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УМАНСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ САДІВНИЦТВА

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СЕКЦІЯ 1.
РОСЛИННИЦТВО

ORIGIN OF VEGETABLE PEAS

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Among leguminous crops, peas, beans, and vegetable beans are of production importance in agriculture, in particular in vegetable growing. Vegetable peas have been known to man for a long time. In Switzerland, archaeologists excavated settlements dating back to the Stone Age and found peas. The grains found differ little in size from the culture grown in our time.

The fruits of peas are beans, which are often incorrectly calling pods. The ancestors of these cultures in ancient times were lianas in tropical forest conditions, where the struggle for light was crucial. Peas are one of the oldest crops. The homeland of peas is Central Asia and the Mediterranean. A. Dekandol found peas in the wild in Western Asia, in the south of the Caucasus, in India and Italy.

Peas are one of the oldest agricultural crops. There is a version that the homeland of the seed pea is Iran, Turkmenistan, where its small-seeded species are grown. Large-seeded peas have been grown on the lands of modern Ukraine since ancient times (4-6 thousand years BC), which is proven by archaeological finds. A well-known saying in the Ukrainian language about the antiquity of the event – it was during the reign of Tsar Pea, also indicates the widespread cultivation of peas in ancient times.

Remains of seeds found in settlements dating back to the Stone and Bronze Ages indicate that the pea is a very ancient cultivated plant. Its culture in Western India and Ethiopia dates back to ancient times. Peas were also growning in ancient Egypt and were founding in tombs of the 12th dynasty (2000–1788 BC). Already Theophrastus (372–287 BC) distinguished peas from other legumes. Peas were widely distributed and known among the Romans. At that time, at first, probably, only ripe peas were using for food, and only in the middle of the century, they began to use green peas as well.

It is known from written sources that in Ancient Greece and Ancient Rome as early as the IV–III centuries to BC, peas were used not only for food, but also for livestock feed and as green fertilizer. Vegetable peas are knowning in culture earlier than grain peas. It ranked first among vegetable and legume crops. In Europe, vegetable peas began to be growning in the 17th century in Holland, and at the beginning of the 18th century, it was broughting to England. In the middle of the 18th century, the culture of vegetable peas was widespread in Europe.

On the territory of modern Ukraine, peas have been knowning as a leguminous vegetable crop since the XI century, and some authors name an even earlier date – VI–VIII centuries. Peas gained the greatest distribution in Ukraine from the 17–18 centuries.

During this period, thanks to folk breeding, the final division of pea forms into grain, vegetable and fodder varieties took place, which differ among themselves and according to the requirements for individual elements of agricultural technology: the method of sowing, the density of crops, the background of mineral nutrition, the irrigation rate, etc.

Peas occupy a special place among other vegetable crops. It is growning in all areas of Ukraine, including in the Steppe – up to 25% of the total area. The average yield of pea seeds reaches 24 c/ha, which indicates its high potential.

Peas, as an agricultural crop, have a centuries-old history of cultivation. Initially, peas were growning in gardens, and later they began to grow in the field, increasing the area. With the mastery and development of plant selection, peas began to be growning again, along with field, and in garden (vegetable) culture.

The development of the pea as a cultivated plant certainly began with forms that were very similar to our field pea, or field pea. In addition to colorful flowers and dark-colored seeds, they probably had, on the inside, a flap with a parchment layer so strongly developed that it could tear the bean when ripe. The reduction of this parchment layer, as well as the loss of the colorful color of the flowers and the dark color of the seeds, were important stages on the way of transforming the pea into a cultivated plant. After various forms of peas were describing already in the middle of the century, in the 19th century in England systematic selection of peas was starteding, which was following by local German improved varieties before and after the First World War. Thanks to the simple and understandable structure of the flower, the pea became the object of Mendel's famous crossbreeding research.

FORMATION OF THE WINTER WHEAT CROP STRUCTURE

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The productivity of winter wheat plants depends most on two elements of the crop structure: the density of the productive stem and the mass of grain from one ear. According to the requirements of intensive technology, there should be approximately 600 ears per 1 m. Fertilization at the III-IV stages of organogenesis enhances the formation of elements of spike productivity, contributes to the establishment and preservation of spikes. The number of grains in an ear depends on the number of flowers and their reduction. The laying of flower tubercles begins at the V stage of organogenesis. In winter wheat, the average number of ears in an ear is in the range of 16–22 pcs. This is a varietal trait, which can be influencing by both growing conditions and agrotechnical measures.

The elements of the crop structure are in a complex correlation dependence both among themselves and with grain yield. For winter soft wheat varieties of the intensive type, the determining factor for obtaining high yields is the density of the productive stalk, the number of grains per plant and ear, as well as the weight of grain from the ear and plant. In favorable growing conditions, the increased productivity of the ear (the number of grains and the weight of the grain from the ear) is realizing when there are 600–700 pcs. Productive stems per 1 m^{2}. Temperature and amount of precipitation after flowering and seed setting, ripening conditions, availability of nutrients, additional nitrogen application – all this affects both yield and grain quality.

The winter crop uses the main amount of nutrients during the period of tillering – heading, when the ear is formeding. Nitrogen deficiency during this period leads to the formation of an insufficiently developed ear with a small number of spikelet's containing thin grain.

In the conditions of the Northern Steppe, the most rational dose for local feeding of winter wheat plants of various varieties was the dose of N_{30}, which contributed to the effective improvement of crop structure indicators. The length of stay of winter wheat plants in the state of tillering – the beginning of tuberization is on average 20 or more days. The beginning of emergence into the tube is a critical period for winter crops for providing moisture and nutrition, which depends on the number of grains in the ear. An advantage in the formation of ear productivity of various varieties of winter wheat when they are placing in a black pair compared to growing after spring barley has been revealing.

Under the influence of mineral fertilizers, both the total number of stems and productive ones increase. An important role in the effective use of fertilizers belongs to the variety. Varieties and nutritional background are powerful factors that contribute to increasing the yield of winter wheat grain. The structural indicators that ensure the formation of the crop, the main quality indicators, in particular the content of gluten and protein are significantly influencing by all factors: nutrition regimes, biological features of the variety and weather conditions.

The formation of the ear of winter wheat takes place in the spring during the period of recovery of spring vegetation – emergence into the tube. The mass of grain from one ear is a derivative of the number of grains in the ear and the mass of 1000 grains. It was founding that spring drought causes a decrease in the length of the ear and the number of ears in the ear, summer drought has the most detrimental effect on the formation of the mass of 1000 grains and the mass of grain of one ear.

Grain size is an important component of wheat yield. The main elements of the wheat crop structure are the number of productive stalks per unit area, the number of grains in an ear and the weight of 1000 grains.

ECONOMIC VALUE OF SPRING BARLEY

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At the current level of agricultural development, it is possible to obtain high grain yields every year. The problem of providing the population with food grains is mainly solving by increasing the production of winter wheat and other grain crops. At the same time, there is a need for high-quality fodder grain. Spring barley is one of the important forage crops that can fill this gap.

Barley is one of the most common agricultural crops in world agriculture and has been cultivated since prehistoric times. Excavations show that it, along with wheat, was knowning even in the Stone Age. Barley spread to Europe from Asia Minor in the 4th – 3rd millennia BC. e. In the same period, barley began to be growning on the territory of modern Ukraine.

Wild barley (*Hordeum vulgare* L.) is an important fodder, food and technical crop. The chemical composition of the grain is characterizing by high fodder qualities and is using as a concentrated feed for all types of farm animals and especially for fattening pigs. In terms of nutrition, 1 kg of barley grain corresponds to 1.2 fodder units, which includes 100 g of digestible protein. On average, grain contains, in percentages: proteins – 12.2%, carbohydrates – 77.2%, fats – 2.3%, ash – 2.8%. Protein is valuable for its amino acid composition, especially for its lysine and tryptophan content. Barley straw and chaff are valuable roughages. In the south of Ukraine, barley is used for green fodder and hay mixed with legumes (veca, peas).

From vitreous and coarse-grained double-row barley, which contains 9–11% protein, 82–85% starch. Due to low-quality gluten, flour is not suitable for baking bread. If necessary, it is adding as an admixture to wheat or rye flour when baking higher quality, whole grain bread.

Two-row barley grain is the best raw material for brewing. Brewing grain should be large and leveled with a low protein content (9.0–12.5%) and a high starch content (63–65%). Barley grain is also using for the production of coffee substitutes and malt extracts. Brewing waste (beer grits) is used for animal feed.

In the world structure of sown areas, barley ranks fourth after wheat, rice and corn, and in Ukraine, it is second only to winter wheat and corn. Such a wide distribution of barley is connecting with its universal use.

Ukraine ranks among the five most powerful global producers of barley along with the European Union (27 countries), Russia, Australia and Canada in terms of cultivated area and volume of barley grain production. These same countries are also leading exporters. If we talk about the main consumers, Turkey, Saudi Arabia and the United States should be adding to the already mentioned countries, of which Turkey and the USA cover their needs at the expense of their own production, and Saudi Arabia is the world's largest importer of fodder barley. China (the world's second largest importer of barley) is a major consumer with a high share of imports.

According to the FAO, 42–48% of the annual gross harvest of barley is using for industrial processing (including compound feed), 6–8% for beer production, 15% for food and 16% for fodder purposes.

In general, the productivity of spring barley depends on such basic elements as number of ears per plant, grain size, weight of ear and weight of 1000 grains. Some authors note that one of the most important signs of productivity of spring barley is the number of grains in an ear. Others insist on a greater influence of the root system. Thus, it has not been clarified which of the elements of productivity is decisive in increasing the yield of this crop and which combination of agrotechnical measures achieves the highest level of grain productivity of spring barley plants.

Varieties of barley of different subspecies belong to various ecological biotypes of culture. They are characterizing by different reactions to changes in the external environment and differ in different rates of growthing and development.

The importance of varieties in technology is determining, first, by their ability, as active biological factors, in the process of self-regulation of ecological systems to effectively counteract the adverse effects of other factors, which to one degree or another are capable of disrupting the balance of natural ecosystems and initiating processes of environmental pollution.

Among the agricultural practices in spring barley cultivation technology, the share of the variety accounts for 20–28% of the yield increase, and in extreme weather conditions, it has a decisive role. The variety remains not only a means of increasing productivity, but also a factor without which it is impossible to realize the achievements of science and technology. In agriculture, the variety acts as a biological system that cannot be replacing by anything.

According to scientific research, it is possible to increase the productivity of all agricultural crops by 30–50% due to the introduction of new varieties. Intensification of agricultural production requires a complex combination of productivity, high grain quality, resistance to pathogens and pests, as well as adverse environmental conditions in one variety. It is necessary to grow not a random set of varieties, but one that will allow the most comprehensive and effective use of the variety of environmental conditions.

The annual increase in air temperature, which exceeds the long-term indicators, against the background of a significant lack of productive precipitation, forces scientists to search and develop effective technological techniques to increase the drought resistance of spring barley plants and introduce modern varieties into production.

The biological feature of the variety, the place and growing conditions determine the value of its grain. In view of climate change, not only varieties with maximum potential yield are important, but also those that combine a high level of productivity with resistance to adverse environmental conditions, that is, have increased adaptive potential. Average yields of spring barley in Ukraine, if the growing technology is following, can be increasing to more than 4.0 t/ha, but intensive-type varieties realize their yield potential by only 20-50%.

The peculiarity of the new varieties is also the special characteristics of grain quality, which must be laid down by the breeder and implemented in the production process using appropriate growing technologies. Requirements for varieties of different quality categories are often diametrically opposed, which excludes the existence of barley varieties of so-called "universal" use. Cultivation of intensive type varieties allows obtaining high yields of barley, but at the same time, a careful approach to the technology of their cultivation is necessary.

Modern technologies for growing agricultural crops are basing on the widespread use of a large number of chemicals; therefore, the ecological stability of varieties and their stability remain important factors in the intensification of grain production.

The potential of spring barley can be successfully realizing due to the application of intensive growing technologies, and therefore new varieties must be suitable for them, provide high economic efficiency of grain production, be adapted to a certain level of agriculture, and be resistant to stress factors.

Scientists note that grain yield and productivity components depend precisely on the biological characteristics of varieties. More resistant to the influence of biotic factors are the six-row varieties of the brewing direction of use. Bare- grain barley samples have lower germination and are less resistant to acceleration of physiological processes than membranous ones.

Its quality indicators depend on the morphotype and variety of spring barley, in particular, the content of protein, starch, sugar, lipids, fiber and ash, and it is 13.7 for membranous barley; 58.2; 3.0; 2.2; 20.2; 2.7, and 14.1 for whole grains, respectively; 63.4; 2.9; 3.1; 13.8; 2.8 g/100 g of dry matter. From the given data, it is clear that bare lake barley is inferior to film barley only in terms of fiber content, but exceeds it in terms of protein and starch content.

According to the literature data, in order to obtain high yields of spring barley, it is necessary to introduce high-yielding varieties that have economic and valuable characteristics and are adapted to the specific soil and climatic conditions of the growing zone.

ORGANIC TECHNOLOGY OF GROWING SOYBEANS

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Soy is an important leguminous crop. Over the past 10 seasons, an increase in the area of crops under it has been recording in 16 regions of Ukraine. This is evidencing by the data of the dynamic infographic of soybean acreage from SuperAgronom.com. Today, about 60% of soybeans are processing into oil.

Soybean is the main grain legume crop in the world in terms of cultivated area and gross grain yield. It is growing in more than 40 countries on a total area of more than 50 million hectares. Such a wide distribution of soybeans is explaining by the universality of its use as an important food, technical and fodder crop. This is due to the exceptionally favorable combination of organic and mineral substances in the seeds.

The high value of soybeans is determining primarily by the high content of complete protein, which in terms of amino acid composition is close to proteins of animal origin and is well absorbing by humans and animals. It is also important that the main soy protein, glycine, is able to coagulate when acidified, which makes it possible to make a large number of different food products from seeds and beans. In addition, medical science has established that soy foods contain antisclerotic substances, which is especially important for older and elderly people.

For organic cultivation, it is necessary to choose disease–resistant varieties, since in the absence of fungicidal protection; the only hope is the plant's own "immunity".

Varieties should be selecting primarily based on such parameters as resistance to stress factors and yield indicators. Resistance to diseases is especially important, because we cannot fight diseases with fungicides. The Khorol variety showed itself very well. It is resistant to damage by pests and diseases, early ripening, and therefore vacates the field early, which makes it a good predecessor for winter wheat. Besides, it is highly productive.

An equally important condition for growing organic soybeans is the observance of crop rotation, because the correct rotation of sowing will minimize the risk of infections and diseases.

In organic production, if you work according to all the rules, soybeans need to be returning to the field once every 4 years, so that infections do not accumulate in the soil and there are no problems with crop diseases in the future. Therefore, inoculation must be carried out during sowing.

Inoculation is the treatment of soybean seeds with bacterial preparations. In the soil, bacteria interact with the legume root system, forming colonies in the root nodules. Now this is not new in agronomy, but there is a removable element of cultivation technology that increases the productivity of soybeans.

Tillage. Soybean cultivation technology requires only high–quality soil preparation. The main tillage ensures wrapping of fertilizers, post–harvest residues, accumulation of moisture, improvement of the structure of the seed layer, high quality sowing of seeds, and weed control.

The main cultivation includes 1–2 husking is to a depth of 8–10 cm, fertilization and plowing to a depth of 22–25 cm after grain precursors and 25–30 cm after corn. In fields where the soil has not been prepared since autumn, surface treatment with deep loosening should be used. Pre–sowing soil cultivation should be minimal and at the same time ensure the destruction of weed sprouts, moisture conservation, additional leveling off the field, before applying fertilizers. Pre–sowing cultivation is carried out to a depth of 5–6 cm with the simultaneous application of one of the soil herbicides. Tank mixtures of these drugs are also using in half doses, depending on the species composition of the weeds.

BIOLOGICAL FEATURES OF WINTER WHEAT

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Wheat is the most valuable grain crop, both from the point of view of its origin and use as a source of food for humans and animals. Wheat is an ancient cultural plant that was cultivated on the globe in prehistoric times, 15–10 thousand years BC.

Moisture accumulated during the autumn-spring period is in many cases the main source from which wheat draws it for growth, development and crop formation during the growing season. Water consumption by the wheat plant during the growing season is uneven and is determined by the power of the plant in individual phases of growth and changes in meteorological conditions.

After the appearance of seedlings, the vegetative mass of wheat increases every day, and with it the evaporation surface increases, and with it the water consumption. In spring wheat, along with the increase in vegetative mass, the external conditions are such that with each growth period, the air temperature increases, its relative humidity decreases, and solar radiation increases. All these elements enhance the ability of wheat to evaporate and despite the shading of the soil by the plant, which reduces losses, water consumption in the wheat field increases.

In winter wheat, the conditions described above occur in the opposite direction, so water consumption under winter wheat goes in the opposite direction. So, to ensure friendly and full germination of winter wheat, 30–40 mm of precipitation needs during the period of the beginning of sowing and emergence of seedlings.

Thanks to the presence of moisture in the soil in the second half of September and in the first half of October, winter wheat plants tend to sprout more vigorously, the root system goes deep into the soil. Excess precipitation during this period leads to the development of a large aboveground vegetative mass, the hardening of plants is weakened, the mass of roots decreases, which leads to a decrease in the resistance of plants to the onset of cold weather. With the onset of spring, water consumption in winter wheat plants is the same as in spring wheat. On hot days, the moisture deficit increases every day, the difference between the need for water and its availability in the soil in the absence of precipitation increases with the further growth of wheat and most during the increase in dry matter of the plant – in the period from the beginning of emergence into the tube until flowering. They react especially sensitively to uniformity of precipitation of the durum wheat plant. The latter, with more frequent precipitation, even with a smaller total amount of it, gave a higher yield than in years with abundant, but rarely falling precipitation.

As is known from the morphology and biology of durum winter wheat, which is studied by many researchers, the bushiness of plants is average (2–3), rarely high (4–6 stems per plant).

In addition to changes in water consumption caused by weather conditions, its losses increase greatly under the influence of damage to plants by leaf rust or insects. Wheat plants affected by leaf rust increase moisture consumption per unit of dry matter by 32–100%. At the same time, damage to plants in the early stage of vegetation leads to higher water consumption, compared to the late period of growth.

Water consumption by wheat plants is determining by many factors and varies widely – from 600 to 2640 g per plant.

The process of seed germination occurs in the presence of a sufficient amount of water, heat and oxygen and consists of five consecutive phases: water supply, swelling, growth of primary roots, development and growth and formation of a sprout.

Water consumption by plants depends on its presence in the soil, the phase of plant development and temperature. It has been established that the lack of water in the soil in the fall, especially in the upper ten-centimeter layer, leads to delayed seed germination, various unfriendly and thinned seedlings, insufficiently developed root system in the upper layers of the soil.

To obtain timely, friendly and complete seedlings in the field, it is necessary that the reserve of productive moisture in the seed layer of the soil is at least 12–13 mm.

It was established that the resistance of winter wheat to adverse wintering conditions depends on the conditions of its cultivation in the autumn period. In Ukraine, under conditions of sufficient soil moisture and optimal sowing dates, in winter wheat, tillering begins 14–16 days after germination.

Numerous scientific studies show that the winter hardiness of winter wheat plants depends on the sugar content in the nodes of the tillers.

The best conditions for the formation of frost resistance of winter wheat are created with optimal soil moisture in the autumn period – 60% of field moisture capacity. Other authors indicate the influence of soil moisture on winter hardiness during the autumn vegetation period of winter wheat, in connection with the positive effect of moisture-charging irrigation. On chernozems, due to irrigation, productivity increases by 20–30%.

It has been established that when sowing by black steam, an important role in the formation of high frost resistance belongs to phosphorus -potassium fertilizers, which are applied individually or in a complex manner.

Studies show that the ratio of mineral elements has a positive effect on the frost resistance of plants. The highest resistance is characterized by plants where the ratio of NPK was 1.0:2.6:2.0 and 1.0:4.0:3.0, respectively.

At the same time, in the steppe zone of Ukraine on ordinary chernozems, the negative effect of fertilizers on the frost resistance of winter wheat after black steam decreases only in those cases when the doses of phosphorus and potassium are four times higher than the doses of nitrogen.

Moisture availability of plants affects the establishment of generative organs. It is known that if there is insufficient supply of water during the tillering period, the number of spikelets in the ear is destroyed, and if there is a shortage of water after flowering, the development of grains stops.

It is knowning that short-stemmed varieties have a slightly higher yield potential of wheat, but less resistance to adverse wintering factors. The resistance of winter wheat plants to wetting and the negative impact of ice crust depends little on the hereditary characteristics of the variety. However, shortening of the stem in winter wheat plants under the influence of shortness genes leads to a reduction in the length of the underground internode (epicotyle), and this, in turn, causes a deeper location of the tiller node and can have a positive effect on the wintering of plants.

