INTRODUCTION AND TECHNOLOGY OF THE GROWING PEANUTS AS THE MAIN NICHE CROP

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Abstract. Balanced nutrition in terms of necessary nutrients is one of the most urgent problems of humanity in the third millennium. Today, there is an acute shortage of complete proteins, polyunsaturated fatty acids, vitamins, minerals, dietary fibers and other nutrients all over the world. *The purpose* of the work is to analyze the literature on the content of vitamins, minerals, and polyphenols in peanuts grown in Ukraine, indicating the insufficient completeness of such studies, which does not allow the safe use of domestic peanuts in healthy food products and requires the search for ways of decontamination. As well as determining the optimal sowing dates, which affect the formation of the yield level. *Methodology of the study* sowing time is one of the agrotechnical methods that have a significant impact on the formation of peanut yield. In the domestic and foreign literature, there is no consensus on the sowing dates, when it is advisable to start sowing. *Results*. The largest mass of 1000 kernels was noting under the condition of early sowing of seeds on May 10. In the case of sowing on May 20 and June 1, a decrease in the mass of 1,000 kernels was observing on average by 22 g and 24 g, respectively, due to an increase in immature kernels. The yield of mature, conditioned grains ranged from 62.0% to 93.2%. At the same time, the highest content was also in the case of sowing on May 10, and the lowest – on June 1. *Practical implications.* Therefore, sowing on May 10 and 20 provided optimal conditions for the appearance of friendly seedlings and the growth and development of plants of the researched peanut variety, which contributed to an increase in yield. Peanuts, sown on June 1, required more time for sprouting, due to the lack of moisture in the soil, and the development of plants was slower than if

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they were sown on May 10 and 20. The crops of the first season entered the flowering phase earlier, which enabled more fruits to reach maturity before frost. *Value*. The technology is practically proving for this crop. After receiving all the seedlings (10-15 days after sowing), the rows were loosened to a depth of 6-7 cm to give air to the soil. 15 days after the first loosening, the second loosening was caring out to a depth of 10-15 cm. 15 days after the second loosening (30 days after germination); the first loosening was carried out. The purpose of tilling is to raise the soil as close as possible to the flowers so that they can take root. 14 days after the first brushing – the second brushing. 14 days after the second brushing – the third brushing. The need for water arises from the moment of flowering, so watering should be done from flowering and end a month before harvesting. Watering: Before each turning, 3-5 days (so that the soil has time to dry) – watering; after turning, you can also water if there is a need for this. Next, water as needed approximately once every 10 days.

1. Introduction

Nowadays, cultivation of a rare crop – cultivated peanut (Arachis hypogaea L.) – is gaining popularity in Ukraine. The expansion of the peanut growing area requires constant improvement of varietal agricultural technology, which will ensure high yields, improve the quality of oil and processing of plant raw materials, as well as health safety. Sowing time is one of the agrotechnical methods that have a significant impact on the formation of peanut yield. In the domestic and foreign literature, there is no consensus on the sowing dates, when it is advisable to start sowing.

The aim of the study was to develop and improve the elements of cultivation technology, in particular the terms of peanut sowing, which would ensure an increase in yield and quality.

Field research was conducting during 2020–2021. The object of research was studying according to the scheme of a one-factor experiment:

The Tsvetelina variety was studied, sowing dates: May 10, May 20, June 1. Quality was also evaluated based on the weight of 1000 kernels (g), and the yield of mature, condensed kernels (%) depending on the timing of peanut sowing.

Objectives of the study. To determine the productivity and quality indicators of the Tsvetelina variety peanut grain depending on the sowing time.

Accounting was caring out in all phenological phases of growth and development of peanuts, the height of plants at the beginning of seedlings, during the first and second wave of flowering was determined. And the accounting of yield began to be carried out at the time of yellowing and falling of leaves, darkening of the veins on the inside of the beans, followed by drying and weighing of biomass and seeds.

Harvesting was caring out as follows: first, they were dugong up with a special digger, then they were dried in the field in rolls for 7-10 days, then harvesting was carried out with a special combine for peanuts. They carried out weighing and recalculation for 1 ha and 10% humidity. The quality of the kernels was also evaluated based on the weight of 1000 kernels (g) and the yield of mature, condensed kernels (%).

The obtained data were subjecting to statistical processing using the "Statistical 6.0" program according to the methodology of B. A. Dospekhova [20].

2. Chemical composition of different varieties of peanuts

A promising raw material for expanding the range of such products is peanuts. The most important in terms of nutritional value in peanuts is the oil, which is dominated by unsaturated acids, which makes this nut an important product in the fight against atherosclerosis and other cardiovascular diseases, and also helps reduce the level of excess cholesterol in the blood. Peanut proteins are characterizing by a high content of essential amino acids, which brings them closer to animal proteins. Peanuts are a source of vitamins and minerals that have a positive effect on the activity of the nervous system, heart, liver and other organs, and accelerate cell growth. The fibrous structure of peanuts makes it useful in the prevention and prevention of some forms of cancer.

