2024 and 26.4-35.5 pods per plant on average over two years. According to the two-year average, the highest number of pods per plant was obtained by the line at L5/18 (35.5 pods per plant), with a distinctly significant difference compared to the control, and the lowest number of pods per plant was recorded in the peanut variety Dăbuleni (26.4 pods per plant).

Table 2. Number of pods per plant and weight of pods per plant in 2023,2024 and average for the two years

Genotype	Number of pods/plant					Weight of pods per plant (g)				
	2023	2024	Average	Difference from the control (g)	Semnification	2023	2024	Average	Difference from the control (g)	Semnification
Dăbuleni	29,3	23,5	26,4	-4,7		64,2	51,5	57,8	-17,4	
Viviana	32,0	26,3	29,1	-2,0		82,6	62,3	72,4	-2,8	
HYY 1	33,5	30,8	32,1	+1,0		75,2	71,2	73,2	-2,0	
HYY 2	32,0	32,3	32,1	+1,0		78,3	70,0	74,1	-1,1	
HYY 3	29,3	29,9	29,6	-1,5		82,6	65,3	73,9	-1,5	
Viorica	33,5	30,8	32,2	+1,1		81,5	69,5	75,5	+0,3	
Prov.China2	30,5	29,5	30,0	-1,1		83,2	62,3	72,7	-2,5	
Ning	33,3	30,3	31,8	+0,7		93,6	67,0	80,3	+5, 1	
Henan Province	33,0	32,5	32,7	+1,6		84,0	72,3	78,1	+2,9	
Brâncoveana	30,6	29,5	30,1	-1,1		86,3	76,3	81,3	+6,1	*
L5/18	36,8	34,3	35,5	+4,4	**	89,2	87,2	88,2	+13,0	**
Average (control)	32,2	29,9	31,1	Mt.		81,8	68,2	75,2	Mt.	
LSD 5%	2,86	3,45	2,75			6,48	8,1	5,2		

Regarding the weight of pods per plant, this character had values ranging between 64.2-93.6 g per plant in 2023 and 51.5-87.2 g per plant in 2024. As a result of the average over the two years, the weight of pods per plant varied between 57.8-88.2 pods per plant, the highest value being obtained by Line L5/18 (88.2 g pods per plant), with a distinctly significant difference compared to the control, and the lowest value was recorded by the Dăbuleni variety (57.8 g pods per plant). The average value over the two years of the weight of pods per plant was 75.2 g. The weight of the pod per plant is an important component of peanut production. The yield and some agronomic characteristics of peanuts are influenced by the genotype and environmental conditions.

Table 3. Weight of 100 pods and percentage of mature pods in 2023,2024 and average over the two years

Genotype	Weight of 100 pods (g)			Percentage of mature pods (%)		
	2023	2024	Average	2023	2024	Average
Dăbuleni	315,3	305,5	310,4	76,0	82,3	79,1
Viviana	365,5	295,3	330,4	79,5	83,5	80,5
HYY 1	324,8	298,3	311,5	78,2	74,0	76,1
HYY 2	360,3	312,2	336,2	77,5	68,0	72,7
HYY 3	345,6	298,2	321,9	74,3	76,0	74,1
Viorica	392,3	305,1	348,7	78,5	77,0	76,7
Prov.China2	353,8	325,6	339,7	76,0	75,6	75,8
Ning	385,5	336,8	361,1	81,2	72,8	76,0
Henan Province	345,3	300,4	322,8	76,3	79,7	77,0
Brâncoveana	381,6	310,6	346,1	81,5	74,5	77,0
L5/18	452,3	328,2	390,2	76,2	72,2	74,2
Average (control)	365,6	310,5	338,1	77,7	76,0	76,2
DL 5%	25,72	21,84	16,13	4,68	4,82	4,84

As can be seen in Table 3, the 100 pods weight values of the peanut lines ranged from 315.3-452.3 g in 2023, 295.3-336.8 g in 2024, and 310.4-390.2 g on average over two years. The differences between the studied peanut lines were statistically significant for the 100-pod weight in both years and in the two-year average. According to the two-year average, the highest 100-pod weight was obtained in the L5/18 line (390.2 g) and the lowest in the Dăbuleni variety (310.4 g).

The percentage values of mature pods varied between 76-81.5% in 2023, 68-

83.5% in 2024 and 76-80.5% on average over two years. As an average over two years, the percentage of mature pods was the highest in the Viviana variety (80.5%) and the lowest in the peanut line L6/18.
The percentage of mature pods was higher in the Viviana and Dăbuleni varieties than in the others studied. The differences between genotypes were statistically significant for the percentage of mature pods in 2023, 2024 and the average over two years.
The percentage value of mature pods is an important character with a role in the peanut production obtained.
Table 4 presents data on the peeling percentage and 1000-grain weight of peanut lines in 2023, 2024 and the two year average.

