PEANUT PRODUCTION MANUAL

SEED HOUSE - SADOVO LTD.

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ENVIRONMENTAL REQUIREMENTS

Peanuts are a heat-loving crop that grows and develops during the warmest months of the year. Low temperatures at the beginning of the growing season limit yields to a greater extent than high temperatures. The minimum soil temperature required for germination is 15°C in the top 15 cm of soil. At this temperature, seeds germinate in 12-14 days. The crop continues to flower until mid-August, when temperatures are at their peak. The vegetation period of the different varieties created at the Sadovo Seed House ranges from 135 days (Lotos) to 110-115 days (Kanna and Granat).

WATER REQUIREMENTS

Peanuts, as a tropical crop, require a lot of water. In the early stages of development, the plants do not need large amounts of water and in most cases successfully use the moisture available in the soil. During the period of intensive growth, mass flowering, and fruit formation, their water requirements increase, and irrigation during this period has a favorable effect on crop development. During seed ripening, the need for water decreases.

Peanuts fully satisfy their water requirements during their vegetation when the amount reaches 600-700 l/m2. Water shortage has a negative effect on yields and seed quality.

SOIL REQUIREMENTS

Despite their short vegetation cycle, peanuts require large amounts of nutrients. For this reason, the crop thrives in rich soils with high humus content and higher moisture retention capacity. In poor soils, it is necessary to increase the fertilization rate. Peanuts require light, warm soils that are well-supplied with water and nutrients. Alluvial, well-structured, and aerated soils are most suitable. Heavy, structurally damaged, waterlogged, and saline soils are unsuitable.

Peanuts grow well in soils with a pH of 5.5–7.

Grown on soils with a pH higher than 7.5, peanuts suffer from chlorosis. Carbonates block the access of iron, and adding it in the form of chelated fertilizers is not an effective enough measure.

GROWTH AND DEVELOPMENT

The table below shows the main phases of growth and development of the peanut plant. During the first 15-20 days of its vegetation, the above-ground parts (stem and branches) of the plants grow slowly. During this period, the root system grows predominantly. After this period, the growth of the stems and branches intensifies significantly and the vegetative mass increases over several times. As the growing season progresses and flowering stops, the growth rate slows down, with soil moisture having a limiting effect in this case.

During the germination, sprouting, and budding phases, weed proliferation poses a particular risk. Weeds are especially harmful during this period and can reduce yields if they are not removed between

the 15th and 25th day after the peanut plants emerge from the soil. During this stage of plant development, weeds can be controlled by mechanical methods, by hoeing/chiseling between rows and using graminicides without any risk immediately after the crop emerges. Bentazon-based herbicides can be used successfully against broadleaf weeds.

Mechanized chiseling between rows also leads to loosening and aeration of the soil, which is why the first chisel between rows should not be delayed. This is done two weeks after the plants have emerged. Irrigation should usually start 35-40 days after emergence /flowering stage/, however if there is not enough soil moisture, early irrigation is advised. During the period of mass flowering, peanuts need nitrogen fertilization (nitrate nitrogen only) the most. When fertilized in this phase, no later than the sixth week after the plants emerge, peanuts respond with increased yields. Nitrogen should not be applied after the end of mass flowering, as this will lead to increased vegetation of the crop and delay in ripening. Regular watering during this period is a mandatory measure.

Stages	Description	Days after sowing
Vegetative stages		
Germination	Seeds begin to germinate	2 - 5
Emergence	Appearance of cotyledons	12 - 25
Budding	Appearance of flower buds	20 - 30
Mass flowering	50% flowering plants	32 - 35
Reproductive stages		
Start of fruit formation	The first flowers are below the soil surface	44 - 47
Mass fruit formation	Good flowering on the central stem and branches, formation of gynoecium/	51 - 54
End of fruit formation	90% of plants have stopped flowering	90 - 100
Ripening	Physiological maturity	115 - 135
Dry down stage		
Full maturity	All seeds are ripe, plants are dug out of the soil	121 - 141

GERMINATION

For germination, peanuts need a temperature of 15°C in the soil layer at a depth of 10 cm. The seeds germinate when water accumulates equal to 70% of their mass. This phase ends 7 days after sowing. Over-moistening and cooling of the soil during the germination period have an adverse effect on germination and create a risk of rotting of a large part of the seeds.