Under natural conditions, wheat plants react sharply to changes in temperature. According to many researchers, the optimal temperature for germination is 12–15°C, during the earing period 18–20°C and during the ripening phase 22–25°C. A decrease, like an increase in temperature, leads to a violation of the natural development of plants and, as a result, to a decrease in productivity or death.

For winter wheat, the temperature in the second half of October and the beginning of November is the most critical. The higher the temperature, the lower the next year's wheat harvest.

Wheat plants are precise about soils. They must be fertile, structural, have a sufficient amount of nutrients: nitrogen, phosphorus, potassium and other elements.

The reaction of the soil solution should be neutral or slightly acidic, pH 6 – 7.5.

Black soils are the best soils for wheat. Thanks to good physicochemical properties, the root system of wheat on chernozems, in the presence of moisture in the soil, can penetrate to a depth of up to 2 m, and thanks to the presence of nutrients at the entire depth, chernozems provide a high yield with low rates of fertilizers.

The need for cultivated plants, including wheat, in water is often determining by the value of the transpiration coefficient or the water consumption coefficient. The transpiration coefficient shows the amount of water consumed by the plant per unit of dry matter. Academician Williams, summarizing long-term data on changes in the transpiration coefficient of various varieties of wheat, concluded that the transpiration coefficient of this crop ranges from 235 to 1350.

The wheat plant, like any living organism, can be damaged by high temperatures. For higher plants, a temperature of 58°C is considered the lethal limit. Due to the historical conditions of formation, wheat is considered more resistant to heat, so high temperatures rarely cause a lethal effect.

Spring and winter forms of wheat before the onset of high temperatures (spring and summer) have time to loosen and take root well. Therefore, the leaves shade the node of the bush and the soil, in connection with which, the temperature of the plants is lower than that of the soil and air. Based on this, high temperatures do not affect the plant directly, but indirectly through metabolic processes.

Studies have shown that high temperatures in wheat plants disrupt proper photosynthesis, stop their growth and development. The growth of plants does not stop immediately, but their gradual damage is observed.

THE HISTORY OF THE DISTRIBUTION AND NATIONAL ECONOMIC IMPORTANCE OF CULTURE

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Lupine belongs to the most ancient cultures, which were growing before our era in Egypt, Greece and the Roman Empire. Long ago, lupines were growing in Rome, which in terms of varietal qualities almost did not differ from modern ones. Even then, the Romans and Greeks were well aware of its medicinal, valuable and agricultural, food and toxic properties. Lupine was grown as a grain crop, which was used in the preparation of everyday things and fed to animals.

In literary monuments, lupine is first mentioned in the writings of the Greek physician Hippocrates (460–364 BC). In his book "On human nutrition", he gives an assessment of its economic and valuable characteristics, comparing it with other leguminous crops. Theophrastus in the works «History of Plants» and «Physiology of Plants» (375-289 BC) reported more details about lupine as an agricultural crop at that time. Since ancient times, lupine has been cultivated as a grain crop, getting rid of the bitterness in order to use it as a food product and for animal feed. Outstanding scientists of the ancient world – Dioscorides, Avicenna, Galen, Pliny, etc. mention lupine as a useful edible and medicinal and cosmetic plant. It is knowning that lupine was also used as a green fertilizer.

In the middle Ages, lupine was growning in Mediterranean countries, such as Italy, France, Spain, Portugal, where it was first known as a good sidereal crop, and later as food and fodder.

Then the lupine migrated to the countries of Central Europe. In Germany, this culture was not crowned with success for three reasons: late maturity, the need to constantly import seed material from other countries, and damage by Fusarium wilt. Therefore, yellow and narrow-leaved lupins began to be grown in Germany, not white ones.

The time of domestication of yellow and blue lupins is considering a new stage in the history of this culture (1940). By the end of the 20th century, the cultivated area in Germany reached 40,000 hectares. However, cultivated plants retained many features of wild plants, which contributed to the reduction of the cultivated area by almost half by the 1930s.

For the first time in 1916, T. Remer put forward the idea of removing the bitterness and toxicity of plants in order to fully use alkaloid-free lupins. Later, D. M. Pryanishnikov made attempts in 1924. On the way to the appearance of alkaloid-free species of lupine, the main obstacle in this regard was the lack of cheap and quick methods for determining alkaloid content. For the first time, such a technique was developed at the Central Institute of Genetics in the city of Münchenberg (Germany) by the breeder Zengbusch, who isolated new stable alkaloid-free forms of lupine. On this basis, breeding work for fodder purposes began. Soon, white lupine became interested in Poland as well, where they not only carried out breeding work, but also developed agrotechnical techniques.

In Ukraine, the sown area of lupine is 50,000 ha, and the average yield is 1.0–1.2 t/ha. On the territory of Ukraine, scientific publications published the results of collective research (Chernihiv, Volyn, Kyiv, Mogilev provinces) in 1910–1914, which showed the effectiveness of growing lupine for green manure.

In 1931, an express method for analyzing lupine plants for alkaloid content was developed in the biochemical laboratory under the leadership of N.N. Ivanov. According to M. I. Vavilov, the discovery of alkaloid-free lupine is a discovery of exceptional interest for agronomy. This time is considered the beginning of the establishment of lupine as a fodder crop.

The discovery of alkaloid-free varieties of lupine, including white ones, in the late 20s and early 30s of the 20th century contributed to the formation of a new stage of lupinization, which opened up huge opportunities for strengthening the fodder base and increasing the production of plant protein. From that time, culture began to occupy a significant place in world agriculture.

Compared to other types of lupine, white lupine is characterized by early maturity, fast growth rates, high fodder productivity and low alkaloid content.

Culture plays an important role in strengthening the fodder base, providing livestock with high-protein fodder that is balanceding in terms of amino acid composition. Lupine can be used in various sectors of the national economy. Yes, protein concentrates are using to make artificial wool. They are developing technologies for the use of lupine in the food industry for baking confectionery, candy production, etc. Culture is also important for technical purposes; it is using in paint, pharmaceutical, cosmetic and other industries.

Lupine, as one of the most nitrogen-fixing crops, is a valuable sidereal crop. For 1 kg of crop sowing, up to 200 kg of nitrogen is fixing from the air, which is equivalent to the effect of 36–40 tons of manure. Thanks to a well-developed deeply penetrating root system, this culture is able to assimilate phosphorus from difficult-to-dissolve compounds. Lupine grows well on poor sandy soils, so it is using to improve them.

When plowing 3.5 t/ha of green mass as green fertilizer, the soil is enriched by 180–200 kg/ha of biological nitrogen and 35–40 t/ha of organic matter, which is equivalent to 45–48 t/ha of manure.

White lupine is better adapted to growing on poor soils with a low humus content and high acidity. According to scientifically based technology and appropriate agricultural technology, high yields of green mass and grain can be provided on them. This is caused primarily by high nitrogen-fixing and phosphorus-mobilizing properties abilities of plants.

In this connection, lupine is a valuable precursor for many crops, especially for winter crops and potatoes.

Based on the above-mentioned advantages of the culture, with the help of white lupine it is possible to successfully develop the most intensive industries – animal husbandry, poultry farming, pig breeding, dairy cattle breeding. Expanding the planted areas of plants is a way to increase soil fertility, strengthen the economy, and increase food resources.

However, despite the great national economic importance of white lupine, its sown areas, like the rest of leguminous crops in our country, remain at an insufficient level. Yield and gross production of grain do not meet the needs of farms.

ECONOMIC VALUE AND BIOLOGICAL FEATURES OF GRAIN SORGHUM

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Sorghum is the most important fodder, technical and food crop, which occupies a wide area of cultivation throughout the world. Its distribution in African countries, as well as the great variety of wild forms found on this continent, indicate that the homeland of grain sorghum is the vast expanses of Africa. On the ancient Egyptian monuments, built 2200 years before our era, drawings of harvesting were found and sorghum grains were found, which testifies to the cultivation of this crop since time immemorial. Its antiquity is confirmed by ancient monuments in the countries of East and South Asia; therefore, there are indications in the literature that some forms of it have an Indian origin, where cultivation was engaged in about 3000 years BC. In China, sorghum culture was known before 2000 BC. Therefore, the origin of sorghum can be equally associated with Africa, India and China, where agricultural culture arose independently.

Sorghum is grown on all continents of the world for fodder purposes, and in arid regions part of its grain is used for human food. It is estimated that more than 200 million people use sorghum grain obtained in Asian and African countries as food during the year. Here, sorghum is the main bread crop, with which the lives of millions of people are connected, starting from ancient times and up to the present day.

Currently, sorghum is grown in 85 countries of the world. India, USA, Argentina, Mexico, Nigeria, Sudan, China and Ethiopia occupy the largest cultivated areas. They account for more than 90% of the gross harvest of sorghum grain. Over the past 30 years, the global area under sorghum has increased by 50%, and the yield has more than doubled. In the south of Russia, a wide study of sorghum was started in 1880, but it was not widely used in practice [9]. The active introduction of sorghum into production dates back to the late 1940s and early 1950s.

There is no accurate information about sorghum entering the territory of Ukraine. It is known that from about the middle of the 18th century, peasants began to grow "Turkish millet", which was sorghum plants. This shows that sorghum was brought to the territory of Ukraine from Turkey. In the south of Ukraine, sorghum perfectly adapted to the difficult local climatic conditions. Until the beginning of the 40s of the last century, large areas of grain and sugar sorghum were grown in the Mykolaiv, Kherson, Zaporizhzhya, Odesa, Dnipropetrovsk regions and in the Crimea, but before the beginning of the Second World War and after it, the sown areas of sorghum were significantly reduced and by the mid-1980s did not exceed 20,000 ha.

At the beginning of the 80s of the last century, agrarian scientists of Ukraine theoretically proved the feasibility of increasing the sorghum-sown area in the southern regions of Ukraine. Professor M. A. Shepel, who recommended expanding the sorghum-sown area in the south of Ukraine to 1.8 million hectares, did significant work in this direction.

According to the data of the State Statistics Service of Ukraine, during the period from 1990 to 2020, the sorghum-sown area changed from 10.4 thousand hectares (in 1995) to 136.9 thousand hectares (in 2012), in the last 5 years sorghum area in Ukraine was 49.9–70.2 thousand ha.

The yield of sorghum grain at the end of the last century did not exceed 1 t/ha. However, since 2005, there has been a gradual increase in crop productivity to 1.5–3.9 t/ha, and only in 2018–2019 did this indicator exceed 4.0 t/ha.

Until 2010, the gross harvest of sorghum grain did not exceed 61.4 thousand tons, since 2011 there has been a steady increase to the highest figure of 354.4 thousand tons (in 2013). From 2014 to the present, the gross harvest of sorghum grain is in the range of 188.3–237.3 thousand tons.

Such indicators are quite low and indicate the need to intensify scientific and research work in order to improve zonal technologies for growing sorghum, its main advantages are exceptional drought resistance, salt tolerance, high productivity, stability of harvests over the years, good fodder qualities and versatility of use.

Sorghum is valued not only as a high-yielding drought-resistant crop, but also for its high fodder qualities, which are directly dependent on a number of factors: variety, soil and climatic conditions, cultivation technology, etc. Sorghum grain contains an average of 12–15% protein, 3.4–4.4% fat, 70–80% nitrogen-free extractives, 2.4–4.8% fiber, 1.2–3.3% ashes For comparison, we will give the chemical composition of some cultures. As can be seen from Table 1.1, in terms of chemical composition, sorghum grain occupies an intermediate position between corn and millet, and in terms of the content of essential amino acids, it surpasses barley, corn and rice grain.

100 kg of grain contains 118–130 feed units. Sorghum grain contains provitamin – carotene, B vitamins and tannins. The content of carotene in sorghum grain depends on varietal characteristics, as well as growing conditions.

Red and yellow grains contain more carotene than white grains. Sorghum grain contains no less B vitamins than wheat and other grain crops. Due to the high content of essential amino acids, sorghum protein has great biological value. Each kilogram of grain contains 5.1–7.3 g of valine; 0.9–1.0 g of tryptophan; 3.2–5.0 g of threonine; 1.4–5.0 g of lysine; 2.5–3.3 g of methionine; 4.5–13.3 g of arginine; 3.5–5.4 g of phenylalanine; 1.9–5.5 g of histidine; 4.2–5.3 g of isoleucine.

Sorghum is an important insurance crop in case of drought in the first half of summer, as well as in case of poor overwintering of winter crops. Therefore, in these cases, the acreage under it grows significantly.

In addition, it has a high reproduction rate and with an average seed yield of 1.5–2.0 t/ha, it is possible to sow an area of 250–300 ha with the harvest of this seed from 1 ha, since the sowing rate of sorghum seeds is only 5–6 kg/ha.

Sorghum grain can be used as a raw material for the starch-molasses industry. 65 kg of starch can be obtained from 100 kg of sorghum grain. In addition, it is an excellent concentrated feed for pigs, poultry, cattle, sheep, horses and even pond fish. The use of sorghum in livestock fattening is equivalent to the use of barley in terms of growth and meat quality. Nevertheless, when feeding sorghum grain from 1 ha, you can get twice as much pork as when feeding barley grain due to higher yield. Poultry production increases by 25–30% compared to traditional feeds, and the productivity of pond fish increases by 34%. Sorghum grain is widely used for monofeed, to obtain flour, granules, briquettes, and is a good grain crop for the food industry.

BOTANICAL CHARACTERISTICS AND BIOLOGICAL FEATURES OF SUGAR SORGHUM

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Sorghum originates from equatorial Africa, and secondary centers of distribution include such countries as India, China, and Egypt. At the same time, sorghum came to Europe in the 15th century, but to America only in the 17th.

The sorghum genus (*Sorghum)* has from 34 to 50 species, among which there are wild and cultivated, annual and perennial. Common in Ukraine: common sorghum (two-color), soriz, sugar sorghum, sorghum- Sudanese hybrid, broom sorghum, perennial sorghum and Sudanese sorghum.

The root system of sorghum is well developed, twining and spreads to a depth of up to 300 cm and to the sides for 100–120 cm. Sorghum germinates with one root, and with the development of the root system, it can form aerial roots from the lower aerial nodes.

A well-developed root system efficiently absorbs soil moisture, even that which is unavailable to other crops. In addition, sorghum's resistance to drought in the period of high temperatures in July and August ensures the formation of a waxy layer on the leaves and stems of plants.

The stem of sorghum in low-growing forms reaches a height of 1 m, in tall forms – up to 3.5 m, and in tropical regions and under irrigation it can grow as high as 5–7 m. Early-ripening varieties form about 7–10 internodes on the main stem, medium-ripening ones – 11 -15 and late ripening – 16–25 internodes. The length of the internodes varies depending on the height of the stem and can be from 0.4 to 2.1 cm in the lower part of it and up to 45 cm in the upper part.

The stalks of sugar sorghum contain approximately 80–90% juice when ripening. The juice contains both simple and complex sugars, but the highest concentration of sucrose in the stems is in the phase from waxy to full ripeness of the grain. At this time, simple sugars are converted into sucrose.

Sorghum leaves are large, 50–100 cm long, covered with a wax coating, often with anthocyanin color. In conditions of moisture deficiency, the leaves are covered with a waxy layer that prevents excess evaporation.

The cells of the stomata have a dense membrane, due to which they are not damaged when they are closed in case of moisture deficiency. That is why plants retain the ability to restore vital activity even during prolonged drought. That is why under such conditions they enter a state of anabiosis, able to resume growth and development even after a two-week drought.

The sorghum inflorescence is a panicle, the axis of which can be from 3 to 50 cm long, straight or bent, and when branching forms side branches of the first, second and subsequent orders. At the ends of the branches of the inflorescence are two or three spikelets, one of which is sessile bisexual, fertile, the others are barren, male or sterile.

Grains can be bare or membranous, round, oval, elongated-oval, ovoid in shape. The mass of 1000 grains is 20–40 g, and the number of grains from a panicle is from 800 to 3000.

The duration of the growing season in different types and varieties of sorghum ranges from 75 to 150 days. It is generally accepted to grow precocious varieties in the north, and varieties with a long growing season in the south, because the sorghum yield depends on the duration of the growing season.

The critical phases of sorghum development to high temperatures fall on the period of development of its vegetative part. Thus, resistance to drought during the growing season of the development of the generative part – from the beginning of the ejection of panicles to maturity – is significantly higher, compared to the first phases of the culture's development.

A variety or hybrid correctly selected for growing conditions plays a significant role in the formation of a high level of productivity of sorghum crops. Thus, an important condition for increasing the level of productivity of sugar sorghum is the introduction into production of new high-yielding varieties and hybrids.

As of 2019, 21 varieties and hybrids exclusively of sugar sorghum have already been registered in the State Register of plant varieties suitable for distribution in Ukraine, of which 14 belong to domestic breeding.

Compared to the last decade, interest in varietal crops has increased significantly, and in particular, in sugar sorghum. Thus, an important measure of the intensification of demand for varieties and hybrids of sugar sorghum is the increase in the share of foreign selection in the structure of the register of plant varieties caused by the increase in demand for the cultivation of this crop. Considering the fact that the situation in the field of animal husbandry has not changed in general and the number of cattle has not increased, the main area of use of sugar sorghum remains the food industry and processing it into biofuel.

Varieties and hybrids of domestic selection are mainly represented by high-yielding genotypes capable of forming both large volumes of biomass – 72.3–98.7 t/ha – and relatively small biomass with a high content of sugars in the juice – Honey $F_{1.}$ Therefore, they can be successfully grown not only for green fodder, but also for processing into bioethanol and solid fuels.

NUTRITION OF NICHE CROPS: SORGHUM, CHICKPEAS, BEANS

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Niche crops are calleding niche crops because they are not sowning everywhere. Therefore, our farmers often have little experience with growing technologies. Moreover, everyone adapts the scheme of protection, processing and fertilizing at their own discretion, based on outdated data or advice from colleagues. However, here you can make a mistake: if you apply too much – you will spend excess funds, if you do not apply enough – you will reduce the yield, if you apply nitrogen without sulfur – there will be no overall result. This is the topic of feeding niche crops

Sorghum is a heat–loving and drought–resistant plant. Maximum growth is observing at a temperature of 20–30°C. Nevertheless, the culture does not tolerate any frost in any phase of its development. You need to be careful with the timing of sorghum sowing – you do not need to rush. During the period of unfavorable conditions, the plant falls into an anabiotic state and waits until the conditions change.

Soil requirements of sorghum. Sorghum is completely undemanding to soils. It can grow both on depleted, light sandy and clay soils. The main condition is good aeration (saturation of the earth with air).

At the same time, this plant does not tolerate cold, waterlogged, and acidic soils. Sorghum is useing for the development of virgin and reclaimed lands. The plant has a very powerful root system and gives good crops for 2–3 years on impoverished and exhausted land.

Moisture requirements. The amount of water required for swelling of sorghum seeds is approximately 35% of the total weight of the seeds. For example, 40% is required for corn, and 60% for wheat.Sorghum consumes 300 parts of water, corn – 340, wheat – 515, oats – 600, peas – 730, and sunflower – 1200 to form a unit of dry matter.

Nutrient requirements of sorghum. Nitrogen. Nitrogen rates for sorghum are almost identical to those for corn. The total dose should be dividing into 2 parts: the first should be appling in the pre–sowing treatment, and the second – during the vegetation of the plant. It is not necessary to increase the amount of nitrogen. Moreover, if the vegetation process is going well, then, on the contrary, nitrogen can be reducing. There are two growth stages when nitrogen deficiency can significantly affect yield. The first stage is observing 30 days after emergence, when sorghum enters a period of rapid growth and begins to form the potential number of grains. Therefore, nitrogen must be enough for this process. The second – occurs at the stage of emergence into the tube or about a week before earing, when nitrogen contributes to good pollination and grain filling.

Phosphorus. It should be appling only on depleted soils with a low pH value. If the acidity of the earth is less than six or more than eight, then phosphorus cannot be appling. Potassium. Most of the soils of Ukraine do not show a deficiency of this element. Nevertheless, if the analyzes revealed a lack of potassium, then it is necessary to apply the same amount as for corn. Sulfur. If the soil analysis showed a low value of the element, then it should be appling. The ratio of nitrogen to sulfur should be about 15 to 1.

Chickpeas. The culture is heat loving. Chickpea seeds begin to germinate at a temperature of 3–5°C. It can withstand short–term frosts down to –10°C, but during the flowering period, the optimal temperature should be 24–28°C.It has early ripening varieties (90 days of vegetation) and late ripening varieties (150–220 days).

Feeding chickpeas. Nitrogen. Chickpea is a legume. It responds well to inoculation and does not require special nutrition with nitrogen fertilizers. Phosphorus. Unlike nitrogen, chickpeas have a high need for phosphorus. Phosphorus promotes the development of a large and strong root system, promotes germination and good development of nodules, which leads to increased nitrogen fixation. Phosphorus is not a mobile element, so it should be appling by banding; the phosphorus application rate is approximately 22 kg/ha on depleted soils. However, the amount of fertilizer decreases with a lack of moisture. Potassium. Usually, chickpeas do not need additional potassium. However, it should be applied when there is a shortage in the soil. Sulfur. If the soil analysis shows that the level of sulfur is low, then it should be appling in the form of ammonium sulfate. You must be preparing for the fact that the sulfur you introduced will be available only after a season. Micronutrients are not adding to chickpeas. An exception is only when there is an acute shortage of them in the soil.

