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RESEARCH ON THE INFLUENCE OF HARVEST TIME ON YIELD IN GROUNDNUTS GROWN ON SANDY SOILS

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Abstract

The research was carried out in the experimental field cultivated with peanuts at Research Development Station for Plant Culture on Sands in the period 2019-2021. The purpose of this study was to determine the effect of different harvest times on some elements of productivity and yield in peanuts grown under sandy soil conditions. The experiment was mono-factorial with three harvest periods: 153, 163, 173 and 183 days after sowing (DAS). The Viviana variety was used for sowing. The results showed that the number of mature pods per plant was higher in the late harvest. The pod yield over the three years increased from 3805 kg/ha to 4710 kg/ha when the harvest was delayed from 153 days after sowing (DAS) to 173 days after sowing (DAS).

Key words*: groundnuts, yield, pods, harvest, soil.*

INTRODUCTION

Peanuts (*Arachis hypogaea* L.) are considered one of the most important oil crops that occupy a world area of 25.2 million hectares with an annual world peanut production of 45.2 million tons (FAO, 2013). The groundnut crop is the second most important cultivated food and the world's fourth edible oil seed crop (Shilman et al., 2011). In the area of sandy soils in the south of Oltenia, peanuts find favourable pedological conditions for growth and fruiting, conditions that allow the cultivation of this species with good results (Mitrea I., 1993). In the context of climate change, crop production and food security in vulnerable areas are one of the major global challenges of the 21st century. Globally, agricultural systems are affected by climate variability and climate change that directly affect crop yields and indirectly biotic constraints and could lead to the invasion of weeds, pests and pathogens into areas where they were not previously relevant (Partal and Paraschivu, 2020; Paraschivu et al., 2021; Velea et al., 2021; Matei et al., 2021; 2022; Păunescu et al., 2022). Peanut seeds are an important source of proteins, lipids and fatty acids for the food industry. It is an important source of edible oil and protein for human consumption (Gulluoglu, 2011; Arioglu et al., 2013; Chamberlin et al., 2014; Chowdhury et al., 2015). Peanut kernels have an oil content of 47-50% (Sanders, 2002). They contain palmitic, oleic and linoleic acids, representing about 90% of the total fatty acids at maturity of the seeds (Young et al., 1972). Peanut seeds with high oleic acid provide a lower oxidation rate resulting in greater marketing acceptability (Mozingo et al., 2004). In 2015, peanut oil represented 3.0% of the world's production of vegetable oil (FAO, 2015). 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). Ishag (2000); Jordan et al. (2008) and Kaba et al. (2014) reported that peanuts have indeterminate growth types and that the plants produced many flowers during the growing period, but only 15-20% of the flowers produced mature pods. Young et al., (1982) reported that the total pod production increased continuously with the growing season, but that the harvested production decreased due to losses caused by the delay in the harvest date. Court et al. (1984) and Gulluoglu et al. (2016a) found that delayed harvesting increased yield, shelling yield and oil content. Sattayarak (1997) pointed out that harvest timings influenced yield, 1000 kernel weight, shelling yield, oil and protein content. Canavar and Kaynak (2013) reported that pod number and pod yield per plant, 1000-grain weight, shelling yield, oil and protein content increased by delaying harvest. Lu et al. (1997) reported that early harvesting resulted in the lowest pod and grain production, low oil and protein content. Wright and Porter (1991) and Kaba et al. (2014) showed that harvesting peanuts too early reduced production by 15%. Therefore, it is very important that harvesting is done at the right time to obtain a high yield and reduce production losses through seed germination in the soil. Oil content is an important quality characteristic for groundnut seeds.

The oil content of peanut seeds is influenced by genotype, growing conditions and maturity. Lu et al. (1997), Canavar and Kaynak (2013) showed that with the delay in harvesting time, the oil content of peanut varieties increased. The fatty acid content of peanut grains is influenced by genotype, sowing date, soil nutrients, air and soil temperature, growth and development conditions (Dwivedi et al., 1996; Isleib et al., 2008). Andersen and Gorbet (2002) and Gulluoglu et al. (2016a) reported that seed maturity can influence the fatty acid composition of peanuts. In general, oleic acid increases and linoleic acid decreases with seed maturity. The increase of oleic acid with seed maturity is normally accompanied by a decrease in palmitic and linoleic acids. Bovi (1982), Raheja et al. (1987) and Onemli (2012) reported that there was a negative correlation between oleic acid and linoleic acid.