EMERGENCE

Peanuts emerge in 12-25 days, depending on the temperature and moisture content of the soil. Delays in this phase due to unfavorable conditions lead to the depletion of the seedlings and the death of a large proportion of them. Plant growth and development is slow, and they compete strongly with weeds that have appeared. From the emergence of the cotyledons to the appearance of the first pair of true leaves, the period lasts about 14-18 days.

Following recommendations for optimal sowing rates is crucial for the germination phase. Dense sowing allows soil pathogens to spread more quickly and easily among the germinated seeds.

BUDDING

When the average daily air temperature rises above 20°C for a prolonged period, the budding phase begins. At this phase, plant growth and development accelerate. It is necessary to start monitoring for the appearance of insects. Water requirements of the plants increase drastically. At this phase Irrigation should begin.

FLOWERING

Mass flowering occurs immediately after the budding phase and lasts about 65-70 days. During this period, the plants' requirements for water and nutrients in the soil are highest. Fertilization is carried out early in the morning, and the presence of atmospheric moisture (dew and fog in the morning) reduces the percentage of aborted flowers.

At the beginning of flowering, the flowers are underground, which is why this phase goes unnoticed. This phase ends after the first flowers appear on the soil surface.

Agrotechnical measures during flowering aim to accelerate and promote plant development. During this phase, foliar fertilizers containing boron, manganese, zinc, and calcium should be applied. Weeds are controlled by using graminicides /quizalofop-p-ethyl/ against grass weeds and bentazon-based herbicides against broadleaf weeds, and insecticide sprays are applied against moths. Chiseling between rows also has a beneficial effect on the plants. During the late flowering stage, it is advisable to water the plants, which will cause the formed fruits to fill.

FRUIT FORMATION

The beginning of this period is considered to be the appearance of fruits the size of a grain of rice at the end of the gynophores. Mass fruit formation occurs forty-five days after sowing. Peanuts are indeterminate and the flowering and fruiting phases continue together for a long period of time. Buds, flowers, and fruits are found simultaneously on one plant. This is the period when the plants are hilled after each watering.

Hilling is a mandatory practice and aims to bring the soil closer to the plant. Only gynophores that manage to stick into the soil form fruits.

PHYSIOLOGICAL MATURITY

This phase technically begins during the reproductive phase when the pod is formed. During this phase, most of the leaves remain grass green in color. The seeds in the earliest formed pods turn pink, while the remaining seeds are small and milky white. During this phase, 90% of the plants stop flowering. This stage ends when the plants reach physiological maturity. Physiological maturity occurs when 75% of the pods have seeds that are finally red in color and have a streaked skin. The period of physiological maturity is important because after this point, the crop is less susceptible to yield loss due to seed shattering. It is also an indicator that the time is approaching to use harvesting aids.

FULL MATURITY

The stage of full maturity is crucial, as this is when the peanuts are removed from the soil to help the crop dry out. It occurs very soon after physiological maturity and is characterized by the fact that all seeds are ripe, and the parenchyma of the inner wall of the pod turns from white to brown. In this phase, the plants are harvested. They can be harvested immediately after removal, but then the fruits contain a high percentage of moisture and need to be dried further. Therefore, it is preferable to leave the plants in the field until the moisture content of the fruits is 12% before harvesting.

AGRICULTURAL PRACTICES

AREA SELECTION

Peanuts grow and develop best in well-drained, light to medium-light soils. The crop provides successful yields on a variety of soil types. Overly moist soils reduce oxygen and interfere with normal root development. Peanuts tolerate slightly acidic to slightly alkaline soils (pH 5-7.5) with a high humus content. Peanut yields will be reduced if they are grown on alkaline soils with a pH of around or above 7.5.