Bean. For beans, it is very important to properly prepareing the soil. It should be as level as possible. Bean pods are located very close to the soil and particles of earth can be capturing when harvesting. The soil under the beans must be treating with an herbicide. It is also very important to choose the right inoculant. It affects the increase in productivity. Peat inoculant is most often used.

It is also important to sow beans in moist soil so that the seeds can swell and give healthy roots. Two weeks after germination, the field is treating with an insecticide. If the humidity of the beans is 17–18%, then desiccation should be carring out before harvesting.

Application of fertilizers under beans. Nitrogen.Applying a large amount of nitrogen fertilizers under beans is impractical. However, if there are problems with inoculation, then it is necessary to give no more than 50 kg/ha of fertilizer. With an excess amount of nitrogen, white mold may appear on the beans. In general, in many cases, you can do without nitrogen fertilizers.

Phosphorus. This element is applied in the maximum amount from 20 to 40 kg/ha, if the value according to the available phosphorus analysis is less than 19 mg/kg. If it is more, then phosphorus does not need to be givening at all.

Potassium. It is appliing in quantities from 20 to 60 kg/ha, depending on the soil analysis you received. If there is more than 25 mg/kg of potassium in the ground, it cannot be appling.

Sulfur. If the value of sulfur is less than 6 mg/kg, it should be applied in the form of ammonium sulfate at the rate of 10 kg/ha. The necessary trace elements for beans are zinc and iron. They can be givening foliarly (on leaves) – this is the best way to cover the deficiency.

ECONOMIC IMPORTANCE AND DISTRIBUTION OF FIELD PEAS

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One of the important directions of the successful development of the latest agricultural technologies in crop production is the creation of highly productive agrocenoses of leguminous crops, which make the most complete use of the bioclimatic resources of the region. Leguminous crops are the main and extremely important source of vegetable protein and solve the biological and ecological problems of modern agriculture in Ukraine.

Peas are one of the oldest agricultural crops. It comes from the countries of Central, Eastern and South-Eastern Asia (Iran, Transcaucasia, Turkmenistan), where it's small-seeded species were grown. In the Mediterranean countries (Spain, Italy, countries of the Balkan Peninsula), this culture was known for 4–6 thousand years BC. In Ukraine, large-seeded peas began to be grown in 500 BC, as evidenced by archaeological excavations conducted near Kharkiv.

Peas have high nutritional and fodder qualities [81]. Pea grain contains from 16 to 36% protein, starch, sugars, fat, vitamins (A, B_{1}, B_{2}, B_{6}, C, PP, K, E), carotene, minerals (salts of potassium, calcium, manganese, iron, phosphorus), up to 54% of carbohydrates. The amount of ash in pea seeds fluctuates significantly and depends on the soil, agrotechnical methods of their processing and climate. The average ash content is from 2 to 5%, as in cereals, 75% of ash consists of phosphorus and potassium. Unlike cereals, pea ash contains less magnesium, but more calcium and especially sulfur. The fat content is small – in the range of 2–3% and it varies slightly in different varieties of culture. In seeds, fat is mainly in the germ.

Pea protein is complete in terms of amino acid composition and is absorbed 1.5 times better than wheat protein. It contains 4.66% lysine, 11.4% arginine, 1.17% tryptophan (from the total amount of protein), while wheat protein contains only 2.32% lysine and 3.56% arginine. This is its value not only as a food product (high taste qualities), but also as a dietary and medicinal product. It helps to remove salts from the body. 100 g of its grain contains 491 kcal (wheat contains 457 kcal). Protein is about the same as in raw meat. 1 kg of grain contains 1.17 feed units, 180–240 g of digestible protein, 15.2 g of lysine; 3.2 g of methionine.

The chemical composition of pea grain, when compared with other leguminous crops, in terms of protein content (based on 100 g of mass as a percentage) is somewhat lower than that of lupine, soybean, sorghum, fodder beans and lentils and varies between 20–35%, while in lupine, these indicators reach 30–48%, and soybeans – 30–50%. The fat content in pea grains is 1.3–1.5%, which is 10 times less than that of soybeans. The most fiber can be contained in lupine grains – from 11.0 to 18%, while in beans 5.0 – 7.1%, in peas these indicators range from 3.0 to 6.0%. The indicator of the ash content in the grains of leguminous crops is almost the same and is 2.0–4.9%, except for soybeans – for this crop they are from 4.5 to 6.8%.

Today, peas are growning on all continents, and their sown areas occupy about 7 million hectares. On the globe, among leguminous crops, it ranks fifth after soybeans, beans, peanuts and chickpeas. For European countries, peas are the main leguminous crop, which is grown for food and fodder purposes on an area of about 3 million hectares. In Ukraine, the area sown under peas has decreased significantly in recent years. Among the reasons for the decrease in pea production, we can name both some biological properties of the culture (tendency to lay down and shedding of seeds, strong, when compared with other crops, suppression by weeds, significant damage by pests and diseases, low reproduction ratio), and objective factors (lack of technological varieties and equipment for harvesting, reduction of the number of agricultural animals). The largest pea sown areas are concentrated in the Forest Steppe and make up 55% of the total sown area, in the Steppe – 25% and in the Polissia – 20%. From 2010 to 2020, indicators of the total area of pea crops in Ukraine decreased significantly and ranged from 191,000 hectares (2013) to 405,000 hectares (2017), compared to 1,148.2 hectares (1992).

According to the results of the 2020 harvest, the average yield of peas in Ukraine was 2.16 t/ha. Having analyzed the mentioned indicators in each oblast, it can be stated that the farms of Chernihiv (34.0 t/ha) and Khmelnytskyi (33.0 t/ha) oblasts became the leaders. Poltavshchyna (32.0 t/ha), Vinnytsia (30.0 t/ha) and Sumy (29.0 t/ha) also demonstrate higher crop yield indicators.

The lowest yield of peas was recorded in Chernivtsi, Ivano-Frankivsk and Rivne regions, where the indicators were less than 10 t/ha. In 2020, there were no pea crops in Zakarpattia Oblast.

In the same year, the analysis of data on the gross collection of this crop proved that the most peas were collected in the agro-formations of Zaporizhia (134,000 tons), Kharkiv (50,000 tons), and Donetsk (43,000 tons) oblasts. Dnipropetrovsk region and Mykolaiv region were in fourth and fifth place, where 41 and 33 thousand tons of beans were threshed, respectively.

The symbiosis of modern intensive varieties of leguminous crops and strains of nodule bacteria leads to an increase in plant productivity by 10–30%. The symbiotic system of pea plants remains active during all phases of growth. Biological nitrogen, which is assimilated during the growing season of legumes, is environmentally safe and improves soil fertility.

During the growing season, peas, depending on the yield level, leave with straw and plant residues approximately 60–90 kg/ha of nitrogen, 15–20 kg/ha of phosphorus, and 20–30 kg/ha of potassium. It is a good phytosanitary, improves soil structure and increases its fertility.

The increase in the volume of pea production is due to several reasons, first, good export demand for the crop at relatively high prices. The world production of peas is in the range of 11–12 million tons. The largest producer is Canada, which produces more than 3 million tons of peas per year. In second place is France (about 1.5 million tons), powerful world producers are China and Russia (with production volumes at the level of 1.2 million tons), India (800 thousand tons), followed by Germany (400 thousand tons). Tons) and Great Britain (200 thousand tons). It is clear that these figures fluctuate from season to season. The main suppliers of peas to the export market include Canada, France, Australia and SINA. The largest importers of products are Spain, India and Bangladesh. Italy, China, Cuba, Germany, Pakistan and other countries buy peas on the world market. Considering that the domestic consumption of peas in Ukraine does not exceed 200 thousand tons, more than 500 thousand tons of legumes can be exported.

In 2017, the profitability of this industry in Ukraine was only 10%, while a year earlier it was 80%. In particular, since 2016, domestic producers have been increasing their volumes annually, and in recent years they have shown an almost two-fold increase in production – 573 thousand tons were produced, and in 2017 – 1097.8 thousand tons. At the same time, the cultivated area under cultivation in 2017 was 405 thousand hectares, and in 2018 – 431.7 thousand hectares.

At the beginning of 2018, for the first time on the domestic market, peas (the price per ton in Ukraine reached a minimum) began to cost less than wheat. The export potential of the record harvest of 2017 was not fully realized, so the stocks at the end of the period were excessively high. Competing countries were able to push Ukrainian producers out of the international arena due to lower prices. The situation was further complicated by the sharp increase in the production of leguminous crops in India itself and, in addition, by the introduction of customs duty in this country – imports decreased almost 10 times. As a result, Ukraine's share in world pea production fell to 4%.

However, along with the obvious advantages of peas, there are also disadvantages. Its yield is lower than that of grain crops, although under favorable weather conditions and protection from diseases, pests and weeds, it can form a yield of up to 3.5–6.0 t/ha. Legumes are sensitive to unfavorable phytosanitary conditions in crops, which significantly affects the elements of the crop structure.

Modern technologies for growing peas are the basis of the precise application of appropriate agrotechnical operations for the care of crops in certain microstages according to the BBCH scale.

Scientists have proven that knowledge of the biological features of the stages of pea development plays a crucial role in ensuring a high level of its productivity. Our task was to study the reaction of varieties to different doses of mineral fertilizers and growth regulators, which to some extent depend on the growth stages of pea plants.

ECOLOGICAL AND BIOLOGICAL CHARACTERISTICS OF GRAIN SORGHUM

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This ancient and widespread culture got its name for its tallness from the Latin word Sorghums, which in translation means to rise. It has a great ecological and geographical diversity, which is still difficult to classify due to the large number of intermediate forms. Sorghum belongs to the cereal family, the genus Sorghum, has many species and varieties and is polymorphic, because along with cultivated ordinary sorghum, it also includes a number of its wild species (herbaceous), of which only Sudanese grass and sorghum (perennial) are cultivated..

The All-Union Research Institute of Plant Breeding named after academician M. I. Vavilov carried out the development of sorghum taxonomy. According to the classification proposed by him, the existing ecological and geographical diversity of cultivated sorghum plants can be divided according to the method of their main use into economic groups – grain, sugar, and vine and grass sorghum. This classification did not cover all the ecological and geographical diversity of grain sorghum, which turned out to be more significant and diverse than other economic groups of sorghum. Therefore, E. S. Yakushevsky into a number of species, taking into account their geographical distribution, family ties with wild relatives, and the presence of common characteristics and properties, divided the polymorphic species – common sorghum.

Thus, Guinea grain sorghum is growning in the countries of West Equatorial Africa, Kaffir grain sorghum – in the countries of South Africa. Grain sorghum is cultivated in the countries of Northeast Africa, India, Central and Eastern Asia, and Chinese grain sorghum (sorghum gaolian) is grown in the countries of East Asia (China, Korea, Japan, etc.).

An important feature of sorghum, which distinguishes it as a valuable crop for arid regions of the country, is the ability to form nodular roots in the over dried layer and, breaking through it, reach moist soil. Basal internodes are very short, others are longer – from 5 to 40 cm or more, depending on the variety and growing conditions. The drought resistance of the culture is due to the ability of the stomata of the leaves to restore normal activity after a lack of water, ensuring the maximum rate of photosynthesis, which, in combination with a powerful root system and the ability to reflect a large amount of heat (gray-white coating on the stems and leaves), makes the plant very drought-resistant.

The shape of rod panicles they are cylindrical, oval, rounded, egg-shaped, pyramidal, etc., and stemless – spreading and drooping, distinguishes lumpy panicles. In addition, the grain of many filmy varieties of sorghum contains tannin glucosides, which protect the seeds from mold under adverse germination conditions. In the lower part of the panicle, the grain has a smaller mass of 1000 grains, in the middle and upper part of it – the most complete grains, but in the upper part (in most varieties) they are somewhat inferior in weight to the seeds from the middle part of the panicle.

The rate of emergence of sorghum seedlings is influenced by humidity, soil density and depth of seed wrapping. However, soil temperature is crucial. The relationship of sorghum to low temperatures dictates the timing of its sowing. Sorghum belongs to late spring crops and is sowning when the average daily soil temperature at a depth of 10 cm reaches +14...+16 °C. In the flowering phase and at the beginning of ripening, frosts at -1 °C are dangerous for sorghum [22, 54]. The greatest need for heat in sorghum is observed in the germination period – panicle ejection – 1400–2100 °C, the smallest – in the sowing-emergence period – 243–297°C. However, the total temperature does not give a clear idea of the heat requirements of sorghum plants, especially since the same amount can be different in different years.

The first signs of economical use of water appear already during the germination period. So, the amount of water required to swell sorghum seeds is only 35%, corn – 40%, wheat – 60% of their own weight.

The high degree of drought resistance of sorghum is associated with the power and absorption capacity of the root system, the peculiarity of the leaf surface, the structure of the stomatal apparatus and the dense epidermis.

A characteristic feature of sorghum is the ability to suspend its growth during particularly unfavorable conditions for growth and development, and as it were, freeze for a while, remaining in an anabiotic state until favorable conditions occur. Drought resistance of sorghum also increases because in the period of high temperatures, when it throws out panicles, a white waxy coating is released on the leaves and stems, which protects the plants from severe overheating and evaporation. Therefore, this property of sorghum allows it to be widely and effectively grown under rain fed and irrigated conditions.

Sorghum can withstand the increased concentration of salts in the soil solution, because it is able to grow and develop normally at a concentration of salts in the soil twice as high as corn requires. It is possible to grow this culture on almost all soils, except for swampy ones, with a close occurrence of groundwater.

Sorghum forms a large biomass of plant residues, which ultimately enriches the soil with organic matter and performs the role of phytomeliorants. On average, sorghum annually leaves 62.7 tons of crop and root residues per hectare, which contained 7.6 tons of nitrogen and 8.08 tons of sugar per hectare. After wheat, these indicators are respectively 18.6; 2.6 and 0.07 c/ha.

ІСТОРІЯ ПОХОДЖЕННЯ ТА ПОШИРЕННЯ КАРТОПЛІ

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Картопля має велике господарське значення, оскільки вона є важливою культурою для харчування людей та тварин, а також використовується для виробництва різноманітних продуктів.

Серед способів використання картоплі можна виділити споживання картоплі в їжу, використання в якості корму та виробництво крохмалю.

Картопля є однією з найбільш поширених культур в світі. У світі картопля вирощується практично в усіх країнах, але найбільшими виробниками є Китай, Індія, Росія, США, Україна, Німеччина, Польща, Нідерланди та Франція. Картопля є основною культурою для харчування людей в Європі, Азії та Північній Америці.

Україна також входить до переліку країн зі значним обсягом вирощування картоплі. За даними Державної служби статистики України, у 2020 році загальна площа, засіяна картоплею, становила 288,3 тис. га, а виробництво – 22,9 млн тон. Найбільші області–виробники картоплі в Україні – Тернопільська, Житомирська, Волинська, Полтавська та Хмельницька області.

Картопля має досить цікаву історію свого походження та поширення.

Картопля походить з Південної Америки, де вона була вирощувана тисячоліттями корінними народами. Імперія інків використовувала картоплю як основну культуру і навіть вважала її священною рослиною. Інкам вдалося зберегти багато різноманітних сортів картоплі завдяки їх методам зберігання та селекції.

У Європу картоплю привезли в XV столітті колумбійські мандрівники, які під час своїх подорожей здобули цю рослину в Перу. Спочатку картопля не була популярною в Європі, і її вирощували виключно як декоративну рослину, тому що вона мала дуже привабливі квіти. У Франції в кінці 18 століття картопляні квіти носили у волоссі, робили з них букети.

У Німеччині вирощували картоплю на клумбах перед палацами. Про те, що у картоплі можна їсти лише бульбу, багато хто спочатку навіть не здогадувався. Крім того, рослину вважали отруйною, тому що вона належать до родини пасльонових, яка містить отруйні рослини, такі як білена, ядовита мандрагора та інші. Лікарі вважали картоплю переносником прокази і причиною помутніння розуму. Тому люди вважали, що картопля може бути небезпечною для споживання. Так, у Франції лише в 1771 р. Паризька медична академія визнала, що бульби не є небезпечні для споживання.

В кінці XVI століття картопля стала популярною в Ірландії, де вона стала важливим джерелом їжі для бідних фермерів. Оскільки Ірландія мала важкі соціальні та економічні проблеми в той час, картопля дозволила забезпечити життям багатьох людей.. Картопля мала багато переваг, зокрема, вона легко зберігалася взимку, була дешевою і могла вирощуватися на поганій якості ґрунтах, що робило її цінною культурою для бідних фермерів. Пізніше вона розповсюдилася по всій Європі

У XVIII столітті картопля стала важливою культурою в Європі, а потім в Америці та інших країнах світу. З тих пір картопля стала однією з найбільш поширених культур у світі.

В Україні картоплю стали вирощувати з XVI століття. В Україні її вперше посадили в 1805 році в Харківській губернії. Запорізькі козаки знали картоплю, але як трофей, який вони здобували в походах. На територію Українських Карпат потрапила з Австрійської Імперії та довгий час не сприймалася місцевим населенням. Свободолюбиві гуцули сприймали її як спосіб прив'язати їх до землі та зробити землеробами. Тут почали культивувати її аж з кінця XIX століття. У Російській Імперії картопля почала поширюватися у першій половині XVIII століття за наказом Петра I, який заохочував споживати її для знищення епідемії цинги, що дало з часом позитивний результат. Хоча звиканню людей до нового продукту передувала ціла низка так званих "картопляних" бунтів. Вона стала важливою культурою для українського народу, оскільки вона дозволяла вирощувати їжу на більшу кількість людей в складних історичних умовах. З тих пір картопля стала невід'ємною частиною української кухні та господарства.

GRAIN PRODUCTION AND ITS IMPORTANCE IN THE ECONOMY OF UKRAINE

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In today's world, such basic resources as drinking water, grain and oil determine the country's development prospects. Ukraine has unique conditions for the development of grain production, since it is the grain sector that is the basis for most branches of the agro-industrial complex and significantly affects the well-being of the rural population, the development of rural areas and the state in general. The grain industry is one of the most important in the agricultural sector of Ukraine, the products of its processing are of strategic and extremely important importance for the country. Grain prices determine the prices of bread, pasta, confectionery, dairy products, meat, eggs, etc. Grain production is crucial for the development of all branches of agriculture; it is a raw material for the processing industry, an important export product that can provide significant foreign exchange earnings.

Increasing the competitiveness of agricultural enterprises as a strategic direction for solving the problems of food security in Ukraine and the development of rural areas is impossible without the identification and further development of priority industries that express the economic policy of the state, which is being formed for a long period. The formation of the mechanism of profitable management in the agro-industrial complex should be based on uniform principles and the orientation of all its areas to achieve highly efficient production results.

The grain sector of Ukraine is a strategic branch of the state's economy, which determines the volume of supply and the cost of the main types of food for the country's population, in particular grain processing products and livestock products, forms a significant share of the profits of agricultural producers, determines the state and trends of the development of rural areas, forms the foreign exchange earnings of the state export account. The grain industry is the basis and source of sustainable development of most branches of the agro-industrial complex and the basis of agricultural exports.

Grain production was and remains the leading branch of agriculture in Ukraine. Cereal crops annually occupy more than half of the total sown area, and, as a result, the technology of their cultivation significantly affects the level of agricultural technology of other crops and agriculture in general, and the economic efficiency of the entire agro-industrial complex.

In recent years, Ukraine has become one of the world leaders in grain production and export. Favorable weather conditions in 2008 – 2010 made it possible to harvest record crops – more than 53 million tons in 2008, and 49 million tons and more than 45 million tons in 2009 – 2010, respectively. Ukraine's internal needs are 26–27 million tons, therefore, at least 23–27 million tons are subject to export.

The production of grain crops and their sown areas traditionally occupy leading positions in the structure of agricultural production. It should be noted that the areas sown under grain crops, in particular wheat and barley, as well as their grain yield levels, vary depending on the year of cultivation.

The correct definition of the structure of sown areas directly affects the efficiency indicators of grain production and depends on the soil and climatic conditions of the region and the specialization of the farm.

The main and fundamentally important way to increase the gross harvest of grain crops is to increase the yield of their grain. Unfortunately, in recent years, the grain yield of winter wheat and spring barley has decreased. According to the State Statistics Service of Ukraine, as of October 1, 2020, the harvested area of grain and leguminous crops in Ukraine amounted to 10.9 million hectares; with a grain yield of 3.64 tons per hectare, the volume of production amounted to 39.7 million tons.

The main grain crops grown in Ukraine are winter wheat and spring barley. As of October 1, 2020, the area of the harvested spring barley crop was 236,000 hectares, the volume of production was 78.1 million tons, and the grain yield was 3.3 tons/ha.