Establishing the moment of harvesting for peanuts is particularly important, as it is necessary to place it so that it coincides with the achievement of the maximum number of mature pods per plant and the achievement of the minimum number of sprouted pods, knowing that in early varieties, without germination rest, the first seeds reached at maturity they sprout in the soil before harvesting (Krapovickas A., 1969, cited by Rehm S. and Espig G., 1976). The aim of this study was to investigate the effect of harvest data on some productivity and quality elements of peanuts grown on sandy soils in southern Oltenia.

MATERIALS AND METHODS

The paper presents the results of the research under the conditions of the Development Research Station for Plant Culture on the Dăbuleni Sands in the period 2019-2021, the variety used as plant material being the *Viviana* peanut variety. The research was carried out on sandy soil with low natural fertility, low in humus (0.38%) and rich in coarse sand (76%). The study was carried out in an irrigated system, with the water deficit during the period of growth and development being supplemented by irrigation. Climatic data during the growing season (2019-2021) compared to the multi-year average (1965-2021) were recorded. The experiment was located according to the method of randomized blocks, in three repetitions. The surface of the experimental variant was 6.3 m^2 (2.1 x 3.0 m).

The distance between rows was 0.7 m and the distance between plants per row was 0.18 m, giving a sowing density of 7.9 plants/m^2. Fertilization was done with 15-15-15 complex fertilizers before sowing and in vegetation at the beginning of flowering with ammonium nitrate. Weed control was done with Stomp 4 l/ha applied pre-emergence (immediately after sowing), in vegetation with 2 mechanical harrows and post-emergence herbicide with Fusilade 2 l/ha + Corum 0.25 l/ha. In order to complete the water deficit in the soil during the vegetation period, the culture was irrigated by sprinkling. Harvesting was carried out manually by pulling the bushes and then drying them in the sun, followed by a manual detachment of the pods, in four different moments with an interval of 10 days between them at: 153, 163, 173 and 183 days after sowing (DAS). At harvest, biometric determinations were made on some productivity elements (the number of pods/plant, weight of 1000 pods, peeling yield) and pod production at 9% humidity was determined.

RESULTS AND DISCUSSIONS

On the sandy soils at RDSPCS Dabuleni, during the experimental period 2019-2021, the average monthly air temperature during the vegetation period (April-October) was 12.7°C to 25.4°C in 2019, from 12.9°C to 24.9°C in 2020 and 9.7°C to 25.7°C in 2021. Recorded growing season precipitation was 289 mm in 2019, 347 mm in 2020 and 307 mm in 2021, but unevenly distributed (Table 1).

Table 1. Climatic elements registered at the Meteorological Station of RDSPCS Dabuleni during the peanut vegetation period (2019-2021)

Year/Month/ Climatic element	2019							2020							2021						
	IV	V	VI	VII	VIII	IX	X	IV	V	VI	VII	VIII	IX	X	IV	V	VI	VII	VIII	IX	X
Average air temperature, °C	12.7	17.4	23.4	23.8	25.4	20.2	19.5	12.9	17.7	22.0	24.5	24.9	21.0	13.6	9.7	17.6	21.7	25.7	24.6	18.3	10.0
Multiannual average temperature (1956-2021), °C	11.9	17.1	21.6	23.1	22.6	17.8	11.4	11.9	16.9	21.5	23.2	22.6	17.9	11.5	11.9	16.9	21.5	23.2	22.6	17.9	11.4
Rainfall, mm	53.4	55.4	87.2	54.8	12.0	10.0	16.2	11.6	59.2	55.8	73.0	51.0	40.2	56.2	30.6	55.0	53.0	16.8	9.0	9.2	133.0
Multiannual sum rainfall (1956-2021), mm	47.1	62.8	70.7	55.7	32.8	46.2	42.1	46.8	62.8	70.4	55.2	36.8	45.3	42.5	46.5	62.7	70.1	54.6	36.6	44.7	43.9

During the growing season, observations and determinations were made on the number of pods per plant, the weight of the pods per plant, and it was observed that the influence of the harvest season on the number of pods per plant and on the production of pods per plant, there are differences statistically significant. Young et al. (1982) and Canavar and Kaynak (2013) reported that the number of pods per plant increased by delaying the harvest time. The average number of pods per plant ranged from 16.9 to 22.2. It increased when the harvest was delayed from 153 DAS to 173 DAS, and then decreased when harvesting at 183 DAS. While the number of pods per plant was 16.9 pods when plants were harvested 153 DAS, it increased to 22.2 pods plants harvested 173 DAS and then the number of pods per plant was decreased to 20.3 pods when the harvest time was delayed to 183 DAS (Table 2).