CROP ROTATION

Peanuts do not tolerate cultivation after cotton, sunflowers, and alfalfa, as these crops dry out the soil deeply and deplete it. The best predecessors for peanuts are autumn grain crops with a compact surface. Good predecessors are root legumes and early vegetables. Peanuts should not be grown as a monoculture, but due to limited irrigation areas, they can be sown two years in a row. Peanuts are an excellent predecessor for grain crops.

SOIL PREPARATION

An important condition for obtaining high peanut yields is to prepare the soil in such a way as to ensure complete and timely germination of the crop. This is only possible if there is sufficient moisture in the 3-8 cm soil depth. On the other hand, peanuts develop slowly in the early stages and there is a risk of them being smothered by weeds. Careful soil preparation not only creates conditions for sufficient moisture accumulation, but also preserves it to a large extent. Such preparation leaves the soil free of weeds and in good structural condition.

For winter grain crops and legumes with a short growing season, deep plowing is carried out according to the farm's schedule.

If the previous crop was late, plowing is started immediately. Phosphorus and potassium fertilizers can be applied with deep plowing. In the spring, as soon as it is possible to enter the field, one deeper cultivation/chiseling (20-25 cm) is carried out.

Before sowing, another cultivation is carried out at a shallower depth (10-15 cm), with the aim of creating a firm bed for the seeds and keeping the area free of weeds. The optimal time for the second cultivation is immediately before sowing, in order to preserve the soil moisture necessary for germination. The use of disc harrows in the spring is not recommended because it leads to deep drying of the soil and the formation of large soil aggregates, which prevents the seeds from germinating.

Nitrogen fertilizers can be applied together with the second cultivation/chiseling.

HERBICIDES

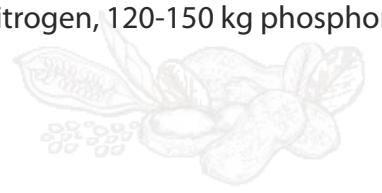
After sowing, before the seeds sprout, pendimethalin-based preparations can be successfully applied. When weeds appear during vegetation, graminicides based on quizalofop-P-ethyl can be successfully applied. Bentazon-based herbicides are applied against broadleaf weeds that have sprouted during vegetation. The herbicide can be applied up to two times during the vegetation of the crop without risk.

CROP NUTRITION

Peanuts, as an oilseed crop grown under irrigated conditions, have very high requirements for soluble nutrients in the soil and respond well to fertilization. Despite their relatively short growing season, peanuts extract large amounts of nutrients. Fertilizing the predecessor with phosphorus and potassium does not satisfy their needs for these two elements. They must be applied with deep plowing in the fall or before sowing. The plants need nitrogen during active vegetation. During the first six weeks, while the nodule bacteria have not yet developed, nitrogen must be supplied with mineral fertilization. Drought during this period leads to disturbances in the dynamics of this element's uptake, and peanuts respond with lower yields. The most effective method is pre-sowing application or feeding the crops in the first six weeks of crop development with nitrogen fertilizers in nitrate form. It is not recommended to use the amide form of nitrogen for peanuts, either as a pre-sowing application or as a fertilizer, because this prolongs the growing season. Late application of nitrogen fertilizers is not recommended as it will give priority to the vegetative phase over the generative phase, prolong the vegetation period, and delay ripening.

The approximate nutrient requirements for 1000 kg of yield per ha are 75-80 kg of nitrogen, 45-50 kg of phosphorus, 35-40 kg of potassium, and 20-30 kg of calcium.

Approximate fertilizer rates given in active ingredient per ha, depending on soil type, predecessor crop, and soil fertility, may be: 200-220 kg nitrogen, 120-150 kg phosphorus, 80-100 kg potassium, and 60-80 kg calcium.