The level of production and rational use of grain is a determining indicator of the state of agricultural development and the state of the economy of the state as a whole. It directly affects the material well-being of the population. World grain production is increasing due to the expansion of cultivated areas, but the decrease in ending stocks contributes to the increase in food prices. Cereal consumption is also increasing. As for Ukraine, the consumption of food products made from grain is decreasing, which is connected with the decrease in the population of the countries. According to the information of the State Committee of Statistics of Ukraine, there is a tendency to reduce the consumption fund of bread products. Thus, in 2010, the specified fund decreased by 39.1 thousand tons, the level of consumption per person decreased from 124.9 kg/year to 111.3 kg/year in 2000.

The strategic direction at the current stage of development of the grain sector of Ukraine is to increase the production of high-quality food grain. The problem of increasing the volume of grain production in the country is solved first by increasing the yield levels, but along with the main task of increasing the gross harvest, the improvement of the baking qualities of the grain is no less important.

Wheat is one of the main cereal crops in the world. In the structure of production, its share in recent years is at the level of 33–39%. According to WHO /FAO data, the world production of wheat is more than 650 million tons, while about 2.9% (more than 19 million tons in 2011) of wheat is produced in Ukraine. About 70% of wheat is used for the production of various food products, such as bread, bakery products, cereals, pasta, etc.

Winter wheat has always been and remains one of the leading grain crops in Ukraine, occupying 40% of the grain acreage and forming 45–50% of the country's gross grain harvest. Agricultural enterprises, farms and private households are engaged in the production of winter wheat grain in Ukraine. In 2010, agricultural enterprises accounted for 73.1% of produced grain, farms – 5.9%, and households – 21.0%. This is the most valuable and most widespread grain food crop of breads of the first group. There are three civilizations that were formed on the basis of the three most important grain crops – wheat, rice, and corn. More than half of the world's population uses wheat grain for food purposes.

ІСТОРІЯ ТА ПОШИРЕННЯ КОНОПЕЛЬ

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Коноплі є однією з найдавніших технічних культур людства. Вироби з неї відомі ще з 1 тисячоліття до н. е. Міцні конопляні стебла спочатку використовували для плетіння мотузок. Потім навчилися виготовляти з волокон тканини, а з тканин – одяг. Зрештою з конопляного насіння почали виробляти олію, рослинне молоко, готувати гарніри та навіть протеїн для спортивного харчування, який легко засвоюється (вміст якого більший ніж у льоні та чіа). Щоб підвищити поживну цінність корму для тварин, можна додати насіння під час його виготовлення.

З волокон конопель, які називають пенька або пеньок, люди впродовж багатьох століть виготовляли, канати, троси, мотузки та навіть якісну мішковину, яка цінується до сьогодення.

Вироби із конопель мають високу стійкість до солоної води, що ціниться в морській справі. Деякі історики повідомляють, що у Китаї культуру використовували вже 5 - 6 тисяч років тому, а в Єгипті її виробництво було популяризоване для людей. Назва конопель відома ще із шумерських текстів, де було зафіксовано її першу назву як «кунібу». Часто її перекладають як «димна», натякаючи на те, що цю траву ще й палили. Із джерел відомо, що іменні Шумери розповідали, як до них потрапила ця культура, тобто можна зрозуміти – коноплі були завезенні з далекої «країни за горами». З географічного розміщення легко можна здогадатися швидше за все це був Іран або ж Середня Азія.

Степові племена, які отримали цю культуру не до кінця розуміли її значення та назву. В Шумерів коноплі могли запозичити й китайці. Хоча самі китайці стверджують, що культивували цю рослину самостійно, ще й навчили сусідів її вирощувати.

Таким чином, можна вважати, що родом дана рослина з Центральної Азії. Далі саме звідси конопля поширилася на схід: в Індію і Китай. З Індії коноплі перекочувала в Північну Африку і в Іспанію, звідки мореплавцям потрапила в Америку.

Сільськогосподарська культура коноплі має багату історію використання людством в якості їжі – переробка насіння в харчову продукцію, технічного матеріалу – для виготовлення з волокна ниток, паперу, одягу, оскільки стебла рослини складаються з вельми міцних волокон, а також в якості наркотичного засобу.

Східна культура зберігає найбільш архаїчні письмові свідчення про коноплі. Гашиш в стародавньому Китаї використовувався як знеболювальний засіб і числився в аптечці імператора Шен- Нуна (2737 р. до н.е.) як ліки від захворювань горла. XV в. до н. е. датовані свідоцтва китайських лікарів про вживання конопель як засобу, що знімає болі ревматичного характеру і подагри. Трохи пізніше канабіс стали використовувати як ліки від нервових розладів.

В добу середньовіччя коноплі були найпоширенішими серед ткацьких культур. Їхня сировина мала велике значення в мореплавстві, а саме для виготовлення канатів. Із стебел та насіння можна отримати екологічно чистий бензин, який не виділяє сірку та інші забруднюючі речовини. На жаль, питання збереження екології Планети було не нагальним на той час.

Ще одним випробуванням, яке в прямому сенсі впало на людство, – засмічення пластиком навколишнього середовища. Вирішення проблеми було запропоновано ще 1998 року хіміком Полом Бенхаїмом, який розробив технологію виготовлення пластику з додаванням конопель. Продукти з такого пластикового матеріалу міцні та довговічні, а головне вони повністю розкладаються та переробляються.

На територію сучасної України коноплю була занесена скіфами не пізніше V століття. Коноплі мали велике промислове значення з XV по початок XX століть, в даний час посіви значно скорочені. Єдина Конвенція ООН 1961 р. включає коноплю в список рослин з наркотичним вмістом і зобов'язує уряди країн-учасників строго контролювати її вирощування.

Галузь коноплярства в Україні має глибокі корені. Саме ж коноплярство на даний час можна визначити як галузь рослинництва, що займається вирощуванням конопель, стебло яких є джерелом цінного волокна, а насіння – унікальної харчової складової.

Сьогодні у багатьох країнах набирає обертів процес легалізації медичного канабісу, який допомагає від спазмів та судом м'язів, пригнічує біль та лікує анорексію. Особливої актуальності цей проєкт набув через повномасштабне вторгнення, яке серйозно вплинуло на психологічне здоров'я, ПТСР, багатьох українців. Влітку минулого року на розгляд Верховної Ради України було подано законопроєкт про легалізацію медичного канабісу, рішення було відкладене. У Монреалі, яке є другим за величною містом Канади, людям, які страждають на тяжкі захворювання, зокрема хворобу Альцгеймера, глаукому та сильний хронічний біль надають допомогу в клініці Santé Cannabis.

ВПЛИВ ТРАВМОВАНОСТІ НАСІННЯ ПШЕНИЦІ ТА ІНШИХ ЗЕРНОВИХ КУЛЬТУР НА ЙОГО ПОСІВНІ Й УРОЖАЙНІ ЯКОСТІ

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Тенденцією останніх десятиріч є підвищення рівня механізації сільського господарства. Це стосується усіх рівнів виробництва: від посіву до зберігання та переробки. Головною ідеєю механізації є зменшення затрат людської праці та пришвидшення процесів виробництва. Але поруч з цим з'явилася проблема пошкодження зокрема рослин в полі при їх обробці та насіння при збиранні та переробці. Воно також спричинене іншими факторами, зокрема, пошкодженням шкідниками та хворобами, а також впливом навколишнього середовища.

Прийнято поділяти травми насіння на на макро і мікро травми. Макротравми включають повне або часткове відбиття зародка, сім'ядолей, ендосперму, оболонок насіння. Мікротравми неможливо помітити неозброєним оком і включають омертвіння тканини насіння, раннє відчуження насінини від рослини без утворення роздільної тканини, внутрішні розтріскування насіння, вм'ятини.

Шкідники можуть травмувати насіння із інтоксикацією (такі як клопи) та без (гризуни та інші шкідники які в більшості викликають мікропошкодження). Екологічне травмування виникає внаслідок дії на насіння змін погоди: сонце – дощ, мороз – посуха.

Усі ці травмування так чи інакше впливають на посівні якості насіння. До цих показників відносять чистоту, вологість, енергію проростання насіння, лабораторна схожість, маса 1000 насінин. Інший показник схожості – польова, на яку крім якості посівного матеріалу впливають і параметри ґрунту та глибина загортання насінини.

Отож, як сказано вище – пошкодження може відбуватися на різних рівнях виробництва і залежно від типу травмування і стадії коли воно може проявитися будуть різні ефекти на майбутню рослину. Наприклад, висіявши пошкоджене насіння ми можемо отримати закручення проростка і як наслідок – суттєве зменшення продуктивності насіння. Також не слід забувати що в пошкоджені оболонки насінини заселяються грибки, які в цей період призводять до її повної втрати. Якщо говорити про цифри, то травмоване насіння може втратити від 15 до 30% польової схожості, а якщо перевести це на урожай, то при 10% пошкодженого насінєвого матеріалу втрата врожаю близько 1 ц/га.

Найбільше пошкоджень насіння отримує при обмолочуванні. Звісно, при використанні найсучасніших агрегатів і машин кількість пошкоджених насінин значно падає, але вплив мають такі фактори як фаза розвитку рослини, вид та сорт культури, якість налаштування комбайну та банально людський фактор недбалості. Параметри комбайну, серед яких величина обертів барабану, швидкість подачі маси в молотильний апарат, зазор між барабаном і підбарабанням, налаштування системи відведення полови, соломи є основними на які можна вплинути в процесі збирання зерна. Також механічні пошкодження дуже впливають на зберігання насіння. При тривалому зберіганні такого насіння його лабораторна схожість знизилась на 60–90% (відносно контролю, який був не пошкоджений, його схожість зберіглась на рівні 96%).

Ще одним важливим показником насіння є його хлібопекарські та технологічні характеристики, які теж сильно падають при пошкодженнях зерна.

Але все ж таки, найбільший вплив на якість насіння при обмолоті має вологість під час збору врожаю. При нормальні вологості 10,3-15% лабораторна схожість 93%, при вологості 17-29% - лабораторна схожість уже 85%. Комбінація правильної вологості і налаштування зернозбиральної машини забезпечує високий рівень збереження врожаю як при прямому так і при роздільному комбайнуванні.

Необхідно зазначити, що пошкодження під час транспортування, переробки, обробки зерна теж відіграє велику роль у якості насінєвого матеріалу, адже із поля воно може поступати чудовим, а в разі невірної техніки переробки, зберігання, транспортування його якість може погіршитись на складах. Якщо конкретніше, то окрім механізмами збиральних машин, зерно може пошкодитись при проходженні решітного стану, скребкових, шнекових, стрічкових, ковшових транспортерів, механізмів післязбирального оброблення зернового вороху, підготовлення насіння, транспортувальних і завантажувальних засобів, а також технічних засобів протруювання та сівби. І до речі, за даними досліджень, сучасні збиральні апарати можуть травмувати зернівки в меншій мірі чим під час доробки і підготовки насіння. Але перше залежить від другого, тобто чим більше насіння пошкодилось при збиранні, тим гірше буде під час подальшої обробки. Що гірше – це потім нашаровується, тобто чим більше насіння проходить циклів обробок – тим більше буде з'являтися дефектних насінин через порушення процесів і технологій збору-переробки початкових етапів. Також може здаватись, що насіння яке було деформоване під час переробки – відновилось. Так, таке можливо через пружні і пластичні властивості зерна, але внутрішня структура змінена безповоротно, якість уже не повернути. Практичним шляхом доведено, що деформація зернівки всього на 0,5 мм уже знижує лабораторну схожість на більш ніж 30%. Якщо згадати багаточисленні транспортери, якими облаштовані усі зерносховища та споруди зернопереробки, то дослідженнями науково-дослідного інституту зернового господарства України доведено, що всього один цикл проходження зерна через насіннєпроводи знижує схожість на 2-3 % а енергію проростання до 12%.

Які можуть бути загальні висновки по забезпеченню мінімізації травмування зерна. Дослідним шляхом доведено, що найменше травмувань зерно отримує при обмолоті з його вологістю 16-17%. Якщо вологість буде нижчою – насіння буде отримувати мікро- і макротріщини та битись; при вищі вологості за оптимальні – травми у вигляді вм'ятин, що псує його як посівні, так і продовольчі характеристики. Загалом, щоб отримувати високоякісне товарне і посівне зерно необхідно щоб зернозбиральна машина пройшла обкатку збором на близько 300 га полів, тоді вона повністю готова до збору насіння високої якості. Особливо актуально для зернобобових.

Практичним досвідом доведено ефективність обмеження решітних станків двома решетами, що забезпечує достатню чистоту насіння а травмуватись воно майже не буде.Також одним із варіантів зменшення травмованості насіння є збільшення зазорів між барабаном і підбарабанням. Але тут треба знати міру, тому, що буде більше огріхів в обмолочуванні колосків. Окрім цих регулювань необхідно налаштовувати зерноочисні й зернопровідні пристрої, швидкість подачі соломи в молотильний апарат швидкістю руху комбайна по полю. Також тим, на що можна звернути увагу є перехід до однороторної обертальної системи молотильного апарату комбайнів, але це актуально для господарств які користуються старою машино-технічною базою, яких з кожним роком все менше.

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ВИРОЩУВАННЯ КАРТОПЛІ НА ЧІПСИ В УКРАЇНІ

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Оптимальні технологічні параметри вирощування картоплі на чіпси в Україні передбачають використання сортів, що мають високий вміст крохмалю та низький вміст цукру, використання підготовлених ґрунтів, регулярний полив та додаткове внесення поживних речовин.

Згідно з цитатою з наукової статті, оптимальні технологічні параметри вирощування картоплі на чіпси в Україні передбачають використання сортів картоплі, що мають високий вміст крохмалю та низький вміст цукру.В Україні тах сортів є башато наприклад тані сорти як:

Сорт картоплі "Atlantic" є дуже популярним для вирощування на чіпси. Цей сорт відомий своєю високою врожайністю та стійкістю до захворювань. Крім того, картопля цього сорту має високий вміст крохмалю, що є важливою характеристикою для вирощування на чіпси.

Картопля сорту "Atlantic" має кремовий колір шкірки та білу м'якоть. Її текстура хрустка та смакові властивості добрі. Цей сорт також має досить довгий термін зберігання, що є важливим фактором для виробників чіпсів.

Для вирощування картоплі сорту "Atlantic" рекомендується використовувати добре дреновані ґрунти з достатньою кількістю вологи та добрими рівнями поживних речовин. Також важливо дотримуватись правильного розміщення рослин у рядках та забезпечувати регулярне поливання.

У виробництві чіпсів сорт "Atlantic" є популярним через свої смакові властивості та відмінну текстуру, яка забезпечує хрусткість та приємні відчуття при споживанні.

Сорт картоплі **Lady Rosetta** був створений в 1978 році в Німеччині і вирощується в багатьох країнах світу, в тому числі й в Україні. Цей сорт дуже популярний серед виробників чіпсів завдяки своїй високій врожайності та якості продукту. **Lady Rosetta** має гарний вигляд та дуже привабливий колір. Її шкірка має глибокий червоний колір, що робить її особливо привабливою для використання у продуктах з високим доданком візуальної привабливості. М'якоть картоплі має яскраво–жовтий колір і добре підходить для виробництва чіпсів з високим ступенем золотистого кольору.

Технологія вирощування **Lady Rosetta** схожа на технологію вирощування інших сортів картоплі. Її вирощують на піщаних та легких грунтах, з рівним розподілом вологи. Технологія посадки та догляду за рослинами також залежить від конкретної кліматичної зони, де проводиться вирощування.

Для отримання картопляного чіпсу з **Lady Rosetta** зазвичай використовують технології фритюрування в глибокому жирі, сушіння в гарячому повітрі та пакування у плівку з контрольованою атмосферою. Такий процес виробництва допомагає зберегти смакові властивості картоплі та додати до неї додатковий аромат і смак.

Сорт картоплі **Hermes** відноситься до ранньостиглих і має високу врожайність та хорошу збережуваність. Він також є відмінним вибором для вирощування на чіпси завдяки своїй високій концентрації крохмалю та хорошій якості продукту.

Згідно з дослідженням, проведеним Інститутом картопляних наук Нідерландів, сорт **Hermes** має дуже добрі смакові властивості та є відмінним вибором для виробництва чіпсів. Картопля має світло–жовту шкірку та білу м'якоть, що робить її ідеальною для виробництва свіжих та смачних чіпсів.

Для вирощування картоплі сорту **Hermes** рекомендується використовувати добре дреновані грунти з високим рівнем органічних домішок та високою поживною цінністю. Технологія посадки та догляду за картоплею схожа на технологію вирощування інших сортів картоплі, включаючи атлантичний та леді розетту. Після збору картоплі його очищують та нарізають на тонкі шари, які обсмажують у рослинному маслі для створення свіжих та смачних чіпсів.

Оптимальна технологія садіння картоплі на чіпси полягає у наступному: Обробка ґрунту: підготувати грунт, знявши з нього всі рослинні залишки, вивезти добрива та провести необхідні мінеральні та органічні добрива, щоб покращити родючість грунту.

Обробка засівного матеріалу: перед садінням картопля має бути оброблена для запобігання хвороб та шкідників. Зазвичай використовують хімічні засоби, такі як фунгіциди та інсектициди.

Садіння картоплі: саджанці картоплі садять на глибину 8–10 см та на відстань 30–35 см між рядками. Полив: картопля потребує достатнього поливу під час вегетації. Рекомендується поливати рослини два рази на тиждень в залежності від погодних умов та вологості грунту.

Догляд за рослинами: необхідно виконувати розпушування грунту та знищення бур'янів, а також забезпечувати необхідну кількість добрив для росту та розвитку рослин.

Збір врожаю: врожай картоплі на чіпси збирають, коли рослини повністю зріють та листя починає жовтіти. Після збирання картоплю необхідно очистити від грунту та ретельно перевірити на наявність хвороб чи шкідників.

Ще один важливий аспект технології вирощування картоплі на чіпси в Україні – це правильна обробка картоплі перед переробкою. Згідно зі статтею на сайті "**Agroexpert**" про технологію вирощування картоплі на чіпси, після збирання картоплі її потрібно відразу ж відвезти на переробну фабрику для подальшої обробки.

Обробка картоплі на чіпси включає в себе такі етапи, як миття, очищення від землі та видалення крихітних корінців. Після цього картоплю ріжуть на тонкі скибочки за допомогою спеціальних різальних машин, після чого вона проходить етапи відварювання, фритюрування та смаження в олії.

Технологія вирощування картоплі на чіпси в Україні включає в себе не тільки правильний вибір сортів картоплі та дотримання оптимальних технологічних параметрів вирощування, але й правильну обробку картоплі перед переробкою. Це допомагає забезпечити високу якість та смакові властивості чіпсів, що виробляються з української картоплі.

Окрім цього, важливим етапом технології вирощування картоплі на чіпси є зберігання картоплі після збирання. Згідно зі статтею на сайті "**AgroTimes**", картопля для виробництва чіпсів потребує особливих умов зберігання, щоб зберегти свої смакові властивості та характеристики якості.

Зокрема, для зберігання картоплі на чіпси потрібна певна температура та вологість повітря. Звичайно, ці параметри залежать від сезону та регіону вирощування. Також важливо забезпечити належні умови зберігання, щоб уникнути розвитку хвороб та шкідників на картоплі.

Тому, для успішної технології вирощування картоплі на чіпси в Україні, виробники повинні відповідати вимогам щодо зберігання картоплі після збирання та дотримуватися оптимальних технологічних параметрів обробки картоплі. Тільки так можна забезпечити високу якість та смакові властивості чіпсів з української картоплі.

FORMATION OF PRODUCTIVITY OF SAREPTSKY MUSTARD DEPENDS ON VARIETAL CHARACTERISTICS

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Ukraine occupies one of the leading places in Europe in terms of oil production. Sunflower occupies the largest areas. Rapeseed, soy and other rare oil crops are grown on somewhat smaller areas. In recent years, the global consumption of oils and vegetable fats has increased by 4% every year. The increase in the production of oil crops for the last decade is about 3.5 million tons every year.

Oil crops are growning in almost all countries of the world, but each country has its own leading oil crop. In Ukraine, such a crop is sunflower, in the USA - soybeans, in Canada - linseed, in England and India - rapeseed, in Asia and Africa - peanuts. Soybeans, peanuts, rapeseed, linseed, sunflower and sesame occupy the largest cultivated areas in the world. The world sown area of oil crops, including soy, is more than 150 million hectares, and the world production of oils is about 185 million tons [1].

In Ukraine, mustard of various types is growning in all its regions. Today, in particular, the largest areas of gray mustard in the country are about 86,000 hectares. Depending on the varietal characteristics and species, it is possible to obtain a grain yield of 0.8–1.2 t/ha. Today, the average yield of commercial mustard crops in Ukraine is quite low. This is explained by non-compliance with a whole complex of elements of cultivation technology, which inhibits the increase of both the area of crops and the volume of seed production. The oil, which has high taste qualities, is useingin the food industry and is a raw material for the soap-making, textile, pharmaceutical, cosmetic, and perfumery industries [2].