Table 2. Influence of harvest season on average number of pods per plant and average pod yield per plant (2019-2021)

Harvest time	The average number of pods per plant	Pod weight per plant (g)
15 IX	16.9	39.9
25 IX	19.6	47.0
5 X	22.2	57.8
15 X	20.3	52.3
LSD 5% =	2.15	3.9

Depending on the harvest season, pod production per plant ranged from 39.9 to 57.8 g per plant. Pod production per plant increased when harvest time was delayed to 173 DAS. The highest pod production was obtained when the plants were harvested 173 DAS and after that, the pod production per plant started to decrease. As the harvest date was delayed, pod yield per plant increased from 39.9 g to 57.8 g per plant at 173 DAS and decreased to 52.3 g per plant when the harvest was achieved 183 DAS (Table 3).

Table 3. The influence of the harvest season on some productivity elements and the average production of pods per plant (2019-2021)

Harvest time	Weight of 1000 grains (g)	Shelling percentage (%)	Pod production (kg/ha)
15 IX	1,180	68.2	3,805
25 IX	1,220	69.3	4,550
5 X	1,252	70.5	4,710
15 X	1,270	71.3	4,605
LSD 5% =	231	1.84	202

Young et al. (1982) reported that total pod production increased continuously with increasing growing seasons, then decreased due to losses due to longer field sprouting. Delaying harvest after physiological maturity may result in many pods being left in the soil due to gynophores degradation. Similar results were reported by other researchers (Court et al., 1984; Knauft et al., 1986; Park and Oh., 1992; Lu et al., 1997; Rahmianna et al., 2009; Canavar and Kaynak, 2013; Kaba et al., 2014).

The mass of 1000 grains is one of the very important productivity elements for achieving production. The average values obtained were between 1,180-1,270 g. There was a difference in 1000-grain weight between harvest times averaged over the three years. By delaying the harvest time, the weight of 1000 grains increased significantly. The 1000-grain weight increased when the harvest time was delayed from 153 days after sowing to 173 days after sowing and the highest increase in 1000-grain weight (1,270 g) was found when the harvest was made at 183 days from sowing (October 15). Harvesting at physiological maturity gave better results than earlier harvesting for 1000-grain weight. Duncan et al. (1978) suggested that the length of pod filling period is correlated with 1000-grain weight. Therefore, it is very important to harvest at an appropriate time (the color of the mesocarp pod is brown or black) to obtain a weight of more than 1000 grains. Rahmianna et al. (2009) and Canavar and Kaynak (2013) reported that 1000-grain weight increased when harvest time was delayed. Differences between harvest periods were also for the percentage of peeling. The average values of the peeling percentage ranged between 68.2-71.3%. The peeling percentage increased when the harvest time was delayed, reaching the maximum level at the physiological maturity of the pods. Peeling percentages were higher at each subsequent harvest date. Overall, the shelling percentage increased from 68.2% for the first harvest date (153 days from sowing) to 71.3% for the October 15 harvest date (183 days from sowing). Knauft et al. (1986) and Canavar and Kaynak (2013) reported that the percentage of shelling increased when harvesting was delayed. Regarding the average production of pods obtained in the three years of experimentation, there was a statistically significant difference between the harvest periods. Thus, the average production of pods had values between 3,805 kg/ha and 4,710 kg/ha (Table 3). While pod production was 3,805 kg/ha when plants were harvested 153 days after sowing, it increased to 4,710 kg/ha in plants harvested 173 days after sowing, and then pod production decreased to 4,605 kg/ha when the plants were harvested 183 days after sowing.

CONCLUSIONS

The climate and soil conditions in the area of sandy soils in the south of Oltenia are favorable for peanut cultivation.

Peanut plants have an indeterminate growth type, and flowering and pod formation continue long into the growing season until close to harvest.

Establishing the moment of harvesting for peanuts is particularly important, as it is necessary to place it so that it coincides with the achievement of the maximum number of mature pods per plant and the achievement of the minimum number of sprouted pods, knowing that in early varieties, without germination rest, the first seeds reached at maturity they sprout in the soil before harvesting.

The number of pods per plant, 1000-grain weight, pod yield/ha, shelling yield increased when the harvest period was delayed. The maximum production of mature pods was obtained when it was harvested 173 days after sowing (October 5), after this date the production decreases due to the increase in the percentage of sprouted pods.

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