In addition, peanuts are a source of vitamins, minerals, polyphenols, phytosterols, resveratrol and other BARs, which makes it an indispensable product for a complete and healthy diet. Today, there is practically no information on the chemical composition and BAR content of peanut varieties adapted to growing in Ukraine.

The analysis of the literature regarding their content in peanuts grown in Ukraine indicates the insufficient completeness of such studies, which does not allow the safe use of domestic peanuts in healthy food products and requires the search for ways of decontamination.

South America is considering the homeland of peanuts. This is confirming by a vase found in Peru, which belongs to the period when Columbus did not yet discover America. This vase, shaped like a peanut and decorated with an ornament in the form of these nuts, shows that peanuts were valued already in those ancient times. The Spanish conquerors, having met peanuts in South America, decided that such a product would be very useful to them during sea voyages. They brought peanuts to Europe, where Europeans began to use them in their own way, even instead of coffee.

Later, the Portuguese brought peanuts to Africa. There they quickly appreciated its nutritional properties and the fact that it can grow on soils too poor for other crops. Growing peanuts contributed to the enrichment of poor soils with nitrogen. Then they have to know peanuts in North America, where they came from Africa during the slave trade. In the 1530s, the Portuguese brought peanuts to India and Macau, and the Spanish brought them to the Philippines. Then traders from these countries introduced peanuts to the Chinese. The Chinese saw peanuts as a culture that could help the country fight hunger.

In the 18th century, botanists studied peanuts, calling them ground peas, and concluded that they were excellent fodder for pigs. At the beginning of the 19th century, commercial cultivation of peanuts began in South Carolina. During the American Civil War, which began in 1861, peanuts served as food for soldiers on both sides. Nevertheless, at that time, many people considered peanuts to be food for the poor. This fact partly explains why American farmers did not grow peanuts as a food crop at the time. In addition, until the invention of special equipment around 1900, growing peanuts was very labor intensive.

In 1903, the American Agrochemist Dzhordzh Uoshinhton Karver began to look for ways to use the peanut plant. Over time, he invented more than 300 products and goods from peanuts, including beverages, cosmetics, dyes, medicines, laundry soap, insect repellent, and printing ink. Carver also convinced farmers to alternate growing soil-depleting cotton with peanuts.

At the time, the cotton weevil was causing frequent cotton crop losses, so many farmers decided to follow Karver advice. As a result, peanut cultivation was so successful that it became a major cash crop in the southern states of the United States. Today, there is a monument to Karver in Dothan (Alabama), and in the city of Enterprise (Alabama); there is

even a monument to the cotton weevil, because farmers switched to peanut cultivation due to the invasion of this particular insect. Tasty and nutritious seeds are eating fried, used to prepare peanut paste, halva, chocolate, cakes and other confectionery products.

Peanut oil is nutritionally superior to many vegetable oils. It is using to prepare various foods; in the canning industry, it replaces olive oil. The homeostatic effect of peanuts was founding in patients suffering from hemophilia. In 1957, the French scientist Professor Budro, who himself suffered from hemophilia, accidentally discovered the beneficial effect of underground peanuts on his body. Then, during self-observation and observation of other patients, he established that when eating peanuts in raw or slightly roasted form, or oil from them for two days, hemophiliac bleeding stopped.

Professor Budro noted that the weakening of clinical symptoms of hemophilia under the influence of peanuts did not depend on the time of blood coagulation and, despite this; patients with this disease were curing without any other treatment. Peanuts are also recommending for children suffering from exudative diathesis. I. Z. Akopov recommends that patients with hemophilia take underground peanuts in the form of raw or lightly fried fruits (50-150 g) 3 times a day half an hour before meals or take 1 tablespoon 3 times a day before meals of peanut butter inside, but without cancellation of pharmacotherapeutic agents prescribed by the supervising physician.

In the pharmaceutical industry, oil is using to prepare various medicines, and peanut seeds can be using to replace sweet almonds to prepare an emulsion. There are reports that peanuts have been effective in the treatment of children suffering from hemorrhagic diathesis (a blood disease in which multiple hemorrhages and a sharp decrease in blood circulation are observing). Seeds begin to germinate at a temperature of 12°C. The stairs are sensitive to frost. At a temperature of -1°C, they die. The optimal temperature for the growth and development of plants is 25-28°C. Fruits are forming in autumn only at a temperature above 12°C.