Among the oil crops of the cabbage family, mustard occupies one of the leading places in terms of the content of oil in the seeds and its quality characteristics. Nevertheless, the seed oiliness index is not a constant value. It depends on growing conditions and soil and climatic conditions of the zone.

Both winter and spring forms are growning in Ukraine, but the spring form is the most widespread. In addition to Sarepta, white, black and Abyssinian grapes are also grown on small areas.

The insignificant, but greater popularity of gray mustard among other species is explained, first, by biological and ecological properties - drought resistance and the ability to form economically viable crops in areas with a rigid hydrothermal coefficient, accordingly, the main areas of crop cultivation are concentrated in the Steppe and the south of the Forest Steppe.

Mustard is characterized by relative unpretentiousness to growing conditions, which to a certain extent reduces the cost of production, increases the level of economic profitability and makes it possible to compete more successfully in the modern market of agricultural products [1, 3].

In literary sources, there is enough information on the cultivation of white mustard and the application of mineral fertilizers, but little work is devoted to the influence of varietal characteristics on the formation of crop productivity.

Today, in modern conditions, the variety has become a means without which it is impossible to realize scientific and technical achievements in agriculture. The variety is a necessary and indispensable link of a complex complex of organizational, economic and technical measures aimed at increasing the production of high-quality products, as well as a factor of mitigating the impact of extreme weather conditions [4].

Therefore, the purpose of the scientific work is to study the element of cultivation technology and the selection of modern mustard varieties of cultivated species capable of realizing their biological potential under specific natural and climatic conditions.

Varieties of Sarepta mustard were studied in the research: Tavrychanka, Mriya, Svitlana, Dizhonka, Retro.

During the growing season, the following phenophases were noted in mustard: seedling, rosette, branching, budding, flowering, and ripening.

It was established that the duration of interphase periods was different among varieties. Therefore, it was investigated that seedlings appeared in all studied varieties after 10 days.

The study of varieties by biometric indicators indicates that the height was at the level of 97.8–118.4 cm. The average number of branches of the first order by varieties varied considerably from 1.7 to 5.5 pcs. Plants had the maximum branching rate of 5.3 pcs, and the lowest this indicator was 2.0 pcs.

Research of the mass of 1000 pcs. of different varieties of gray mustard, it can be noted that the largest indicator was 3.4 g, and the smallest was 2.6 g, respectively.Seed yield is the main indicator that characterizes the genetic potential of modern varieties under the same growing conditions (natural and climatic conditions, growing technology).

It was established that the yield of the studied varieties varied from 22.8 to 23.5 t/ha.

In terms of oil content in gray mustard seeds, a significant advantage was noted in the Mriya variety - 41.4%.

Thus, in the course of research, it was established that Sarepta mustard varieties had their own agrobiological features.

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MODERN TECHNOLOGY CULTIVATION OF A FLAX

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Oilseed flax (Linum usitatissimum L.) is a fibrous dicotyledonous plant in the flax family (Linaceae) with potential economic value (Fig. 1), known as common flax or linseed (Saleem et al., 2020a), which has a long history of cultivation in agriculture and is grown throughout the world. It has many commercial, medicinal values, and other important funtions. Oilseed flax is also useding as livestock feed (animal fodder). Flax fiber (which is 3 times stronger than cotton) has been used to make linen in many textile industries due to its natural ability to straighten, be soft, wear-resistant, water absorption, and swelling large (Saleem et al., 2020b).

Flax fiber is also used to produce decorative fabrics, solid yarn, cordage and tires, and it is the first biological fiber used in textile industry (Jiang et al., 2019). For its inexpensive, biodegradable, and having good chemical properties, flax fiber is use ding to produce clothing, table linen, rag-based bags, linoleum, and printing inks, which has become popular due to the increasing demand in the market. In recent years, the market prices of oilseed flax gradually increased due to both the research and development of value-added products made from oilseed flax (Zhao et al., 2020). The demand and economic value of oilseed flax are increasing, thus the cultivated area in the world is expanding with the improvement (Gao, 2020). In 2018–2019, the cultivated area of oilseed flax in the world was about 3.04 million hectares. In addition, the production was 2.61 million tons, as increases of 6.15% and 1.95% over the previous year respectively (FAO http://www.fao.org/statistics/zh/).

Flaxseed is an important source of industrial vegetable oil (Hocking and Pinkerton, 1993). The essential fatty acids present in flaxseeds have several benefits for human nutrition (Patenaude et al., 2009). Flaxseed is rich in ω-3 fatty acid, vitamin E, dietary fiber, lignin's, and other functional nutrients (Xie et al., 2015), lowering cholesterol and protecting humans from cancer. It is also useding for carpal tunnel syndrome and ulcers (Flower et al., 2014). Flaxseed contains 20%–25% protein and 40%–45% fatty acids, which are edible and can prevent heart diseases, cancer, strokes, and diabetes (Saleem et al., 2020c). Flaxseed is also adding to animal feed to improve reproductive performance and animal health (Safdar et al., 2017).

Flaxseed might be produced into vegetable oils known as "linseed oil". Flaxseed oil is edible and considered one of the oldest commercial oils. The oil plays an important role in promoting human intelligence, physical brain, preventing cardiovascular diseases, and suppressing disease genes (Zhao et al., 2011). Moreover, it is also used to control blood pressure, rheumatoid arthritis, cholesterol, and many other common diseases of manking (Saleem et al., 2020a). Thus, in addition to edible oil, flaxseed oil is widely used in medicine, food additive, cosmetic powder, paint, printing, tanning, and other industrial departments.

Effects of inorganic fertilizer on grain yield. Application of chemical fertilizers, especially nitrogen (N), phosphorus (P), and potassium (K) fertilizers, has been widely considered an effective agronomic practice to improve crop productivity (Zhao et al., 2020).

One of the most important agronomic practices for flaxseed production is nitrogen fertilization because of its positive response to N. However, the overall response is less than that in wheat, barley or canola (Dordas, 2010). N fertilization increases N uptake and protein content in leaves of oilseed flax (Wang et al., 2017), increases N contribution of leaves and capsule peel to grain seed, and improves N use efficiency and grain yield (Xie et al., 2015). However the plants cannot take up additional N when supply exceeds demand (Xie et al., 2015), which resulted in wastage of resources and environmental pollution. Under the premise of constant total N application, it is of great importance to appropriately reduce N application rate in early stage of plant growth to achieve sustainable agricultural production.

Previous studies have shown that topdressing could meet the peak nitrogen demand at the flowering stage of oilseed flax and promote the accumulation of assimilates and nitrogen (Guo et al., 2020). Research showed that the traditional N fertilization was 150 kg/hm2 on oilseed flax in Dingxi, Gansu Province, China. However, when N rate was reduced by 40%, not only grain yield was remained, but also N use efficiency was increased (Zhang et al., 2020). Therefore, the productivity of oilseed flax can be improved by implementing the N fertilizer deferral and reduction practice.

Flax is currently grown on about 12 million acres worldwide, with the majority of the production in northern Europe and Russia. Early immigrants originally brought flax to America from Europe. Although there were close to two million acres of flax in the U.S. as recently as the early 1970s, U.S. acreage dropped substantially. However, acreage has been about one-half million acres, and is gradually increasing.

Benefits of flax seeds. Lots of fiber. If you want to increase your dietary fiber intake, adding flax seeds to your meals can be a good start. In 1 tbsp., the product contains almost 3 g of fiber, which is 11% of the recommended daily allowance. According to the American Heart Association, adults should get 25 to 30 grams of dietary fiber per day, but most people get about 15 grams. Increasing the risk of developing chronic diseases.

Omega-3 fatty acids. Flaxseeds are particularly rich in alpha-linoleic acid, a type of omega-3 that the body cannot produce. The only way to get this nutrient is through food, and flax has a lot of it.

In general, consumption of omega-3 fatty acids has been shown to reduce inflammation in the body, which in turn prevents the development of chronic diseases. In particular, alpha-linoleic acid has been linked to a reduced risk of heart disease, such as heart attack and stroke, as well as a reduction in high blood pressure. Seeds are a rich source of this substance, as are walnuts, fatty fish and some plants.

Bowl with flax seeds. Support for overall heart health. As we already know, omega-3 fatty acids help reduce the risk of heart disease. According to a research review in Advanced in Nutrition, there is strong evidence of a link between alpha-linoleic acid intake and a reduced risk of cardiovascular disease. This can be explained by the fact that this compound is a polyunsaturated fatty acid that has an anti-inflammatory effect on the body, which is also important for heart health. Unsaturated fatty acids also have powerful antihypertensive, antitumor, antioxidant, antidepressant, antiaging, and ant arthritic effects.

Research also suggests that consuming flax seeds can help lower blood cholesterol levels. High levels of low-density lipoproteins (the so-called bad cholesterol) lead to their accumulation in the arteries, which increases the risk of heart disease.

Another heart-related benefit of the product is its ability to lower blood pressure, which is important for preventing heart attacks and strokes.

Improvement of digestion. Flax seeds help digestion. The product is known to be a natural laxative that can help with digestion and constipation. A 12-week study published in Nutrition & Metabolism found that flaxseed added to baked goods was able to reduce symptoms of constipation as well as blood sugar and lipid levels in people with type 2 diabetes.

In addition, the product has a positive effect on the intestinal microbiome, increasing the number of beneficial bacteria. At the same time, the presence of Proteobacteria and Porphyromnadaceae, which are associated with alcoholic liver disease, decreases.

Weight control

Maintaining an optimal weight is important for long-term health. Adding flaxseed to your diet can be one-step in that direction. In particular, the fiber in the product promotes fullness and satisfaction after a meal for a longer time, according to Appetite.

In addition, adding flaxseed helps control blood glucose levels and insulin sensitivity, which are important for weight management.

ПРОДУКТИВНІСТЬ КОРМОВИХ КУЛЬТУР ЗАЛЕЖНО ВІД ЕЛЕМЕНТІВ ТЕХНОЛОГІЇ ВИРОЩУВАННЯ

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На формування врожаю кормових трав впливає комплекс факторів: ґрунтовокліматичні умови регіону, біологічні особливості сорту, якість насіннєвого матеріалу, технології вирощування та загальний фітосанітарний стан посіву. Для створення оптимальних умов росту і розвитку рослин кормових трав необхідно впроваджувати такі технології вирощування, які базуються на останніх досягненнях науки і виробничої практики. За зростання вартості мінеральних добрив, пошук шляхів підвищення ефективності їхнього використання набуває особливого значення. Саме тому розробка способів підвищення ефективності дії мінеральних добрив, застосування стимуляторів росту, удосконалення способів сівби, теж додає актуальності [1, 2].

Методика досліджень. Програмою досліджень було передбачено проведення лабораторних, польових та виробничих дослідів, які виконувалися в науковій лабораторії кафедри рослинництва Уманського НУС. Площа посівної ділянки – 30 м², облікової – 25 м². Технологія вирощування конюшини лучної, за виключенням досліджуваних факторів, була загальноприйнятою для Правобережного Лісостепу України.

Результати досліджень. Конюшина лучна за безпокривного способу сівби незалежно від сортового складу зі два роки вегетації в середньому забезпечує вихід сухої речовини 9,27-9,88 т/га, кормових одиниць 6,40-7,21 і 1,66-1,88 т/га сирого протеїну, обмінної енергії 85,3-93,9 ГДж/га із коефіцієнтом використання ФАР – 1,12-1,19 %. Найбільшу продуктивність забезпечив сорт конюшини лучної Тайфун з виходом сухої речовини 9,88 т/га, кормових одиниць 7,21 та 1,85 т/га сирого протеїну за внесення повного мінерального добрива та проведення передпосівної обробки насіння.

За два роки використання травостою конюшини лучної вихід сухої речовини за безпокривного способу сівби становив 11,03 та 10,00 т/га за підпокривного вирощування під ячмінь ярий, або він зріс на 10,3 %.

Найбільший вихід сухої речовини забезпечив сорт Тайфун 11,39 т/га, Тіна – 11,21 та 10,50 т/га Либідь за безпокривного способу вирощування, тоді як за підпокривної сівби показники становили відповідно 10,42; 10,12 та 9,47 т/га.

В рік сівби комплексне застосування повного мінерального добрива та проведення інокуляції насіння забезпечили приріст сухої речовини 14,8 % до контролю без добрив та 8,9 % до фону – інокуляція. Приріст сухої речовини між внесенням повного мінерального добрива та фосфорно-калійним добривом становив 3,5 %.

За показниками хімічного складу сухої речовини конюшини лучної вміст сирого протеїну коливається в межах 16,8-19,2 %, білка – 11,9-13,6, сирого жиру – 2,3-2,6, сирої клітковини – 23,3-25,4, безазотистих екстрактивних речовин – 45,4-48,0, сирої золи 8,5-8,9 %.

Вміст макроелементів становив фосфору – 0,32-0,37 %, калію – 2,21-2,52, кальцію – 0,49-0,58, магнію – 0,16-0,19 % та мікроелементів – цинку – 13,714,8 мг/кг, міді – 3,5-4,9, марганцю – 44,0-48,3, заліза – 64,4-68,8 мг/кг.

В сухій речовині вміст важких металів знаходився на рівні 1,8-1,9 мг свинцю, 1,8-1,9 мг нікелю, 0,2-0,3мг/кг кадмію, N–NO3 – 0,02-0,05 %.

Встановлено, що сорт конюшини лучної Тайфун відрізнявся більшим вмістом сирого протеїну та білка в сухій масі (на 0,6-1,7 %). За внесення N60P60K90 у поєднанні з інокуляцією насіння збільшувався вміст сирого протеїну на 1,1-1,2 %, білка 0,5-0,8 та 0,01-0,02 % нітратів, порівняно з контролем без внесення добрив

Висновок. Для забезпечення тваринництва дешевими трав'яними кормами й отримання з 1 га 6,0-7,0 т кормових одиниць і чистого прибутку 23,0-24,0 тис. грн/га та нагромадження 200-250 кг/га симбіотичного азоту на типових малогумусних чорноземах Правобережного Лісостепу за триукісного використання і трирічного користування доцільно створювати одновидові агрофітоценози конюшини лучної з нормою висіву 18 кг/га інокульованого бульбочковими бактеріями насіння сорту Тайфун, застосовуючивуючи безпокривний спосіб сівби.

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TECHNOLOGY OF GROWING ORGANIC CORN

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Heat requirements. Corn is a heat-loving crop. The minimum temperature for seed germination is 8-10°C; seedlings appear at 10-12°C. When sowing in cold soil (< 8°C), seeds germinate very slowly, swollen seeds do not germinate, and field germination decreases sharply. In the phase of 2-3 leaves, it withstands frosts down to -2°C. Corn seedlings die at -3°C. The danger of return of spring frosts in Ukraine exists and occurs once every 5-6 years. If the temperature drop (below -5°C) lasts for several hours, the corn freezes regardless of the development phase. Corn biotypes bred by breeders that can germinate at a temperature of 5-6°C are promising.

The smallest early autumn frosts damage the leaves and the plant as a whole. It should be noted that in recent years, in connection with the spread of corn in the northern regions, new early-ripening hybrids have been created. They are characterized by high cold resistance. When the temperature drops, encrusted seeds can lie in the soil for 25-30 days and are able to germinate after warming. In the summer, growing season, at a temperature of 14-15°C, the growth of plants slows down, and at 10° C, they do not grow. In the stages of sprouting - throwing out panicles, the optimal temperature for growth and development is 20-23°C. Before the appearance of generative organs, an increase in temperature to 25-30°C does not harm corn. In the flowering phase, a temperature increase of more than 25°C has a negative effect on plant fertilization. The maximum temperature at which the growth of corn stops is 45-47°C. The sum of active temperatures at which early-ripening hybrids reach maturity is 2100-2200°, mid-early and mid-ripening -2400-2600°, and late-ripening - 2800-3200°.

Moisture requirements. Maize belongs to drought-resistant crops. Thanks to the strong development of the root system, it uses moisture from a larger area and deeper soil horizons. For the formation of a unit of dry matter, it consumes two times less water than wheat. The transpiration coefficient is 250. However, high yields of green mass and grain cause a greater need for water than grain crops. During the growing season, corn needs 450-600 mm of precipitation. 1 mm of precipitation makes it possible to obtain 20 kg of grain per one ha. Corn is less demanding on moisture in the first half of the growing season. Before the formation of the 7-8th leaf, cases of lack of moisture for the growth of corn are almost never observed. Plants need the most moisture 10 days before the panicles are thrown, when the stem grows intensively (daily growth can reach 10-14 cm) and dry substances accumulate. This critical period accounts for 40-50% of total water consumption. After 20 days after the panicles are thrown out, the need for moisture decreases. Corn uses a lot of water during the pouring of grain. It effectively uses precipitation in the second half of summer. Corn does not tolerate waterlogging of the soil, sharply reducing the yield. Due to the lack of oxygen in overmoistened soil, the supply of phosphorus to the root slows down, which worsens protein metabolism.

Light requirements. Corn is a light-loving plant with a short day. Does not tolerate shading well. In excessively thickened crops, the development of plants is delayed, grain productivity decreases. Plants vegetate faster with 8-9 hours of daylight. With a day length of 12-14 hours. Corn ripening is delayed. It needs more solar energy than other grains.

Soil requirements. Corn yields high yields on clean, well-aerated soils with a deep humus layer. It is moderately demanding on soil fertility, with proper tillage and fertilization, it grows well on most types of soil. The optimal reaction of the soil solution is neutral or slightly acidic (pH 5.5-7.0). Cold, swampy, acidic, heavy clay, saline and peaty soils (which often lack copper) are unsuitable for growing corn.

Crop rotation. In order to obtain the planned harvest of organic corn, the farmer must solve the following issues: maintaining the cleanliness of the fields, forming the optimal density of plants for harvesting, and reducing plant lodging.

Corn is best grown after winter wheat, peas, soybeans, beans, pastures, and siderates. Sunflower and sugar beets are not recommended predecessors with insufficient moisture. After corn for silage and melon crops, the farmer faces the problem of weed control by agrotechnical means. Millet and corn have a common pest, the corn stem butterfly, so millet is also not an acceptable predecessor. It is good to sow spring crops after corn. Corn can be used as a monoculture, but this leads to the accumulation of a characteristic pest (corn stalk moth) and weeds, so one-year breaks (at least) should be taken between crops.

Soil preparation and fertilizers. Tillage. The main cultivation of the soil after crops of continuous sowing (winter wheat, barley, peas) on the plain includes husking of stubble and plowing. Hulling helps to clear the field of weeds and effective control of pests. It is carried out following the harvesting of the predecessor with LDH-10, LDH-15 disc harrows to a depth of 8–10 cm, and preferably with heavy tandem two-track disc harrows (BDV-7, BDP-6.3, BGR-4.2 "Solokha") on a depth of 14–16 cm. Against perennial rhizome weeds (thistle, milk thistle, field birch, etc.), two peelings are used. The second peeling is carried out during the period of the mass appearance of weed rosettes to a depth of 10–14 cm with flat-cutting tools (KPSH-5, OPT-3–5) or anti-erosion cultivators (KPE-6N), or combined tools (KR-4, 5, CABG- 5.6 "Resident", KSHN-5.6). The second peeling of the soil can also be its main treatment when growing corn using shallow loosening technology in order to save fuel and money.

Fertilizers. The development of a fertilization system for organic corn should be based on a balanced approach to nutrient use. The main goal of the system is to increase soil fertility and provide corn with the necessary nutrients for growth and development. The main fertilizers for organic corn are compost and humus. These fertilizers contain a significant amount of nutrients necessary for crop growth. The optimal amount of compost or humus for corn is 10 - 15 tons per hectare. To improve soil fertility, you can also use biological preparations, such as bacterial preparations, microbial preparations, humic substances, etc. These preparations help increase the viability of beneficial microorganisms in the soil, which improves the structure and nutritional value of the soil. Optimum conditions should be observed when applying fertilizers to the soil. For example, compost and humus must be applied to the soil in the fall before corn is planted, so that the nutrients are successfully spread through the soil. Biological preparations can be used throughout the growing season of corn, observing the recommended doses and timing of application.

Sowing. Seed preparation. It includes calibration, poisoning with fungicidal and/or insecticidal poisons, possible processing with a complex of macro- and microelements to meet the needs of plants in the early stages of growth.

The technology of growing organic corn requires the use of seeds of organic quality, and seeds obtained through genetic modifications are not allowed.

Sowing method. Corn is sown in a dotted pattern with rows of 70 cm with the help of planters SUPN-8, SUPN-12A, UPS-8, UPS-12, Optima. The depth of sowing depends on the soil and the area of cultivation. In the forest-steppe and Polissia, corn seeds are sown to a depth of 4-6 cm, on light soils and when the seed layer dries - to 5-8 cm. On wet soils, the sowing depth is reduced to 3-4 cm. In the conditions of Western Ukraine, when sowing early-ripening, cold-resistant hybrids are recommended to be sown at a depth of 2-3 cm in later periods. In steppe areas with a moisture deficit in the upper layer of the soil, the seeds are wrapped to a depth of 6-10 cm.