PLANTING

Regular germination and crop yield depend largely on the sowing date. Peanut sowing begins when the temperature in the top 10 cm of soil reaches 15°C. During this period, and provided there is sufficient moisture in the soil, the peanuts will germinate within 12-14 days. The sowing depth for peanuts should not exceed 8 cm, with the optimal depth being 3-4 cm. The seeds should fall on a firm bed, at the same depth and with "secure" moisture. If the soil does not have the necessary moisture when the optimal temperature conditions for sowing are reached, it is better to water before sowing. If the seeds fall on "uneven moisture", the seeds and seedlings suffer and are attacked by wireworms and pathogens. Compliance with these rules is particularly important when sowing with untreated seeds. Peanuts are planted with pneumatic seeders for precise sowing, with discs with 5 mm holes. Within the row, the seeds should be 8-10 cm apart. At this density, about 120-140 thousand plants per hectare reach harvest. Depending on the absolute weight of the seeds, the sowing rate of the crop varies from 100 to 120 kg/ha. After sowing the seeds, the area must be rolled with light Cambridge rollers.

CARE DURING THE VEGETATION

After sprouting, peanuts grow and develop slowly. During this period, the crop is severely suppressed by the harmful effects of weeds and lack of moisture in the soil. Timely weed control is crucial for yields. The first hoeing of the plants is done with a cultivator at a shallow depth, leaving a larger protective zone. It is advisable to use cultivators equipped with a device to prevent the plants from being covered with soil for this type of cultivation. The second hoeing is usually done after 12-14 days at a greater depth and with a smaller protective zone. Weed control in this case can be combined with vegetative herbicides that destroy the weeds mentioned above. By the end of the growing season, another hoeing is performed. After each irrigation of the crop in the phase of active flowering and fruit formation, the plants are mulched.

The main disease affecting peanuts is fusarium wilt caused by Fusarium sp. Rhizoctonia solani and Phitoftora sp. These soil-dwelling pathogens attack plants at various stages of their development and can cause serious crop thinning. There are no completely resistant varieties, so control measures focus on seed treatment and scientifically based crop rotation. Other diseases affecting the crop include leaf spots (Alternaria sp., Phyllosticta sp., etc.), which are of no economic significance.
Pests include aphids, grasshoppers, and moths, which are controlled as necessary.

FUNGICIDES

Seeds can be treated with Vibrans Duo at a dose of 200 ml per 100 kg of seeds in a solution of 3-4 liters of water.

INSECTICIDES

A wide range of active substances with contact and systemic action can be used successfully against cotton and leaf moths. It is good to apply them when moth damage appears, but no more than twice during the growing season.

HARVESTING

The harvesting of peanuts is a two-stage process. In the first phase, when the peanuts reach full maturity, the roots of the plants are cut with a digger and laid on the soil surface. Depending on the model of the digger, several rows of peanuts can be dug and put together into 1. It is important for the quality of the harvest and to prevent losses in this phase that the soil is not compacted and overmoistened. With proper chiseling during the growing season, these adverse effects can be avoided. Otherwise, the soil is dug up into large clumps, many fruits remain in it, or huge clumps accumulate on the plants.
The second phase is the harvesting of the fruit. This is done with a special harvester attached to a tractor. The moisture content of the fruit should be no more than 12%. If the fruit is harvested at a higher moisture content, it needs to be dried quickly.

Picture 1. Light spring rollers after sowing

Picture 2. Peanut seed germination.

Picture 3. Emergence of peanut plants

Picture 4. Emergence of peanut plants

Picture 5. Peanut crop

Picture 6. Early chiseling to remove weeds and aerate the soil

Picture 7. Fruit formation stage

Picture 8. Digging of peanuts – first stage of harvesting

Picture 9. Dug out peanuts waiting for moisture to reach 12%.

Picture 10. Dug out peanuts waiting for moisture to reach 12%.

Picture 11. Peanuts in-shell

Picture 12. Shelled raw peanuts.