Groundnut absorbs the most moisture in the phase of flowering and fruiting. On insufficiently moist soil, the ovaries develop poorly and the bean harvest is small. Peanuts are light loving and demanding on nutrients. The best soils for groundnut are chernozem with a light mechanical composition. Structure less, saline and waterlogged soils are unsuitable.

Peanut is an annual low herbaceous plant of the legume family, has bushy and slender forms. It differs sharply from other species of the legume family (soybean, bean or pea) in the arrangement of the flower and the peculiarity of the formation of the fruit. A biological feature of the cultivated peanut, or groundnut, is that after pollination, its ovary grows and turns into a fruit-bearing shoot a gynophore, which first grows upwards, and then changes its direction to the soil. Having reached it and delved into the moist layer, the gynophore forms a fruit that develops in the soil [1]. Peanut fruits are beans of different shapes and sizes.

In industrial production, four main varieties of peanuts are cultivated: Spanish, Runner, Virginia and Valencia. They may be calling differently in different peanut-producing countries [5]. The chemical composition of the different varieties of groundnut grown in Ghana has significant differences. Virginia subspecies Hypogaea peanuts are characterized by high fat content (49.7%) and low protein content (22.78%) compared to Spanish and Valencia subspecies peanuts (Fastigiata subspecies), which contain 47.3% fat and 25.69% protein.

The Spanish-type Bronifufuo peanut variety was noting for its high protein content (30.53%) and the lowest fat content (33.60%) [17]. The other four varieties of peanuts, namely: Sinkarzie, F-mix, JL 24 and Manipintar, were characterized by a range of variability of protein from 23.62 to 28.88%, fat – from 38.11 to 48.79%, carbohydrates – from 11, 54 to 19.65% [18].

Scientists Musa Özcan and Serap Seven studied peanut varieties from Turkey ÇOM and NC-7. It was established that the content of protein and fat of the ÇOM variety was higher compared to NC-7, namely: fat – 44.09 and 31.52%, protein – 36.93 and 35.97%, respectively. The fatty acid composition of the fat was also studied, in which the following fatty acids were identified and quantified: myristic (0.13–0.33%), palmitic (8.70–13.03%), palmitoleic (0.23–0.47%), stearic (3.77–4.53%), oleic (43.13–55.10%), linoleic (25.13–35.20%), linolenic (0.20–0.30%), arachidonic acid (1.53–1.90%), gadoleinic acid (0.40–1.37%) and behenic acid (2.40–3.47%).

The content of mineral elements was also studding in these varieties. It has been proving that the kernels of peanut beans of the ÇOM and NC-7 varieties are rich in such minerals as Na, K, Ca, P, Fe, Zn, Cu, Mg, Mn, Al, and B. The

content of minerals (with the exception of Cu, Al, Pb, Cr, and B) in the kernels of the NC-7 variety was higher comparing to ÇOM [19].

Argentine scientist N.R. Grosso and co-authors were engaged in comprehensive research on the chemical composition of peanut varieties cultivated in South America. Varieties of Nypogaea L. and Tiirsuta Kohler (Uruguay), Correntina, Durannensis, Monticola, Batizocoi and Cardenasii and 46 other varieties (Bolivia, Argentina), Hypogaea, Fastigiata, Peruviana, Aequatoriana (Peru), Hypogaea, Hirsuta, Fastigiata, Peruviana (Ecuador). The ranges of the content of the main substances are establishing moisture – 5.5–5.7%; protein – 25.9–31.3%; fat – 44.0–54.7%; carbohydrates – 8.6–35.5%; ash – 2.4–2.7%. The highest fat content was founding in peanuts of the Batizocoi variety, protein – in the Monticola and Durannensis varieties. Peanuts of the Hypogaea variety are the poorest in terms of protein. The fatty acid composition of peanut fat from Uruguay of varieties 1Uv, 2Uv, 5Uv, 6Uv, 7Uv, 8Uv, 9Uv was also studding.

Thus, grade 7Uv is characterizing by a higher content of oleic acid (42.53%), and grades 2Uv and 5Uv had a higher percentage of linoleic acid (43.67 and 43.40%, respectively). The 2Uv sample contained the least palmitic acid – 9.33%, and the most of it was found in the 1Uv sample (10.43%). The content of other acids was as follows: palmitic – (9.33–10.43%), behenic – (2.23–3.40%), stearic – (2.33–2.60%), arachidonic – (1, 0–1.17%) [10; 20–23].

Scientists from Nigeria [24] studied the chemical composition of raw, dried and roasted peanuts. The results of their research proved that the moisture content of raw peanuts was 7.4%, dried – 3.4%, fried – 1.07%. The ash content of the studied samples was 1.48, 1.38 and 1.41%, respectively. The amount of protein in raw peanuts is greater than in dried and roasted ones, namely 24.7, 21.8 and 18.4%, respectively. The same trend is observing with the fat content: 46.1, 43.8 and 40.6%, respectively.