Sowing term. The optimal time for sowing corn is when the soil is warmed at the depth of seed wrapping to 10-13ºC. Seeds should be sown in well-cultivated, ripe soil, usually at the end of April.

Sowing rate. In organic farming, the sowing rate should be from 10 to 11 seeds per m2. An increased seeding rate is recommended for mechanical weed control. The distance between the rows is, as a rule, 70 cm. In dense crops, the grain productivity of corn decreases.

Crop care. Weed control. Corn is very sensitive to weeds. Harrowing should be done before emergence (blind harrowing) and after emergence, when the plants are well rooted (from 10 to 15 cm in height). Late-sown corn grows quickly and suppresses weeds. Early planting due to low temperatures often results in stunted corn growth. Weeds adapted to cold temperatures continue to grow and compete with corn during this time. At the stage of development of 2-8 leaves, corn reacts to competition from weeds most vulnerable. During this period, it is extremely important to get rid of weeds.

Pest control. The corn stalk moth is the main pest during the cultivation of corn. Affected plants yield 10-30% less. The damage is caused mostly by the larvae of the corn stalk moth. Caterpillars penetrate the stems and cobs and damage them. A fairly effective method of combating this pest is the spreading of trichogram with the help of small aircraft and hang gliders (based on the first time 100 thousand/ha, the terms coincide with the beginning of the flowering of corn, and the second time - 200 thousand/ha, the beginning of the formation of grain in the cobs)

Collection. The main method of harvesting is direct harvesting. It should be started in the phase of full ripeness or when humidity reaches 26 - 29%, depending on the hybrid. If you grew the crop for silage, then it should be harvested in the phase of milk-wax maturity.

Undesirable: Excessive delay in harvesting, because the grain gets wet due to precipitation, and its moisture release is delayed. Harvest in the period of frosts, as the quality and stability of grains deteriorates.

WHITE SESAME

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Sesame has a very old and rich history. Mentions of him can be found in numerous myths and ancient manuscripts. Even in the Assyrian myth of the creation of the world, it was said that when the gods met, they drank a drink made of sesame. The Assyrians themselves used sesame seeds in cooking, starting from the 3rd millennium BC.

White sesame is the seed of a plant called sesame (Sesamum indicum). It has a light white color and has a delicate, somewhat sweet taste. White sesame is used in cooking for seasonings and sauces, for sprinkling bread and sweets, and as an ingredient in many Asian dishes. In addition, white sesame has high nutritional qualities and is known for its beneficial properties for health.

White sesame is a plant that can reach a height of up to 1.5 meters. It has stems that branch from the main stem and have hairy leaves. The flowers of the plant are small, white and collected in bunches at the tips of the stems.

However, the main element of white sesame is its seed, which has the characteristic shape of a layered disc. Seeds with a diameter of up to 3 mm, from a greenish-yellow color turn into white during grinding. Each seed contains a source of fatty acids, proteins and other useful substances for the human body.

White sesame is one of the most common crops in subtropical and tropical countries. Growing white sesame can be optimal in a hot and dry climate with high air temperature and sufficient light.

The main stages of the technology of growing white sesame:

1. Soil preparation.White sesame is grown in light, well-drained and well-ventilated soils with a neutral or slightly acidic pH. The soil should be deep, at least 40 cm. During soil preparation, mineral fertilizers and organic matter should be added.

2. Sowing. Seeds are sown immediately after soil preparation. It is recommended that the diameter of the seed is not less than 2.5 mm, so that it is evenly dispersed during sowing. Rows should be separated from each other at a distance of 25-35 cm.

3. Plant care. After sowing, it is important to ensure a constant level of moisture in the soil, as well as to learn plant growth management. Access to moisture should be ensured throughout the growing season. It is also necessary to carry out breeding, separate feeding and harvesting. The latter is carried out by pulling off the pods, when the sesame reaches the phase of full maturity.

To achieve the maximum yield, it is important to carefully study the technology of growing white konjut.

CASTOR: A POISONOUS AND SOMETIMES EXTREMELY VALUABLE PLANT

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Castor oil is a monotypic genus of oil plants from the milkweed family. In Ukraine, this culture began to be grown since 1920. Later, the area of crops was increased to 110-120 thousand hectares. They are concentrated in the southern regions of Ukraine: Kherson, Zaporizhia, Mykolaiv, Odesa, Dnipropetrovsk, and Crimea. The yield of castor oil in Ukraine with the use of high agricultural technology reaches 8-14 t/ha and more, and under irrigation conditions it increases by two-three times.

In the south of Ukraine, the best place for castor in field crop rotations is the links: black steam - winter wheat - castor and corn for silage - peas - castor. It is not recommended to sow castor after sunflower and corn for grain. Castor belongs to late cultures. The growing season lasts 95-120 days. From seedlings to the formation of central inflorescences, the plant grows quite slowly, and its crops can become overgrown with weeds. The optimal period for sowing castor is the time when the soil at the depth of seed wrapping warms up to 8-10°C and further warming is observed. The seed-sowing rate depends on the recommended density of plants per 1 ha of sowing. The optimal density of plants at the time of harvesting is considered to be: for medium-branched varieties - 50-60, strongly branched - 30-40 thousand/ha.

Economic purpose. Castor oil is widely used in medicine and aviation, as well as in the chemical, textile, printing, electrical engineering, perfumery and other industries. The seed kernel contains up to 55% oil. It has 81-96% glycerides of ricin oleic acid, which is not found in other oils. Castor (castor) oil belongs to the group of non-drying (with an iodine number of 82-86), very viscous, slightly soluble in gasoline and other organic solvents, does not solidify at low temperatures (–12-18 °C), ignites at high temperatures (+300-310 °C). That is why it is an unsurpassed quality lubricant, especially for aircraft engines and mechanisms operating in the difficult conditions of the north.

Castor oil is a high quality and wide-ranging raw material for organic synthesis. In addition, the esterification reaction of castor oil was obtained for the first time, which confirms the expediency of its use during the production of biodiesel.

Role in agriculture. The cake or meal that remains after extracting or pressing castor oil from the seeds cannot be used without processing as feed for farm animals due to the content of a number of toxic components, such as the protein ricin and the alkaloid ricinine, which are potent toxins. However, the cake, which is freed from toxic substances in the process of processing, can be successfully fed to animals, which will allow to supplement their diet with protein feed and reduce the burden on natural ecosystems.

Baits for pests are made from castor cake and applied to the soil as a fertilizer (contains about 7% nitrogen and 1.7% phosphoric acid). There is a lot of potassium and other nutrients in the stems of castor beans, so when they are plowed in a crushed form, the fertility of the soil increases significantly. Castor oil does not dry out the soil, cleans the field of weeds. The roots and stems decompose quickly, enriching the soil with organic and mineral substances, so it is a good precursor for grain crops.

How to increase castor yield. One of the important means of increasing castor crops is the application of mineral fertilizers. Sowing application of mineral fertilizers is quite effective. Due to the arid climate of the steppe zone of Ukraine and the high content of potassium in the soil, mainly nitrogen and phosphorus fertilizers are applied under plowing. An increase in fertilizer rates on non-irrigated lands gives insignificant increases in yield and their payback at the same time decreases.

GROWING SOYBEANS AS A BUSINESS

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Although soy began to be grown in Ukraine relatively recently, it has already managed to become one of the most popular agricultural crops. What are the secrets of growing soybeans and why more and more people are establishing businesses related to this plant?

Is it profitable to sow soy? Soy is often called a "miracle crop". Fields sown with it are in more than 60 countries on different continents. All because this plant is unpretentious in cultivation, gives a good harvest and thus brings a good profit to farmers.

Ukraine is among the top ten countries in terms of soybean production. We can observe the so-called "soy boom", which is gaining momentum every year. The volume of soybean cultivation in Ukraine can compete for the first place among all oil crops only with sunflower.

In 2021, 1.28 million hectares of Ukrainian land were sown with soybeans. According to the data of the State Statistics Service, the yield of this agricultural crop was 26.8 t/ha. This is one of the highest indicators for the entire experience of growing soybeans by Ukrainians.

Most soybeans are exported to other countries. The USDA (United States Department of Agriculture) believes that the increase in soybean production capacity and supply is a good boost for the market and will stimulate global trade. In the developed fertile Ukrainian soils, there is a significant potential for growing soybeans and selling them as raw materials to other countries. However, this agricultural crop is also used for the internal needs of Ukraine. For example, some Ukrainian enterprises produce soybean oil and meal.Fields of application of soybeans

Soybean is rich in protein and healthy fats and amino acids, so it is a very nutritious and therefore such a sought-after leguminous crop. Many substitute products are made from it, for example, meat, milk, cheese, coffee, tofu, okara. They are much cheaper than staple foods and are also popular among vegetarians. In addition, soybeans are excellent for the production of various cereals, flour, sauce, and soybean seeds. Soybeans become the basis not only for food products. This plant has significant potential for the production of animal feed, biofuel, cosmetics and is used for other technical and medical needs.

Growing and selling soybeans is profitable, because there is a great demand for wholesale purchases. Moreover, there is considerable interest in this unique plant abroad, so export is a profitable opportunity to sell soybeans for Ukrainian farmers.

Conditions and technology of growing soy Where is it good to sow soybeans? It is good to sow soybeans in the place of winter and spring cereals. Their harvest is usually quite early compared to other crops, so it allows the soil to be prepared for sowing soybeans. Corn, potatoes, sugar beet or others can also be precursors. It is not recommended to sow soybeans in place of perennial legumes, crucifers, and legumes. It is possible not to change the place of sowing soybean seeds for about 3 years.

In general, soybeans grow well in almost all types of soil. But this leguminous crop needs a lot of moisture, so stony and sandy soils are not a very good option for growing soybeans. At the same time, excessive moisture harms this plant. Therefore, it is worth taking care of drainage. Soil acidity is also important for soybeans. It should be in the range of 6.2 - 7.0 pH.

Acidity below 5.5 pH is critical for the plant. In this case, mineral fertilizer NPK 9:18:22 is used to increase the level of acidity.

Varieties. In order to get a good harvest, you should use soybean varieties with different maturing times depending on the area and climate zone. For the steppe zone, late-ripening and mid-ripening varieties are best suited. Mid-emerging soybeans grow well in the forest-steppe zone. On the territory of Polissia, it is best to sow pre-ripened soybeans.

When choosing a variety, you should take into account the weather conditions in your region and find out whether the variety is resistant to a lot of moisture or, on the contrary, can withstand a long drought. It is necessary to pay attention to the possibility of damage to a certain variety by diseases or pests.

When to sow soybeans? Soy should be sown at the end of April - beginning of May. The optimal soil temperature is 10-15 °C. Lower temperatures have a detrimental effect on the seeds, and they may simply not germinate. Late-ripening soybean varieties are sown first, followed by mid- and early-ripening varieties. Soybean sowing rate

So that the work is not in vain, you should carefully approach the question: how many seeds to sow. Some farmers believe that the more and more densely sown, the better. However, the quality of the harvest does not always depend on this. Weather and climatic conditions, as well as the variety of the plant, and especially the time of its maturity, are the key factors for determining the sowing rate of soybeans.

Soybeans can be sown fairly densely in areas with sufficient rainfall. After all, the plants will have moisture and will not compete for it. Instead, in drought-prone regions, sow thinly so that all plants can have access to water.

In the forest-steppe zone, it is advisable to sow from 400 to 550 thousand/ha (depending on moisture). Soy in Polissia needs a similar amount: 400-450 thousand/ha. In the steppe zone, where precipitation is usually less, it is worth sowing from 300 to 450 thousand/ha. Early soybean varieties are sown more densely (about 600-700 thousand/ha), medium-ripening varieties - less often (450-550 thousand/ha). Soybean sowing rate in kg depends on the weight of the seed and its quality. On average, 70 to 130 kg/ha are sown.

Intensive technology. Intensive soybean cultivation technology aims to increase and improve its yield. The stages of preparation and actual sowing are key when using intensive technology. One of the options for increasing the efficiency of sowing is the inlaying of soybean seeds. This is the process of treating seeds with a thin film and enriching them with useful substances.

In this way, a kind of protective shield is formed, which protects against destructive external influences, and also nourishes the plant with the necessary elements. Inlay allows to increase soybean yield by 10-20%.What kind of fertilizers or preparations to use in the intensive technology of soybean cultivation depends on the type of soil, its properties, as well as the variety of soybeans.

So, before you start your business, be sure to create a business plan for growing soybeans. Think through all the details of this exercise and consider the available and necessary resources.

Be sure to check and take care of:

— a variety of soybeans

— place for sowing:

— soil type
— its acidity
— its humidity
— predecessor plants
— sowing time
— sowing rate
— necessary fertilizers

Problems and prospects of sowing soy. Soybean production in Ukraine is very promising. One of the areas of soybean processing is the creation of soybean meal. It is produced in Ukraine on an increasingly large scale. Soybean meal is actively used for fodder for farm animals, for biofuel, etc. Demand for the export of such products is also growing. Soy is also popular abroad as an inexpensive protein product. Therefore, there are usually no problems with where to sell the harvested soybean crop. Some of the Ukrainian businessmen are thinking about the fact that, in addition to growing soybeans, they are also engaged in its processing and manufacturing finished products with added value. Also, in recent years, a trend has been observed: owners of small agricultural lands start to engage in the "soybean business" more often than large entrepreneurs.

Ukrainians are among the most successful in the world in soybean breeding. The "Register of Plant Varieties of Ukraine" includes more than 60 different varieties of this leguminous crop.

Another advantage and perspective is sowing soybeans to save on fertilizers for the following crops. The fact is that the soybean root system contains nodule bacteria that provide nitrogen nutrition to the soil. Therefore, growing soybeans helps to enrich the soil with useful elements in a natural way and save on the application of fertilizers for other plants that will grow in the same place. In addition to nitrogen, the area planted with soybeans also contains phosphorus and potassium, which are useful for many crops.

Among the problems of growing soybeans, one can single out the need for its regular moistening.In arid regions, irrigation systems should be installed to replace natural rainfall. And it is quite expensive, and not all farms can afford such a luxury. Another problem is the lack of state insurance for soybean crops.

Investment, cost and profit. Soy belongs to highly marginal crops. With proper preparation for sowing and plant care, as well as favorable weather conditions, you can get a generous harvest and a good profit.

ADAPTIVE TECHNOLOGY FOR GROWING CORN FOR SILAGE

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Introduction. Adaptive technology for growing corn for silage is a modern approach to growing corn to produce high-quality silage for further use in livestock production.

The main goal of adaptive technology is to maximize the potential of corn to produce high-quality silage, ensure high yields and reduce growing costs.

The main principles of adaptive technology are the use of modern corn hybrids, optimal fertilization and effective methods of weed and disease control.

To achieve this goal, various approaches are used, such as increasing the density of sowing, applying fertilizers in the exact dose depending on the needs of the crop and local soil conditions, and timely implementation of disease and pest control measures.

Adaptive technology results in improved crop quality and quantity, reduced costs of growing corn, and increased profitability. In addition, high-quality corn silage helps to provide animals with high quality and nutritious food, which has a positive impact on their health and productivity.

Contents.

Biological characteristics. Heat requirements. Silage corn has high temperature requirements that vary depending on the growth stage of the plant.

When sowing corn silage seeds, the minimum soil temperature for seed germination should be at least 10 degrees Celsius. The optimum soil temperature for rapid seed germination is 20-30 degrees Celsius.

During the growing season (from the beginning of growth to the beginning of cob formation), the optimum air temperature for silage corn is 25-30 degrees Celsius. Under these conditions, the plant actively grows and forms green mass.

During cob formation, the optimal air temperature for silage corn is 22-26 degrees Celsius. If the temperature rises above this level, it can lead to a decrease in the quality of the silage, as the plant spends more energy on the formation of the cob than on the formation of green mass.

When harvesting corn for silage, the optimal air temperature is 25-30 degrees Celsius. If the temperature is above this level, it can lead to overheating of the silage and deterioration of its quality. Therefore, it is important to harvest silage in optimal temperature conditions.

Moisture requirements. The optimum level of soil moisture for growing corn depends on several factors, including soil type, climatic conditions, and cultivation methods.

Typically, corn grows best in soils with moisture levels between 50% and 75% of the soil's water capacity. The water holding capacity of a soil is the maximum amount of water the soil can hold.

If the soil moisture level is too low, it can lead to a decrease in yield and crop quality. If it is too wet, root rot and other plant diseases can occur.

Light requirements. Corn is a light-loving, short-day plant, which means that it needs enough light to develop efficiently, but it also needs to have shorter day lengths than most other crops.

In addition, corn does not tolerate shading, so it is important that the plants receive enough light without obstruction. In excessively thickened crops, plant development is delayed and grain productivity is reduced.

Plants vegetate faster with 8-9 hours of daylight, while with 12-14 hours of daylight, plants are delayed and corn maturation is delayed. Corn requires more solar energy than other cereals, which means that it has high light requirements for successful development.

Soil requirements. Corn is a plant that has certain requirements for the soil on which it grows. It grows best on clean, well-aerated soils with a deep humus layer. Corn is moderately demanding on soil fertility, but with proper tillage and fertilization, it can grow well on most soil types. The optimal reaction of the soil solution is neutral or slightly acidic (pH 5.5-7.0). The use of corn on cold, wetland, acidic, heavy clay, saline and peaty soils is not recommended, as such soils may lack the necessary copper levels for plant growth and development. In general, to achieve high yields of corn, it is necessary to take into account the above soil requirements and to perform proper tillage and fertilization.

Crop rotation. Growing corn for silage has a certain impact on crop rotation and the choice of crops for the following year. Corn is a high-yielding crop that takes a lot of nutrients from the soil, particularly nitrogen. Therefore, after corn, it is recommended to plant crops that do not require a lot of nitrogen or those that can provide it in the soil. These crops include: cereals and legumes (wheat, barley, peas, soybeans), oilseeds (sunflower, corn), and fodder (alfalfa, oatmeal).

After corn, it is not recommended to plant crops that also require a lot of nutrients from the soil, in particular nitrogen. These crops include potatoes, sugar beets, cabbage, corn, and sunflower.

It is also not recommended to grow corn for silage on the same field for more than 2-3 years in a row, as this can lead to a decrease in yield and deterioration of soil quality. To preserve soil fertility, it is recommended to carry out crop rotation and include a variety of crops.

Soil preparation and fertilizer application. Soil preparation. To prepare the soil for sowing corn for silage, it is necessary to carry out basic tillage, which includes stubble peeling and autumn plowing. This will help clear the field of weeds and effectively control pests. The stubble cultivation is carried out after harvesting the predecessor using disk cultivators or tandem double-track disk harrows to the appropriate depth. To control perennial root and sprouting weeds such as thistle, spurge, field bindweed, etc., two peeling operations are used, the second of which is carried out during the period of mass appearance of weed rosettes to the appropriate depth.

The main soil cultivation before sowing corn for silage consists of peeling and plowing with the application of organic fertilizers in the fall. After that, it is necessary to carry out spring tillage, which begins with harrowing and leveling the seedbed. Spring tillage is aimed at killing weeds and preserving moisture, and the pre-sowing cultivation period should not exceed one day.

Subsequent tillage depends on the appearance of weeds in organic corn crops. Usually, it is two harrowing on the seedlings and two cultivations. It is important to perform all treatments on time and at the appropriate depth to achieve a successful silage corn harvest.

Fertilizer application. Before sowing, you need to apply phosphorus and potassium fertilizers, such as ammophos (NP 12:52) or superphosphate. The dose of fertilizer is set based on soil analysis.

During sowing, it is recommended to apply a small dose of phosphate fertilizer, for example, diammophoska (NPK 10:26:26).

Different types of fertilizers should be used during the growing season, depending on the needs of the plants. For example, at the beginning of the growing season, you can apply sulphate of ammonia (NPS 20:20:16), and during the overgrowth of leaves - nitroammophoska (NPK 16:16:16) or a fertilizer mixture with a predominance of phosphorus and potassium in the general formula.

It is important to regularly monitor plant growth and fertilizer requirements.

Sowing. Seed preparation. Preparation of corn seeds for sowing begins with the selection of seed material. If the seeds are not treated by the manufacturer, they must be treated with a fungicidal preparation, or even better, a fungicidal-insecticidal preparation. This will help disinfect the seedbed and protect the seeds and seedlings from diseases and soil pests. Before sowing, corn seeds should be checked for moisture content - it should not exceed 14%. If the seeds contain contaminants from other plants or are damaged, they should be sifted out.

Sowing method. Sowing depth varies from 4 to 7 cm depending on the region and soil and climatic conditions. Sow in a dotted, wide-row method with row spacing of 70 cm.

Sowing time. Silage corn belongs to heat-loving crops, so it should be sown when the soil reaches a temperature of 10-12 °C at a depth of 6-8 cm, usually in late April or early May.