Table 4. Peeling percentage and 1000 grain weight

Genotype	Peeling percentage (%)			Weight a 1000 grain (g)				
	2023	2024	Average	2023	2024	Average	Difference from the control g)	Semnification
Dăbuleni	61,5	65,6	63,5	794,0	521,0	657,5	-137,5	
Viviana	68,2	69,5	68,8	730,0	920,0	825,0	+30	
HYY 1	62,6	63,4	63,0	799,0	822,0	810,5	+15,5	
HYY 2	63,8	64,8	64,3	702,0	848,0	775,0	-20	
HYY 3	66,5	65,2	65,8	808,0	829,0	818,5	+23,5	
Viorica	61,3	63,8	62,5	847,0	843,0	845,0	+50	
Prov.China2	62,5	63,8	63,1	750,0	830,0	790,0	-5	
Ning	68,0	69,5	68,7	870,0	815,0	842,5	+47,5	
Henan Province	65,5	63,7	64,6	732,0	600,0	666,0	-129	
Brâncoveana	63,8	65,0	64,4	728,0	798,0	763,0	-32	
L5/18	72,3	73,5	72,9	958,0	945,0	951,5	+156,5	***
Average (control)	65,1	66,2	65,6	792,5	797,3	795,0	Mt.	
LSD 5%	3,32	3,37	3,35	37,8	38,0	37,9		

The peeling percentage of the breeding lines ranged from 61.3-72.3% in 2023 and 63.4-73.5% in 2024. The value of the peeling percentage of the breeding lines, averaged over two years, was found to be between 63.0-67.3% (Table 4).
The peeling percentage is an important characteristic for the quality of the peanut pod and may differ depending on the genotype and environmental conditions.
Some agronomic characteristics of peanut are influenced by several factors, including environmental factors, genetic factors and the interaction of these factors (Isleib et. al., 2008). The results obtained are similar to the findings of Gulluoglu (2011), Gulluoglu et. al.,(2016b), Arioglu et. al., (2016), Gulluoglu et. al., (2017) and Kurt et. al., (2017).
The 1000-grain weight of the breeding lines ranged from 728-958 g in 2023, 521-945 g in 2024 and 657.5-951.5 g on average over two years. The highest value of 951.5 g was recorded by the L5/18 line, with a very significant difference of 156.5 g compared to the control.
The production yield and some agronomic characteristics, such as the number of pods, pod weight, 1000-grain weight and shelling percentage in peanuts are influenced by the genotype and environmental conditions.

Table 5. Pod production and grain production in the peanut genotypes studied

Genotype	Pod production (kg/ha)					Grain production (kg/ha)		
	2023	2024	Average	Difference from the control (g)	Semnification	2023	2024	Average
Dăbuleni	2607	2248	2539	-1276		1603	1475	1539
Viviana	2744	4035	3389	-426		1871	2804	2337
HYY 1	2830	3906	3256	-559		1771	2476	2123
HYY 2	4185	5451	4818	+1003	**	2670	3532	3101
HYY 3	4748	2907	3827	+12		3157	2495	2826
Viorica	4089	4030	4059	+244		2506	2589	2547
Prov.China2	4905	4108	4506	+691		3065	2875	2970
Ning	3778	3714	3746	-69		2569	2603	2586
Henan Province	2832	2689	2760	-1055		1855	1758	1806
Brâncoveana	3934	2537	3235	-580		2510	1649	2079
L5/18	5608	6048	5828	+2013	***	4054	4445	4249
Average (control)	3842	3788	3815	Mt.		2512	2609	2560
LSD 5%	445,8	439,5	442,7			291,5	302,7	297

It can be seen in Table 5 that the pod production of the peanut genotypes varied between 2607-5608 kg/ha in the first year, 2248-6048 kg/ha in the second year and 2539-5828 kg/ha in the two-year average. The average pod production of the studied genotypes was 3842 kg/ha in 2023, decreasing to 3788 kg/ha in 2024. On average over two years, the average pod production of the genotypes was 3815 kg/ha. The highest average pod production was obtained by the L5/18 line (5828 kg/ha), with a difference of 2013 kg/ha, very significant compared to the control.

The production and some agronomic characteristics of peanuts are influenced by the genotype and environmental conditions during the growing season.

Canavar and Kaynak (2010) reported that some physiological processes best explain the variation in peanut yield. These are the partition of assimilates between reproductive and vegetative parts, the duration of the pod filling period, and the rate of pod formation.

Grain yield was calculated as “pod yield/ha x shelling yield”. In peanut crop, grain yield is more important than pod yield.

Grain yield of the studied peanut genotypes ranged between 1603-4054 kg/ha in 2023, 1475-4445 kg/ha in 2024, and 1539-4249 kg/ha on average over two years (Table 5).

As a result over two years, the highest grain production was obtained by the L5/18 line (4249 kg/ha), the HYY2 variety (3101 kg/ha), the Provenience China 2 variety (2970 kg/ha), and the lowest production was recorded by the Dăbuleni variety (1539 kg/ha).

CONCLUSIONS

The data on the average pod production per ha and the average grain production per hectare of the studied peanut genotypes show that, for most genotypes, they were higher than the world average production.

As a result, the highest pod and grain production per ha, 1000-grain weight and number of pods per plant were obtained by the L5/18 line. For this reason, this peanut line was proposed to be homologated as a variety.

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