On the other hand, heat treatment has the opposite effect on carbohydrate content: raw peanuts contain fewer carbohydrates than after heat treatment (17.41, 27.19 and 36.11%). The fiber content does not differ significantly and is 2.83, 2.43 and 2.41%, respectively. Studies of peanut fat of other varieties from Nigeria (Boro Red, Boro Light, Mokwa, Ela, Campala and Guta) have shown a rather high concentration of oleic and linoleic acids in it. The highest content of lauric (8.1%), palmitic (4.85%), oleic

(41.67%), linoleic (19.58%), arachidonic (1.18%) and behenic (1.14%) acids characterize the Mokwa variety [25].

The scientist M.A.Y. was engaged in the study of peanuts grown in Sudan. Abdualrahman [26]. The moisture content of bean kernels was determined to be − 5.90±0.01 percentage, protein − 28.97±0.03 percentage, ash −3.64±0.01percentage, fat − 47.94±0.01%, raw fiber – 3.17±0.02%, carbohydrates – 10.38±0.01%. Protein digestibility was 92.65±0.02%. The main amino acids of peanuts grown in Sudan are glutamic and aspartic acids (19.68 and 10.07 g/100 g of protein, respectively), and the amino acid composition of protein in terms of the content of such essential amino acids as phenylalanine, leucine, isoleucine and valine exceeds the composition of the ideal protein FAO/WHO. Among minerals, the content of sodium (2.1 mg/100 g), calcium (59 mg/100 g), phosphorus (254.5 mg/100 g), iron (2.3 mg/100 g) and zinc (3.7 mg/100 g).

A group of authors [27–29] investigated new varieties of peanuts zoned in Mexico (Col-24-Gro, Col-61-Gto, VA-81-B, Ranferi Díaz, NC-2 and Florunner) and found that peanuts contain 50–55% fat, in which the total amount of saturated and unsaturated fatty acids averages 17 and 79%, respectively, the latter containing approximately 30% linoleic and 45% oleic acid. Of particular interest is the O/L ratio (the ratio of oleic to linoleic acids), which is currently used as an index of stability affecting the shelf life of peanut products.

3. The content of fatty acids in peanut oil

The higher this index, the more stable the fat. Studies have proven that the O/L ratio depends on the following factors: the type of soil and its nutrient content, the amount of precipitation, air temperature, and the growing season. The amino acid composition of these varieties mostly contained glutamic acid (177 mg/g protein), aspartic acid (114 mg/g protein) and arginine (125 mg/g protein). High levels of lysine (43.5 mg/g protein) and threonine (21 mg/g of protein) was founding in peanut variety VA-81-B. With the help of gas-liquid chromatography, scientists from the USA determined the content of fatty acids in the oil of peanuts of the NC2 variety, grown on different soils in North Carolina, the eastern part of the Caribbean basin, and Jamaica. It has been proving that an important factor affecting the content of linoleic and stearic acids in peanut oil is the

type of soil. Peanut butter from St. Vincent is higher in linoleic acid than peanut butter grown in North Carolina and Jamaica. Peanuts cultivated in St. Vincent on volcanic loams contain a higher proportion of saturated fatty acids, particularly stearic acid, and less unsaturated fatty acids, particularly linoleic acid, than samples from volcanic sands. In contrast, the amount of oleic acid, regardless of the type of soil and year of cultivation, was 57.4±0.77 percentage [30].

During the study of peanut varieties Florunner, Sunrunner, GK-7, Southern Runner, Sunbelt Runner, Okrun and Langley (USA), significant varietal differences in their fatty acid composition were founding. Thus, the content of oleic acid in all samples ranged from 49.2 to 56.3%, linoleic acid – from 24.1 to 30.6%, stearic acid – from 1.4 to 1.9% [31].

Recently, there has been an increase in the selection of high-oleic peanuts, in the composition of which the content of oleic and linoleic acids is about 80 and 2%, respectively, compared to the usual (52 and 27%) [32].

High-oleic peanuts have a high spectrum of nutrients and improved sensory and processing properties (especially increased shelf life). This is due to the O/L index, which is about 10 times higher than that of conventional varieties. From the point of view of biological value, high-oleic peanuts can be even less allergenic than regular ones. It also knows that regular consumption of high-oleic peanuts can improve lipid profile and markers of glycemic control [33] and help fight obesity [34].

The results of research on eight peanut varieties (KKU72-1, KKU40, KKU1, Tainan9, Khonkaen5, Khonkaen6, Khonkaen60-1 and Khonkaen60-3) from Thailand showed that the fatty acid composition of fat of the KK60-3 variety contained the largest amount of oleic acid (60.3%), the content of linoleic, palmitic, stearic, behenic, linolenic, and arachidonic was lower. A high O/L ratio was found in varieties KK6 (3.83%) and KK60-3 (3.66%) [35].