Seeding rate.

Sowing density is determined depending on the characteristics of the corn hybrids. Usually within the range of 55-70 thousand seeds per hectare. For silage corn, a lower stem density is extremely important. It is important to remember that due to the thickening of crops and a powerful nutrition system, the amount of green mass of corn can increase, but at the same time there may be fewer ears. This will negatively affect the nutritional value and digestibility of the silage. Therefore, it is necessary to plan the density of silage corn crops taking into account the yield of both green mass and the cobs themselves.

Crop care. When growing corn for silage, agrochemicals are used with extreme caution, as their application rates can affect the toxin content of the silage mass. But if the farmer does decide to use pesticides, it is better to use them only in the pre- and post-germination periods.

It is important that corn crops should be cleared of weeds before the 5 leaf stage to ensure optimal conditions for earing, and thus contribute to obtaining more grain in the silage mass. Continuous herbicides are applied after the previous crop has been harvested. During the corn growing season, herbicides are sometimes used to control broadleaf weeds.

To protect against diseases, hybrids resistant to common diseases and seed treatment are the most successful solutions.

Harvesting. Silage corn forms a harvest within 75-180 days. The best time for harvesting is the phase of milk-wax and wax ripeness, when the moisture content reaches 65-70%. The most optimal for harvesting and silage quality is the developmental phase, when the dry matter content in the cut plant is from 30% to 35%. However, from the experience of many farmers, it is known that in order to obtain high-quality silage, it is important to harvest corn at the right stage of maturity, so 2-3 hybrids with different growing seasons are often sown in the fields.

HOW TO GROW SOYBEANS: THE CHOICE OF MINERAL FERTILIZER

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Growing soybeans requires attention to detail, because the yield and sales of the product depend on them. In this article you will find answers to the following questions:

- how to grow soybeans;
- rules for soil preparation for sowing;
- what to feed soy;
- rules for applying mineral fertilizers under soybeans.

Scientists assure that soy began to be grown approximately 5-7 thousand years ago, but it is not known exactly when. In Europe, soy as a crop for agriculture was first mentioned in 1873, when it was presented at an international exhibition in Austria. For a long time, they could not come up with a name for this plant, among the options they once considered oil pea and, for example, oil bean.

Some interesting facts about soy:

1. Global production of soybeans in the world is almost 336.59 million tons, among the leading producers are Brazil, the USA, and Argentina.
2. The leader in soybean consumption is China, the annual consumption of soybeans in China is 110 million tons.
3. 190 countries are involved in the trade of soybeans and its products in the world.
4.35-40% of the grown soybean crop goes to the world market. Most of the harvest remains in the producing countries.
5. 53 countries in the world export soybeans.

The uniqueness of this agricultural crop is its versatility. The genome of this crop was deciphered 10 years ago, and today soy is most often subjected to genetic modifications in the world. Surrogates for many other products are made from it - for example, milk, cheese, tofu, meat.As for Ukraine, according to analysts' estimates, the area sown under soybeans in our country is 1.5 million hectares, and Ukrainian harvests of this crop are estimated at 3.2-3.5 million tons.

How to grow soy. The two most important things you should know after choosing a crop variety are the sowing season and the specifics of preparing the soil for sowing.

Seasonality: top-up fertilizer under soybeans in April-May, when the soil has warmed up to 10-15 °C, because at lower temperatures, seeds practically do not germinate. First, late-ripening varieties are sown, and only at the end - quick-ripening ones.

Soybean crowning: location and previous crops. Most types of soil are suitable for sowing soybeans, but there are nuances. Sandy and stony soils are too dry for this plant. The best soil acidity level for soybeans is between 6.2 and 7.0 pH. Therefore, the acidity of the soil should not be lower than pH 5.5. If you have such land, you need to use a special mineral fertilizer for acidic soils - NPK 9:18:22.

This crop is badly affected by flooding (especially for more than three days), so the soil for soybeans must have good drainage. Also keep in mind that the soil surface should be leveled for easier harvesting.

The peculiarity of soybeans is that in the initial stages of vegetation, this plant develops a powerful root system, so the growth of the plant itself is less intensive. Therefore, in order to have a better result and harvest, make sure that the area under soybeans is not weeded.

It is best to grow soybeans after winter and spring grain predecessors. After all, these plants vacate the field faster than other crops, so it is easier to prepare the soil after them. Instead, it is not desirable to sow soybeans after perennial legumes and sunflowers.

In turn, soybean is a good precursor for sowing other crops. This plant leaves behind soil saturated with nitrogen and nodule bacteria, so the soil after it has an improved structure and good fertility.

Soy is used in two-field crop rotations, and it is best to grow winter wheat, spring barley or corn after it. However, if you have a farm in the northern regions, then keep in mind that after the late harvesting of soybeans, it is not recommended to grow winter crops in that place.

SOIL treatment under soy. Follow the rules of soil preparation before sowing soybeans, because the effectiveness of the fertilizer will depend on this. Soybeans should be sown on warm soil of all types, except acidic and dry, which have poor texture and low organic matter content. It is best to sow soybeans after wheat, rye, barley, as well as corn, potatoes, and beets. We do not recommend sowing soybeans after sunflower, peas, beans, chickpeas and lentils.

The main work before planting soybeans is to apply fertilizers, post-harvest residues, improve soil structure, accumulate moisture and kill weeds.

If you have not prepared the soil since autumn, we recommend applying a surface treatment with deep loosening. Also, don't forget to level the field to apply fertilizer in the future. And what to feed soy?

Top-5 rules for growin soy. If you plan to grow soybeans, we have compiled an agricultural guide for you - a number of important rules for this crop. These items were created based on the experience of Ukrainian farmers.

Rule 1: Ukrainian owners have a saying that they sow soybeans when the apple tree is blooming. It really is. This crop is sown when the average daily temperature reaches +12 °C. The pre-sowing background should be level, and on the seventh day the seedlings should appear.

Rule 2: good technique. To minimize damage to the seeds, perform a technical inspection of the seeding equipment in advance. Check if the planter does not damage soybeans, if so, adjust the seeding rate. And remember that pneumatic planters can injure the seeds of this plant.

Rule 3: Study the soybean variety carefully. This is necessary to know the correct seeding rate to apply, what the seeding depth should be and the recommended row spacing.

Rule 4: soil acidity. Optimally, it should be at the level of 5.5-7 pH for growing soybeans. If this indicator is less than 5.5, then choose a special mineral fertilizer NPK 9:18:22 to regulate soil acidity.

Rule 5: All stages of soybean plant development must be monitored and analyzed. And it is very important to remember that the productivity of this agricultural plant depends on the quality of fertilizers and correct application, but not on the amount of top dressing.

How to feed soy. In order to determine what to feed soybeans, it is necessary to conduct a soil analysis, because the type and amount of mineral fertilizer will depend on its depletion. It is necessary to feed soybeans with fertilizers in three stages: main, pre-sowing and top dressing.

Note that soybean absorbs fertilizers from the soil quite early, so to improve the yield, feed the plant already at the flowering stage.

When to apply fertilizers under soybeans? Fertilization of soybeans should be carried out in the spring - with macronutrients (phosphorus, potassium and nitrogen).

Feed soy as better as possible. Applying fertilizer under soybeans is a process that requires attention and the right approach. Most often, the question that worries farmers is: which fertilizer to choose for soybeans for a high-quality harvest? The solution for many Ukrainian farmers is the mineral fertilizer Nitroamofoska-M from the Ukrainian manufacturer "Tetra-Agro". The advantage of this fertilizer is that it fully nourishes the plant, because it is saturated with nitrogen, phosphorus and magnesium, which are necessary for a high-quality soybean crop, and also balances the acidity (pH) of the soil. And acidity directly affects the subsequent yield.

Norms of mineral fertilizer application under soy. Before understanding how to grow soybeans correctly, you should understand what elements affect its quality and rapid growth.

1. Phosphorus - accelerates the growth and development of the plant.

2. Potassium is important for regulating the water regime and plant photosynthesis, protects against diseases and stress factors.

3. Magnesium - promotes the movement of phosphorus in soybeans, ensures

respiration, converts nitrogen into protein, and also activates enzymes that ensure protein and carbohydrate metabolism.

The NPK content of mineral fertilizer for soybean Nitroamofoska-M is 9:18:22.

The recommended application rate of Nitroamophoski-M is 200-400 kg per 1 ha.

The application rate depends on many factors, in particular the pH level. By the way, the company "Tetra-Agro" measures the acidity of your farm's soil free of charge and, if necessary, can change the NPK of fertilizers for the special needs of your soil.

ВПЛИВ ГУСТОТИ ПОСІВУ НА ПРОДУКТИВНІСТЬ СОРГО ЦУКРОВОГО В УМОВАХ ПРАВОБЕРЕЖНОГО ЛІСОСТЕПУ

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Сорго цукрове – культура, що має особливо глибоку кореневу систему. За допомогою неї вона використовує протягом першої половини літа вологу з глибших шарів ґрунту, сильніше висушуючи їх, а в другій половині літа використовує ґрунтову вологу опадів [1].

Сорго як культура, що має ефективний механізм фотосинтезу С4, може активно здійснювати процеси засвоєння та трансформації світлової енергії за температури повітря 35°С і навіть за 40°С, тоді як інші культури за цих умов практично припиняють асиміляційні процеси і перебувають у стані депресії (пшениця, ячмінь тощо) [2]. Відомо, що врожайність залежить від площі листя та продуктивності фотосинтезу і більшою вона може бути за умови, коли площа листкової поверхні рослин буде оптимальною, що в свою чергу сприятиме процесу фотосинтезу. Як відомо, на величину площі листкової поверхні впливає багато факторів. Одним з них є густота стояння рослин, регулювання якої дає можливість покращити фотосинтетичну діяльність сорго.

Синягін І.І. та ряд авторів [3], стверджують, що за різної густоти стояння рослин у посівах створюються неоднакові умови температури і освітлення, надходження вуглекислоти та інших факторів життя, що впливають на поглинання фізіологічно активної радіації, інтенсивність процесів фотосинтезу і дихання рослин. У загущених посівах спостерігається підвищення відносної і абсолютної вологості повітря, що пов’язано з погіршенням повітряного обміну.

Вимірювання асиміляційної площі листкової поверхні рослин, залежно від густоти стояння сорго цукрового, здійснювали в основні фази розвитку: кущіння, вихід у трубку, викидання волоті-цвітіння, воскова-повна стиглість зерна.

Дані досліджень показали, що площа листкової поверхні наростала від фази кущіння до фази повного цвітіння, формуючи максимум. Надалі вона починала зменшуватися, за рахунок відмирання нижніх листків, до фази повної стиглості зерна.

Встановлено, що сумарна площа листків зменшується значно повільніше, порівняно із зменшенням кількості рослин (густоти стояння) на

велику площу живлення, утворює більше листків, причому окремі листки виростають значно крупнішими ніж у посівах з оптимальною площею живлення рослин.

Збільшення або ж зменшення площі живлення спричиняє великі зміни в розмірах і кількості листків, відповідно змінюється і розмір асиміляційної поверхні як окремої рослини, так і посівів у цілому.

Даними дослідників [4] підтверджується, що оптимальна площа листкової поверхні є показником, що характеризує ефективність дії комплексу або окремих елементів технології вирощування, що впливають на процес формування врожаю.

Найбільша площа асиміляційної поверхні однієї рослини спостерігалась за найменшої густоти стояння у всіх досліджуваних варіантах. У сорго за густоти стояння рослин 200 тис. шт./га вона була максимальною у фазу «викидання волоті-цвітіння» і складала 2248, 2433 та 2156 см2 за сівби насіння з шириною міжрядь 15, 30 та 45 см відповідно. Із загущенням посівів площа листкової поверхні однієї рослини зменшувалась і становила за густоти 300 тис. шт./га 2140, 2290 та 1993 см2; за густоти 400 тис. шт./га – 1954, 2072 та 1804 см2 відповідно до ширини міжрядь рослин 15, 30 та 45 см.

Таким чином, від темпів накопичення біомаси рослин сорго цукрового у всі періоди вегетації напряму залежить чиста продуктивність фотосинтезу. Використання фотосинтетичної активної радіації сприяє формуванню більшої вегетативної маси, яка досягає максимуму під час викидання волоті-цвітіння рослин і поступово знижується у наступні фази росту і розвитку.

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SPATIAL AND QUANTITATIVE PLACEMENT OF CORN IN THE CROP

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Under the conditions of irrigation in the southern zone of the Steppe of Ukraine, it is important to take a differentiated approach to the selection of the sowing period and plant density, which are one of the main factors affecting the yield of corn grain. Spatial and quantitative placement of plants are one of the most important elements of varietal agricultural technology, so they are considering in close interaction.

Sowing time is one of the main factors in obtaining high yields of corn. This issue has been studding for a long time, but every year in the State Register of plant varieties suitable for distribution in Ukraine, new hybrids of corn, different in terms of ripeness and morphological characteristics, appear, which react differently to the influence of environmental factors. Therefore, for each group of hybrids, it is necessary to determine the optimal sowing period, taking into account the culture's requirements for germination conditions and the peculiarities of spring agro-ecological conditions.

Dr. S.-G. of Sciences, professors of the Institute of Irrigated Agriculture of the National Academy of Sciences of Ukraine S. V. Kokovikhin and Yu. O. Lavrynenko believe that when determining the sowing date, it is worth focusing on the maturity group of the hybrid. In particular, the relatively late sowing date of the parent forms of early-ripening and mid-ripening hybrids makes it possible to carry out a set of measures to accumulate moisture and destroy weeds before sowing.

After studying the biological characteristics of corn, it became knowning that the culture uses solar energy, heat and moisture inefficiently during the first two months after sowing in the first half of the growing season, while growing slowly. However, during the second half of the growing season, when the use of these factors is more necessary for the plant - the inflow of solar radiation declines, air temperature and soil moisture reserves become lower. To improve the efficiency of the use of all agro-ecological resources, it is possible to vary the timing of sowing and, accordingly, the time of passage of all phenological phases of crop development.

According to the established multi-year terms, in the Southern Steppe of Ukraine, sowing begins in mid-April, but the temperature of the soil at the depth of seed wrapping is the main factor that determines the start of sowing because when wrapping seeds in insufficiently warmed soil, the death of part of the seeds in the soil, damage may occur seedlings by wireworms, mold diseases and, as a result, uneven growth and development of corn plants in the future.

According to the results of research conducted by domestic scientists, it is necessary to inlay seeds to improve field germination, shorten the growing season by several days, and increase crop productivity by 0.9-1.1 t/ha. However, with the use of encrusted seeds, the corn sowing time becomes 5-10 days earlier, compared to the usual ones.

Very dry weather conditions are observing in Ukraine every 2-3 years due to simultaneous atmospheric and soil droughts. In such periods, it is very important not to be late with sowing campaigns, otherwise the grain may fall into an insufficiently moist soil layer and the result will be poor field germination. In the event of a 10-day delay with relatively optimal sowing dates, the productivity of corn grain decreases by 0.6-0.8 t/ha [1].

At different times of sowing, the combination of temperature and moisture should be optimal. It should be taken into account that during the early sowing period, the depth of wrapping the corn grain should be less, and under the conditions of late sowing - greater, soil moisture is very important. The fact that soil moisture reserves in this period are greater than in the later ones speaks in favor of early sowing periods, which is important during the phase of panicle ejection and waxy seed maturity. Under such conditions, a higher yield of early-maturing and medium-early hybrids, which belong to the siliceous group and are characterizing by increased cold resistance, is obtaining due to better adaptation to growing conditions, more complete use of productive moisture of the arable soil layer. Nevertheless, plants during the early sowing period are subject to the danger of damage by spring frosts, biotechnical factors are activating - pests, diseases, weeds.

In particular, corn is more affecting by the corn moth because the plants will already be sufficiently developing by the time the butterflies fly and lay their eggs. Field germination decreases - the scientist D. P. Tomashevskyi connects this with the aggressive effect of low temperatures in combination with fungal diseases, pathogens of Pythium, Pénicillium, Alternaria, Fusarium species.

Therefore, when choosing the optimal sowing time, it is necessary to first of all take into account such criteria as heat resources, the temperature regime of the soil and air during the period of seed germination and seedling formation, phytosanitary state of crops, precociousness of hybrids and heat supply, the level of plant protection, the total length of the growing season, cultural requirements to the consumption of moisture for the formation of products. Due to the diversity of these factors, the complex and a priori unknown nature of their interaction, the solution to the issue of optimal sowing dates can only be obtaining because of long-term research, in multifactorial field experiments.

Plant density is one of the important factors in modern technologies for growing agricultural crops, which determines the effectiveness of the vital components of agrocenosis - growth processes and their development, allows the maximum realization of plant productivity and the most efficient use of soil moisture and soil nutrient reserves. With the expansion of corn-sown areas in Ukraine, the study of the influence of plant stand density on crop yield has become particularly relevant [3].

Under the leadership of O. I. Zinchenko, research was conducting at the Uman State Agrarian University regarding the study of the influence of seeding density on the productivity of corn per grain. The results of the experiments indicate that the best corn yield can be obtaining under the conditions of compliance with the density of standing of medium-ripening hybrids and varieties: in the southern arid areas of the Steppe within 25-30 thousand plants per one ha, in the central, more humid steppe areas, 35-40 thousand. , in the north - 40-45 thousand, in the forest-steppe and Polissia - 55-65 thousand, on the irrigated lands of the South - 70-75 thousand plants per 1 ha. According to the results of research by scientists, it was established that the density of planting hybrids in areas with insufficient moisture is 55 thousand units/ha, in areas with sufficient moisture - 60-65 thousand units/ha, and in irrigated conditions - up to 80 thousand units. /Ha. The optimal stand density changes annually depending on the biotype of hybrids, weather and climate conditions, in particular arid conditions, especially in the second stage of plant development. The density of the stand depends on the moisture of the soil, as well as the supply of nutrients to the plants. Non-compliance with the optimal stem density threatens with significant yield loss, in particular in the drought conditions of the Southern Steppe of Ukraine [4].

The density of standing corn strongly affects moisture availability. Plants in the most densely planted crops use the moisture reserves of a meter-long soil layer for the development of vegetative organs, mainly in the first half of the growing season. The crisis period in terms of moisture supply in corn begins after the formation of 12-13 leaves in mid-early and mid-ripening hybrids and 14-15 - in mid-late and late-ripening hybrids. During the formation of cobs, the moisture supply of plants deteriorates sharply, which, when the crops are thickened, leads to inhibition of growth processes, a decrease in the intensity of photosynthesis, and, as a result, to a decrease in plant productivity. On a well-fertilized agricultural background, moisture is useding more economically. Thus, with an increase in fertilizer rates and moisture availability of plants - with a sufficient amount of precipitation, the efficiency of thickening increases with irrigation [5].

The density of plant stands has a considerable influence on the hydrothermal mode of agrophytocenosis, water and physical properties of the soil, phytoclimate of crops, which is decisive for the passage of the stages of organogenesis of corn plants. In particular, Bomba M.Ya. and Bomba M.I. expressed the opinion that the yield of agricultural crops depends on the components of varietal agricultural technology by approximately 60% and proved with their research that the rates of growth and development of corn directly depend on the density of the stand, but in different ways are found. This is primarily due to soil and climatic conditions, agrotechnical cultivation, as well as biological and morphological features of the culture [3].

Zaporozhchenko A. L. expressed the opinion that the density of corn stalks should be regulating depending on the indicators of the agrochemical composition of the soil and the moisture supply of the crop plants. According to the scientist, the formation of the optimal density of planting of plants contributes to obtaining the maximum productivity of the culture, because both thickening and thinning of the stand density cause a sharp decrease in yield [2].

Optimizing the density of plant stands is important for the formation of the photosynthetic apparatus, because these concepts are physiologically related. In particular, the researcher A. A. Nychiporovych noted that the optimal indicators of the leaf surface area for crops of the grain group are set at a stand density of 40-50 thousand units/ha. At the same time, due to the process of photosynthesis, 90-95% of the mass of the crop is forming. As for the further increase in the area of the leaves, it was ineffective, the mass share of cobs in the structure of the crop decreased significantly [2].

Foreign scientists conducted similar studies, during which it was found that with an increase in the density of stalked corn - more than 50-60 thousand pcs./ha, the total area of the leaf surface increased in direct proportion to the thickening, but the yield of corn grain decreased. This indicator affects the flowering time of corn hybrids (with excessively thickened sowing, the flowering process is significantly delayed), as well as the number of cobs on the plant - thickening of the crops leads to a decrease in their number on the mother plants, their grain size, weight and yield of grains from the cob.

Conducted by the scientist Kalenich V.I.studies have shown that the influence of the density of planting plants on the size of the cobs was manifesting both in favorable and unfavorable years. At a stand density of 70 and 100 thousand plants per 1 ha in medium-ripe hybrids, the cobs were significantly shorter and with fewer grains than in the case of the sowing density of the same hybrids, but already at a stand density of 60 thousand plants/ha and 40 thousand units/ha. At the same time, the length of the cobs decreased by 6-14%, and their weight by 19-21% [3].