In Florida, research was conducted on six high oleic (79-82% oleic acid) and 10 regular varieties of peanuts for the content of fatty acids and amino acids. As research has shown, the mass share of glutamic and aspartic acids in the protein of peanuts of these varieties is 36–40% of the total content of amino acids, sulfur-containing (cysteine and methionine) amino acids, as well as threonine and lysine are present in smaller quantities [36].

The authors [37] investigated the amino acid composition of peanut variety JL-24, adapted for cultivation in India, and found that its protein has the highest content of proline (6.412 g/100 g of protein), aspartic acid (3.459 g/100 g of protein), and arginine (2.795 g/100 g of protein). The amount of glutamic acid, glycine, alanine, valine, isoleucine, leucine, and phenylalanine ranged from 1.792 to 1.001 g/100 g of protein, and the amount of threonine, cystine, tyrosine, histidine, lysine, and tryptophan was insignificant. Serine was not detecting.

4. Vitamins

Scientists [38] studied the chemical composition, in particular the content of amino acids, in the protein of peanuts of Suwon 88, Daewon, Daekwang, Seonan, Saedeul, Satonoka and Pungan varieties grown in Korea. Protein and oil content varied in the range of 21.4–32.0% and 41.7–47.2%, respectively. Vitamins are important nutrients necessary for life. These are natural organic compounds that the body regularly needs in small doses to maintain normal vital activity. There are 13 vitamins necessary for normal growth, development and functioning of the body. Literary data and the results of scientific research indicate that peanuts and peanut butter contain almost half of the 13 necessary vitamins. Peanut seeds contain a significant amount of vitamin B_1, vitamin E and small amounts of vitamins PP and C.

5. Natural and climatic characteristics of the farm

Climate. The territory of the farm is located in the first (northern) agro-climatic district of the Kherson region, the climate of which is very warm and arid. According to long-term data, the average annual air temperature is +9.9ºC. The coldest month is January with an average monthly air temperature of -3.9ºC; the warmest is June with an average monthly air temperature of +22.8ºC.

Average annual temperatures, precipitation and air humidity over the past two years. The average duration of the frost-free period is 175-180 days, and the growing season – 215-225 days. The sum of positive temperatures and temperatures above 10ºC is 3200-3300ºC; the amount of precipitation during this period is 215-220 mm. The average annual amount of precipitation is 388 mm; the average monthly amount is 32 mm. The

largest amount of precipitation falls on average in June-July – 46-53 mm and the least in February – 21 mm.

In the summer, precipitation falls mainly in the form of showers in this area. The reserves of productive moisture in 50 cm of the soil layer for August, September, October, November are 99 mm on average, and in March, April, May, June – increase to 108 mm. Agronomic maturity of the soil occurs in the first – second decade of March in the absence of atmospheric precipitation and in the third decade of March – the first decade of April in the presence of precipitation.

The hydrothermal coefficient is 0.7. By the end of the third decade of March, the average daily air temperature crosses 5ºC. This coincides with the average sowing dates of spring crops, as well as with the beginning of the growing season of woody plants and winter crops. The last spring frosts end in the third decade of April, the first autumn frosts come in mid-October. The prevailing winds in the region are strong winds from the east and northeast. Strong, long-lasting winds are observing in the spring-summer period. They cause great damage to agriculture. Winters have little snow with very frequent thaws and rains. In winter, there are about 25-40 days with a snow cover of 2-3 cm high.

In winter, soils freeze on average by 1 cm in December 14 cm in January, and 22 cm in February, and then quickly melt. Nowadays, cultivation of a rare crop – cultivated peanut (Arachis hypogaea L.) – is gaining popularity in Ukraine. The expansion of the peanut growing area requires constant improvement of varietal agricultural technology, which will ensure high yields, improve the quality of oil and processing of plant raw materials, as well as health safety. Sowing time is one of the agrotechnical methods that have a significant impact on the formation of peanut yield. In the domestic and foreign literature, there is no consensus on the sowing dates, when it is advisable to start sowing.

The aim of the study was to develop and improve the elements of cultivation technology, in particular the terms of peanut sowing, which would ensure an increase in yield and quality.

Hot, sunny weather is favorable for peanuts, while the sum of active temperatures should be 2600–3500°C. Peanut plants need heat the most during flowering and fruiting. If during this period the temperature is below 12°C, then the fruits suspend their development. The optimal temperature is at the level of 23–25°C [7–9].

Sowing time is one of the agrotechnical methods that have a significant impact on the formation of peanut yield. In the domestic and foreign literature, there is no consensus on the sowing dates, when it is advisable to start sowing. Some authors prefer later sowing dates, which occur when the soil temperature is 12–14ºC at the depth of seed wrapping. Other scientists have concluded that the advantages of early sowing dates compared to late ones lie in the possibility of more productive use of soil moisture by plants. At the same time, ripening takes place under favorable conditions [10].

Choosing the time of sowing is always a difficult issue. The agronomist always hesitates: to sow the seeds in moist, but not warm enough soil and hope for a rise in temperature to get seedlings, or in warm, but over dried soil, and rely on the fact that the rains will pass and all the seeds will germinate. In recent years, the weather conditions in Ukraine have been such that there is no gradual transition from winter to spring. Now summer is coming immediately after winter.

There is a sharp accumulation of the sum of active temperatures and the soil dries up quickly. A delay in sowing for a few days can have a very significant effect on the reduction of yield. Sowing peanut seeds in warmed, but over dried soil entails the risk of uneven seedlings. This is especially noticeable in the fields, where the main and pre-sowing tillage of the soil has been performing poorly. Under such conditions, the probability of getting uneven stairs is very high. In addition, those plants that will emerge later will never be able to reveal their genetic potential. They will lag behind in development, be affecting by diseases [11–13].

6. Peanut – crop care

After receiving all the seedlings (10-15 days after sowing), the rows were loosened to a depth of 6-7 cm to give air to the soil. 15 days after the first loosening, the second loosening was carried out to a depth of 10-15 cm. 15 days after the second loosening (30 days after germination), the first loosening was carried out. The purpose of tilling is to raise the soil as close as possible to the flowers so that they can take root. 14 days after the first brushing – the second brushing. 14 days after the second brushing – the third brushing. The need for water arises from the moment of flowering, so watering should be done from flowering and end a month before harvesting.

Watering:

– Before each turning, 3-5 days (so that the soil has time to dry) – watering;

– After turning, you can also water if there is a need for this. Next, water as needed approximately once every 10 days.

7. Field germination of peanuts

Some scientists believe that the most friendly and complete seedlings can be obtained under the condition of good moistening of the upper layers of the soil and better warming of the air and soil at the depth of seed wrapping. In conditions of insufficient moisture, the growth, development, and productivity of peanuts are particularly negatively affecting by moisture deficiency. When atmospheric and soil droughts occur simultaneously, the damage caused by them is particularly significant. In Ukraine, such phenomena are observing every 2-3 years. Therefore, when sowing is delayed, peanut seeds often fall into an insufficiently moist soil layer slowly absorb moisture, and as a result, the field germination of seeds is significantly reduced [14–17].

Early sowing times create a danger of damage to plants by late spring frosts. The stairs are damaging by frosts of minus 0.5–1°C. It knows that peanuts need a lot of heat. Its seeds begin to germinate at a temperature of 14–15°C. Seedlings die at minus 1°C, an adult plant at minus 2°C. Autumn frosts (-3°C) cause the death of plants, and the seeds of only dug up and not dried beans lose their germination, and at -4°C they become unusable for processing [18–19].

Thanks to the recent changes in the climate, it is possible to have stable warm weather favorable for sowing already in the last days of April. Then – a rapid spring, and already on May 5-10, hot summer conditions are observing and the temperature rises rapidly to 25°C. In addition to the high temperature of the atmospheric air during this period, the "active" negative work of southeast winds that dry the soil is added, and as a result, the amount of moisture in the upper layers decreases rapidly.

Therefore, the timing of sowing cannot be delaying. Usually, the cool weather conditions actually last until May 1. It is necessary to sow peanuts in warm, warm soil after April 20. Some authors claim that such early dates are dangerous for peanut crops due to possible frosts. Nevertheless, I can

only ironically add that peanut seeds, sown to a depth of 5 cm and which have not even "thought" to emerge, will not be harmed by such frosts.

The guarantee of the future harvest of peanuts is high field germination, the level of which depends on the conditions of growth and development of plants and the implementation of technological operations. Under the conditions of the conducted research, the field germination of peanut seeds varied from 72 to 90%, depending on the timing of sowing, the characteristics of the variety and the weather conditions of the year.

A significant influence of sowing dates on the formation of field germination of peanut seeds was observing under unfavorable conditions in 2020, when the weather was cool during the period of germination. Thus, under the conditions of the first sowing period, slightly lower indicators of field germination were noted, which amounted to 80% for the Tsvetelina variety, 81% for the second, and 72% for the third. Under the conditions of sowing on May 10 and 20, there was no significant difference in varieties.

When sowing peanut seeds in 2021, field germination was higher in all variants of the experiment compared to 2020. In particular, the highest rate was recording on May 10 and was 89%.According to average data; it is worth noting that the most favorable period for the formation of field germination is May 10 for the studied variety.

8. Climbing period

The duration of the germination period depends on the timing of sowing. For sowing on a large area, it is advisable to use planters for row crops, but discs need to choose with holes corresponding to the size of the seeds (5 mm). The sowing rate is 70–100 kg/ha. Peanut seeds must be "fresh", because after two or three years of storage, they lose their germination.

Almost all "theoreticians" of peanut production recommend sowing with a row spacing of 60–70 cm, the distance between the bushes should be 15–20 cm, and the seed sowing depth should be 6–8 cm. as a rule, 3–4 times) of rows with crops was enough soil y between rows. Moreover, this is a mandatory condition for obtaining a good harvest of ground beans.

However, here, objectively and critically, it can be noted that the width of the rows can be taken similarly to the scheme of planting ordinary potatoes – 45 cm. Nevertheless, the seeds should be placing in a row according to the scheme of 3-4 seeds in one place with a distance of 15 cm between them.

Why exactly? As the experience of growing peanuts in previous years has shown, even with the use of high-quality seed material and all possible methodical and practical approaches to seed preparation, seed germination remains mediocre. That is, in each future bush, only one or two plants can grow from four seeds. That is, it will no longer be a plantation with a planned good harvest, but only an area conditionally occupied by peanuts. Moreover, we cannot wait for a good harvest here...

The period from sowing to the appearance of seedlings will not be superfluous to keep the soil loose and moist, which can be obtaining by working with light harrows (thereby closing the moisture in the soil). Such harrowing will be appropriate even after the rains, because if you do not do it, the soil will quickly become covering with a crust.

The duration of the sowing-seedling interphase period varied widely – from the 10th to the 16th day, depending on germination conditions and sowing dates. The protracted cool spring did not significantly affect the duration of the interphase sowing-seedling period in 2020, during the first term, which was 16 days. When sowing on May 20 and June 1, there was a reduction of the sowing-seedling period by 3–5 days. Under the conditions of 2021, the emergence of seedlings was noting for 8–14 days. At the same time, the longest interphase sowing-seedling period was in the variant under the condition of sowing on May 10 (12–16 days), and the shortest – in the case of sowing on June 1 (8–10 days). According to the average data, it was establishing that in the case of sowing on May 10, the duration of the interphase period between sowing and seedling was the longest (15 days), and when sowing on May 20 and June 1, no significant difference was observing (11 days). We can conclude that with the shift of sowing dates to later ones, the duration of the sowing-seedling period is shortening.

The beginning of the peanut growing season falls on the first-third decade of May and lasts until the third decade of October, when the formation of flowers and gynophores stops [17]. Since peanuts are sensitive to root rot, the seeds are treat the perianth immediately before sowing. Only after these mandatory procedures, seeds can be sowing by acceptable technical means. Preferably – like a "lace", that is, the straightness of the lines should be impeccable. This will help in further flipping the lines.

The period from sowing to the appearance of seedlings will not be superfluous to keep the soil loose and moist, which can be obtain the perianth by

working with light harrows (thereby closing the moisture in the soil). Such harrowing will be appropriate even after the rains, because if you do not do it, the soil will quickly become cover the perianth with a crust. The height of the plants of the researched peanut variety Tsvetelina, depending on the time of sowing, was different in different phenological phases of growth and development.

Figure 1. Peanut field

At the time of peanut germination, that is, on the 15th day of vegetation, the height of the plants was 4-5 cm, while in the first wave of flowering (21st day) it was higher and amounted to 14-15 cm. During the II wave of flowering of peanut plants, the height they were 28-29 cm, and at full ripeness – 29-30 cm. That is, we can conclude that the time of sowing did not have a significant effect on the formation of height, but depended on varietal characteristics.

9. Caring for peanut crops (Arachis hypogaea)

Until flowering, peanuts are car the perianth for like soybeans. It is necessary to monitor the purity of crops from weeds and, if necessary, use herbicides approved for use on soybeans.

Up to 600 or more flowers are form the perianth on one plant during the growing season, but each flower lives only 1-2 days. In the upper part of the plant, the flowers are barren, those that form fruits are lower, and they are the first to form on the stem.

After fertilization, the perianth and stamens fall off, and the peduncles tend to elongate (they are called gynophores) towards the ground, where they penetrate deep, and fruits are formed already in the soil. The seeds ripen at a depth of 8–10 cm, where they are well protecting from the effects of dry, hot air. One plant can grow from 30 to 60 beans, in each of which up to four elongated oval bright pink seeds are forming.

10 days after the beginning of flowering, we begin to turn the plants. Competent sources recommend that the first weeding be performing at a

height of 5–7 cm. The bushes continue to bloom, and after 10–12 days, a second weeding is done, and then the third. You need at least three of them.

Moreover, this is donning in order to increase productivity. If the peanuts are not turning over, there will also be a harvest, but very little, because only the flowers in the lower part of the plant will be able to reach the soil and sink into it, and the rest will not. It is better to carry out each turning after rain or watering, or in the morning. The main thing is not to rush to pour a lot of soil around the plant in one go.

Watering is caring out once every 10–15 days only with water heated in the sun. Peanuts are watering in various ways, but, of course, drip or furrow irrigation is better. In addition, what, after three or four swipes (beginning of August) does the care end? Shall we wait for a good harvest? The answer is unequivocal: no, we do not finish caring for peanut crops. We take care of it further, only in a slightly different way.

Since peanuts continue to bloom in August and September, let us help him lay an additional crop. We use a simple technological method: after three or four turns of peanuts on one side of the turned-up seed row, at the level of the root system, we make an ordinary vertical digging of the soil (this is why a string must do sowing).

It is advisable to do this operation after rain, when there is enough moisture in the soil. Then we tilt the peanut bushes into this newly formed depression and cover it with soil from the side of the other "whole" upturned row. These two technological operations, taking into account our desire to obtain the most positive result, must be performing simultaneously and promptly. Then both the earth and the fragile roots of the peanut will not dry out and we will not cause damage to the crops.

After such an extreme procedure, peanuts successfully continue their life (after August 5, there is still a lot of time and conditions for vegetation and bean formation). Such a simple agricultural method will help to harvest a larger harvest.

10. The yield of peanuts depends on the timing of sowing

At temperatures below 20°C, usually the third decade of September, ripening and formation of full-fledged beans stops. After September cooling down to 12-13°C, seeds in beans are no longer forming. The seed, which did not have time to finally forming in the bean, has no similarity. At this time,

the leaves of the plant turn yellow, and the seeds are easily removing from the beans – it is time to harvest. In addition, here it is important not to prolong the time of digging up peanuts, because at this autumn time, as a rule, protracted rains begin. Moisture penetrates the beans in the soil and the seeds get every chance to germinate in the beans. We can lose the crop without even digging it. Moreover, of course, such seeds lose their germination and become bitter, becoming unfit for food.

Figure 2. Flipping a peanut

Harvesting is caring out in two stages: first, the peanut plants are digging up, and then they are stacked in rolls and allowed to dry.

From the point of view of production, the main indicator that characterizes the effectiveness of the implementation of an agricultural measure in the technology of growing agricultural crops is their yield, which characterizes the amount of production.

The level of productivity varied from 1.17 t/ha to 1.69 t/ha depending on the timing of seed sowing and the conditions of the research year. It is worth noting that under such conditions, the highest average yield was observed in the studied variety Tsvetelina (1.59 t/ha) under the condition of sowing on May 10, when sowing on May 20, the yield ranged from 1.42 to 1.57 t/ha. During the third term, it varied from 1.17-1.34 t/ha.

Under the conditions of 2021, the yield of peanuts varied from 1.34 to 1.69 t/ha. At the same time, the highest yield was noting when sowing on May 10 in the studied variety. The quality of kernels of peanut varieties depending on the timing of sowing. Peanut varieties best reveal their potential under optimal environmental conditions, which depend on specific soil and climatic conditions of the year and varietal specificity and cultivation technology [19].

11. Conclusions

The ultimate goal of growing peanuts is to obtain a high yield of quality kernels. After harvesting and shelling, quality indicators of peanuts were

determined, in particular, the weight of 1000 kernels and the content of mature condensed kernels.

The mass of 1,000 nuclei is an indicator characterizing their size. Under the conditions of our research, it varied from 724 to 756 g. A decrease in the mass of 1000 kernels is observing depending on the later sowing dates, which causes ripening to take place under unfavorable conditions and the peanut kernels not ripening. The largest mass of 1000 kernels was noting under the condition of early sowing of seeds on May 10. In the case of sowing on May 20 and June 1, a decrease in the mass of 1,000 kernels was observing on average by 22 g and 24 g, respectively, due to an increase in immature kernels.

The yield of mature, conditioned grains ranged from 62.0% to 93.2%. At the same time, the highest content was also in the case of sowing on May 10, and the lowest – on June 1. Therefore, sowing on May 10 and 20 provided optimal conditions for the appearance of friendly seedlings and the growth and development of plants of the researched peanut variety, which contributed to an increase in yield. Peanuts, sown on June 1, required more time for sprouting, due to the lack of moisture in the soil, and the development of plants was slower than if they were sown on May 10 and 20. The crops of the first season entered the flowering phase earlier, which enabled more fruits to reach maturity before frost.

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