Researches of many scientists prove that the density of crops affects the growth of corn and affects both the height of the plants and the height of the attachment of the cob. In particular, G. E. Shmaraev, based on the results of his research, concluded that the later the parental form of the crop and the higher the height of the plants, the higher the cobs are planting. An increase in the stem density of corn hybrids is accompanied by an increase in the total area of the leaf surface, which becomes an obstacle to the arrival of PHAR, as a result - poor pouring of grain, an increase in the number of small cobs and laying of plants, postponement of harvesting dates towards later ones, loss of harvest [4].

Candidates of rural and urban areas of sciences O. M. Grigorieva and T. M. Grigorieva proved in practice that an increase in stand density reduces productivity, regardless of the morphological characteristics of hybrids. Conducted experiments on the influence of plant density on the growth and development of corn of different maturity levels showed that early-ripening hybrids in the phase of panicle shedding with an increase in stand density from 60 to 100 thousand units/ha increased the height of the stem by 11-17 cm.

At the same time, the diameter of the second underground internode decreased by 0.2 cm, the area of the leaf surface also decreased. At the same time, when crops are thickened to certain limits, especially in years favorable for moisture, although the individual productivity of plants decreases, the number of productive plants per unit area increases significantly, which leads to an increase in the yield for hybrids of all maturity groups. In thinned corn crops, despite the ability to obtain high individual productivity of plants, without sufficient stem density per unit area, there is no increase in productivity [5].

According to Sytnyk K. M., primarily hereditary features, and only then determine the total number of flowers on cobs by the influence of growing conditions, because different varieties, lines, and hybrids react differently to these conditions [2].

IMPORTANCE AND CURRENT STATE OF CULTIVATION OF GRAIN LEGUMINOUS CROPS

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Modern global trends in the formation of food and fodder resources, if the protein issue is resolved, are the main components of the global food problem. At the same time, the existing tendency to decrease the production of high-protein foods of animal origin, especially in countries with a low standard of living and income of the population, as well as the high cost of their production, make it necessary to increase the production of proteins of vegetable origin, the demand for which has increased significantly in recent years.

In plant food protein resources, an important place is occupied by one-year grain legumes, which are one of the best sources of high-quality, balanced amino acid composition, relatively cheap and environmentally friendly protein and occupy a prominent place in ensuring food security in many countries of the world.

The special role of grain legumes in solving the protein problem is determined, first of all, by the high protein content, which is 20-22% in pea grains, 23–25% in beans, 35-36% in lupine, 32% in fodder beans, 33-40% in soybeans, cinnabar – 28, vetch – 28-33, peanut – 24%, the presence of a significant number of irreplaceable and critical amino acids, high solubility and nutrition, easy assimilation by the body of humans and animals.

The grain of leguminous crops is used in the food, animal feed, canning and other industries. In addition, due to the high content of fat, oil of high quality is produced from the grain of these crops. More than 20% of protein is currently obtained from legumes. Lupine is also used as a raw material for the food and processing industry. Its seeds produce flour, oil, which is a dietary supplement in the diet for human nutrition, as well as protein concentrates, which are used for the production of artificial fiber, glue, plastics, etc. The total production of legumes in the world has increased over the past half century by more than one and a half times and amounts to almost 75 million tons.

The green mass of lupine is used for livestock feed in the form of green fodder, silage, hay, grass flour, and grain – for the production of compound feed. In the regions of Europe and Central Asia, the three largest producers of culture are Russia, Turkey and France. Ukraine grows only up to one percent of the global production of legumes.

The global area of lupine cultivation is 0.9 million ha, the average yield is 1.45 t/ha. Most lupine is grown in Australia, where its average yield is over 1.0 t/ha. In the structure of lupine production, Australia accounts for 57.5%, South America – 25.0%, Europe – 14%, Africa – 3% and North America 1% of the world's gross harvest of the crop.

In Ukraine, four types of lupine (blue or narrow-leaved, yellow, white and perennial) are mainly grown in Polissia. Varieties of yellow fodder and blue narrow-leaved lupine are common in Chernihiv, Zhytomyr, Kyiv, Rivne, and Volyn regions. White lupine is grown in the forest-steppe and Transcarpathian regions. The sown area of lupine per grain is 20–25 thousand hectares. The average grain yield of fodder lupins is relatively low: yellow – 0.8-1.0, white – 1.6-1.8 t/ha. With high agricultural technology and intensive growing technology, the yield of grain can be 2.5-2.8 t/ha, and green mass – 45.0-50.0 t/ha.

The agrotechnical significance of leguminous crops is also important. They significantly increase soil fertility, enrich them with organic matter and, thanks to symbiotrophy, with biological nitrogen. Biological nitrogen fixation of the atmosphere, which occurs due to the development of nodule bacteria on the roots, is a valuable feature of leguminous crops. Due to this, most leguminous plants provide not only their own need for nitrogen, but also its accumulation in the soil, leaving behind in it from 42 (peanuts) to 157 (lupins) kg of nitrogen per 1 ha, and in years favorable for nitrogen fixation – and much larger volumes.

It is known that legumes in crop rotation significantly improve the passage of biological processes in the soil due to the favorable chemical composition of root and post-harvest residues. The combination of biological processes with the active activity of nodule bacteria improves the nitrogen balance of the soil and restores its fertility. In addition, the use of leguminous crops for green manure significantly increases the yield of cereals and other crop rotations on soils poor in humus content.

Taking into account the listed advantages of lupine, it can be said: this leguminous plant has a great future; therefore, its development is currently a promising direction in the field of crop production.

EVALUATION OF VARIETY SAMPLES BY QUALITY INDICATORS SEED

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China (Latirus sativus L.), like peas and lentils, is used as a fodder and food crop. Its nutritional value is determined by the high protein content in the grain (28-30%), which is well digested by the body. It tastes almost like peas. In Central Asian countries, chickpeas are sown together with other leguminous crops, and porridge and other dishes are prepared from the flour. It is also used as a vegetable crop. Cereals, canned food, flour, and starch are made from the seeds of the quinoa. It is also used to make a coffee substitute. Buckwheat contains 26-36% protein; 0.7-1.2% - fat; 3.9-5.8% - fiber; 2.7-3.4% – ash; 0.2-0.3% - potassium and 0.4-0.5% phosphorus. In terms of biochemical characteristics, chickpeas are not inferior to peas and soybeans, and contain even less fiber than them. According to the collection of protein from one hectare, it ranks first among leguminous crops [1].

The rapid spread of this type of seed in world agriculture is due primarily to its ability to accumulate a significant amount of protein in grain and vegetative mass. It is valuable as a fodder crop. Chinna is used as a forage crop for green fodder, silage, hay and grain. Its seeds contain 28-30% protein, 45-47% starch, 1% fat, 4-5% fiber and 2.5-3% ash. 1 t of green mass contains up to 2.8 kg of digestible protein, 21.5 feed units.In addition, 1 kg of green mass contains 76 mg of carotene and mineral salts necessary for animals: 2.1 g of calcium and 1 g of phosphorus. vetches and alfalfa. China has great agrotechnical importance. Its plants are able to absorb nitrogen from the air and enrich the soil with it. In this regard, it is a good precursor for many agricultural crops - winter wheat, corn, barley, sugar beet and others. The grain yield is high and amounts to 18.8-25.8 t/ha [2].

It is known that wheat grain proteins are characterized by good solubility in water and salt solutions. Their completeness is characterized by the content of all essential amino acids. One kilogram of buckwheat contains: lysine - 17.2 g; methionine – 4.3; cystine – 2.6; tryptophan - 2.9; arginine – 22.7; histidine – 6.3; leucine – 31.6; phenylalanine - 10; threonine – 11.8; valine – 12.6; glycine – 8.2 grams [3]. It is appropriate to point out that rice can be a source of replenishment of vitamins. In particular, 1 kg of its grain contains: thiamine - 7.2 mg; riboflavin - 2.0; nicotinic acid - 30.0; pantothenic acid - 13.0; tocopherols - 51.4 mg. In addition to vitamins, plantain is also rich in minerals. Also, the seeds of plantain are used in the medical field for medicinal purposes. Popularly known as the "scented pea", there are more than 1,000 varieties of pea in the world.

The seeds of the plant are used as fodder and technical crops. From the protein of its seeds, high-quality glue (casein) is produced for gluing high grades of plywood. It is also used in the textile industry and the production of plastics. Shredded grain is fed as concentrated feed to cattle and pigs. Straw is used for animal feed, which significantly exceeds pea, lentil and other leguminous straw in terms of protein content (13%). At the same time, it is not recommended to constantly consume the seeds of this plant, because it can cause a serious disease of bone tissues and the nervous system, which is associated with poisonous amino acids that are freely included in the composition of proteins. Chinna is sown for green fodder, hay and for grazing. It has been studied that the green mass of the plant contains a lot of carotene (provitamin A), which is necessary for the normal growth and development of animals. At the beginning of flowering plants, the carotene content is 270-280 mg/kg of absolutely dry weight. The period of use of green mass for fodder (from the beginning of flowering to the beginning of ripening) is much longer than that of spring vetch, which is important in the functioning of the green conveyor.Sowing of this crop on hay, silage, as well as in mixtures with oats, barley, Sudanese grass and in multi-component mixtures (for example, ryegrass + peas + oats, or ryegrass + vetch + peas) is effective. Hay or grass flour, made from the vegetative mass of the plant during its flowering period and at the beginning of the formation of beans, is one of the best in terms of nutritional properties [1, 3].

Therefore, the aim of the scientific work was to study the varieties of the species according to quality indicators.

The researches used the Oriolga and Spodivanka varieties. China was sown simultaneously with early spring crops, in the usual row method with a row width of 15 cm.

It was established that the Ivolga variety was superior to the Spodivanka variety not only in terms of quality, but also in terms of productivity. The seed yield of the studied varieties was 3.55 t/ha and 3.00 t/ha.

Qualitative components indicate that the protein content of the Ivolga variety was within 29%, and that of the Spodivanka variety was 2% less. The fiber content was 4.7

and 4.0%, respectively. The study of ash in varieties allows us to note that its content varied from 2.9 to 3.1%. The phosphorus and potassium indicators in the Ivolga variety were 0.3% and 0.5%, and in the Spodivanka variety - 0.2% and -0.4%. Thus, in the course of research, it was established that varietal characteristics affect the formation of not only quality indicators, but also crop yield.

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OPTIMIZATION OF PEA AND CHICKPEA SOWING RATES IN CONNECTION WITH CLIMATE CHANGES

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Two problems have arisen for agricultural production, the main one of which is the lack of moisture. The second problem **is** temperature stress. Until now, generally accepted technologies for growing legumes did not fully take into account the natural adaptation of agrophytocenoses to the variability of weather conditions. Therefore, in order to reduce the influence of these factors on crops, there is a need to adapt the existing elements of cultivation to the factors of the external environment, which are constantly changing. All components of cultivation technologies are subject to adaptation, the main of which are: scientifically based placement of crops in crop rotation; selection of varieties (hybrids); sowing technology; soil cultivation system; fertilizer system; a system of crop protection and care, etc., which will make it possible to create a favorable microclimate in the agrocenosis.

One of the ways to regulate the microclimate is to create an optimal sowing structure by adjusting the sowing rate. At the same time, there is a change in the area of plant nutrition, shading of the soil surface and optimization of moisture consumption and reduction of unproductive moisture losses, improvement of the temperature regime inside crops, etc.

Currently, scientific circles and producers do not have a single point of view regarding the optimal sowing rate for leguminous crops in different soil and climatic conditions. A significant number of publications are quite old and correspond to today's realities regarding the biological requirements of varieties and changes in climatic conditions.

As you know, the sowing rate should contribute to the optimization of the density of the agrocenosis in certain soil and climatic conditions.

It is also known that the norms for sowing legumes vary significantly depending on the type of crop, biological and varietal characteristics, technological conditions of cultivation, weather conditions of the year, etc.

For example, according to P. I. Hryshchuk, the sowing rate of early-ripening white-flowered pea varieties reaches 1.2–1.4 million similar seeds/ha, and for red-flowered varieties – 1.0–1.2 million similar seeds/ha seeds Based on a review of literary sources, the author concludes that the rate of pea sowing varies depending on varietal characteristics, ranging from 0.8 to 1.5 million pieces/ha of similar seeds. The author indicates that the optimal sowing rates for varieties of oblique use are within 0.8–0.9 million pcs./ha, for varieties of the leaf type – 1.0–1.2 million pcs./ha, for tall varieties of the moustached morphotype – 0.8–0.9 million pcs./ha, for traditional varieties of leafy and semi-leafy morphotypes – 1.0–1.2 million pcs./ha of similar seeds.

In foreign scientific sources, there are opinions regarding lower sowing rates than in Ukraine. So, for example, in the Czech Republic, it is recommended to sow peas at a rate of 0.9–1.1 million pieces/ha of similar seeds, in Poland – 0.8–1.0 million pieces/ha, and in Germany it is 0.7 -0.8 million pieces/ha of similar seeds.

In the conditions of Ukraine, the data of various researchers regarding the optimal rate of pea sowing vary quite a lot. Yes, according to I. M. Buchynskyi and V. V. Lyhochvora, the optimal sowing rate of pea varieties Madonna and Astronaut in the conditions of the south of the Kyiv region is 1.0 million pieces/ha of similar seeds.

According to the results of research conducted at the experimental field of the Lviv National Academy of Sciences in 2017–2019, the best sowing rate for the Madonna variety was within 1.0–1.1 million pieces/ha of similar seeds, for the Gotivskyi variety – 1.2 million pieces/ha ha of similar seeds, Otaman variety – 1.1–1.2 million pieces/ha of similar seeds. At the same time, the yield of the varieties was 6.5, 6.3 and 6.0 t/ha, respectively.

Scientists of the Institute of plant breeding named after V. Ya. Yuryev recommends growing peas with a sowing rate of 1.0–1.2 ml of similar seeds per hectare, and in dry conditions to reduce the rate by 20–25%.

In the south of Ukraine, with a moisture content in the meter layer of the soil in the range from 95 to 132 mm, the best results when growing peas are obtained with a sowing rate of 1.1 ml of similar seeds per hectare, and with insufficient reserves of productive moisture (52 mm), the sowing rate is recommended reduce to 0.8 million pieces/ha of similar seeds.

Other researchers recommend sowing peas at a rate of 1.2–1.4 million pieces/ha of similar seeds.

A.D. Girka etc. in the conditions of the Northern Steppe, peas are recommended to be grown by sowing with a sowing rate of 1.4 million pieces/ha of similar seeds.

Other researchers also promote thickening of crops in the conditions of the Steppe. V. A. Ishchenko, E. M. Lebed et al., O. V. Ilyenko recommends growing peas on fertilized backgrounds with a sowing rate of 1.4 million pieces/ha of similar seeds.

The same time, in the studies of O. P. Kozhevnikova and others. increasing the pea sowing rate from 1.2 to 1.6 million similar seeds per 1 ha improved the percentage of seedlings obtained by 0.6–2.1 abs.%, plant survival during the growing season by 0.7–1.0 abs.%. In addition, productivity by 0.10–0.15 t/ha depending on the variety.

Thus, there is no unanimous opinion regarding the norms of pea sowing in scientific sources.

The most common methods of sowing chickpeas are conventional row (15 cm between rows) and wide-row (45 cm) sowing methods, but preference is givening to the conventional row method due to the higher yield of the crop.

Analyzing scientific sources, we can conclude that the rate of chickpea sowing mainly depends on varietal characteristics, the method of sowing, soil, and climatic conditions.

So, for example, in the conditions of the Odesa region, for the usual row method of sowing, it is recommended to sow 0.5–0.7 million, for strip sowing – 0.4 million, for wide row sowing – 0.3–0.5 million pieces/ha of similar seeds

Chickpea growing practices in Odesa region get the best results with the continuous method of sowing chickpeas at the sowing rate of 0.5 million units/ha, and with the wide-row system at the rates of 0.35–0.38 million units/ha of similar seeds. Other scientists also consider 0.5 million pieces/ha of similar seeds to be the best norm for sowing chickpeas in the usual row sowing method.

A.O. Babich A.A. Poberezhna is recommended to sow chickpeas in dry years at a rate of 0.6 million, and with sufficient moisture to increase it to 0.8–1.0 million pieces/ha of similar seeds. L.P. also supports the opinion regarding the high standards of chickpea sowing. Mykhaylenko, indicating that the optimal rate of crop sowing is 0.8–1.2 million pieces/ha of similar seeds.

For the cultivation of chickpeas in arid conditions, the largest yield (2.81 t/ha) was obtained by sowing 0.8 million pcs./ha of similar seeds. An increase in the sowing rate had a negative effect on the development of plants and, as a result, on the yield of the crop.

Therefore, according to the research results, the optimal chickpea sowing rates, depending on varietal characteristics, soil and climatic conditions of the sowing site, fertilization, and other factors, vary from 0.5 to 1.0 million pieces/ha of similar seeds per 1 ha.

"THE FLOWER OF THE SUN» OR THE STORY OF THE DEVELOPMENT OF THE SUNFLOWER

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This amazing, world-famous and very ancient plant appeared in North America as early as 3000 BC. After reaching Europe, she impressed the Spaniards with her golden inflorescence, similar to the sun, which miraculously always returns to follow the sun's rays. 3a sunflower was called "flower of the sun".

It believes that North American Indian tribes domesticated this plant. In particular, archaeological evidence proves that sunflowers were grown in the territory of the current states of Arizona and New Mexico.

In many Native American cultures, the sunflower was considered a symbol of the Sun deity, especially among the Aztecs in Mexico and the Incas in Peru. So, in the Aztec temple Templo Mayor (in Tenochtitlan) 10 wild sunflower seeds were found, which can be considered as an offering to the gods.

In those days, the Indians used sunflower seeds mostly in ground form, much like we use flour today. There is also evidence that the Indians made sunflower oil, which was used in baking, and even as a cosmetic product for skin and hair. Stem juice was used to heal wounds, kidneys and lungs were treated with leaf tincture. In addition, the strong, fibrous stem of the plant was used in construction.

Spanish conquerors brought sunflowers to Europe from America in 1510. The sunflower, which grew in the steppe regions of Peru, impressed the Spaniards with its sun-like, golden inflorescence that turned to follow the sun's rays.3and it was the Spaniards who called it the "flower of the sun."

It is worth noting that at first the sunflower was called differently: Mexican flower and Peruvian chrysanthemum, Indian golden flower and American chrysanthemum. But gradually these names were supplanted in almost all nations. They were replaced by words whose root was "sun". In Ukraine, it was called a sunflower; in English, it was called a sunflower (flower of the sun). Sunflower is the "namesake" of the sun among the Italians, the French, the Dutch, and many other nations.

In 1576 the botanist Mathias de Lobel was the first to give a scientific description of the sunflower. The name was legalized and written as Helianthus (from the Greek helios - sun, anthos - "flower"). A century and a half later, Carl Linnaeus added the species name annuus - "one-year" to this name. The Spanish planted the sunflower in the Madrid Botanical Garden. Not even a few years have passed since the sunflower became a permanent "resident" in France, England, Italy, and Germany. However, for the next 200 years, Europeans did not take into account the food and oil potential of the crop. For a long time, exotic flowers were grown in flowerbeds and gardens as an ornamental plant, decorated with clothes, and to a lesser extent used in medicine as an anti-inflammatory agent.

The sunflower entered Ukraine during the time of Hetman Razumovsky in the 18th century together with the pyramidal poplar, and for another 125 years, it was also used purely as an ornamental plant. However, people still tried to find some more practical use for sunflower. The English, for example, ate young sunflower blossoms with oil and vinegar. In Germany, its seeds were roasted and coffee was made from it. For the first time, the English thought about the production of sunflower oil in Europe. In 1716, a patent was registered in England that described this process in detail, but the matter, so to speak, did not go well. In 1769, the first mention of sunflower cultivation for industrial purposes appeared.

The first production of sunflower oil, which was located in the territory of the Voronezh region, was opened in 1829. As a result, sunflower acreage has grown significantly, and the market for the crop has split into two separate sectors – oilseeds and seeds for consumption. The first research programs for the development of varieties that meet the requirements of the markets were created.

Vasyl Pustovoyt is the father of scientific sunflower breeding. Vasyl Stepanovych Pustovoyt is considered the true father of scientific sunflower selection - a Ukrainian breeder, head of the selection and seed production department and the sunflower selection laboratory of the All-Union Scientific Research Institute of Oil Crops. He was born on January 2, 1886 in the village of Taranivka of the Zmiiv district of the Kharkiv province (now the Zmiiv district of the Kharkiv region).

The scientist, who is one of the initiators of the selection of sunflower for high oiliness, began breeding sunflowers in 1912 at the "Kruglyk" experimental station in the Kuban. The oil content of sunflower was increased from 20 to 50% or more.

He developed new highly effective breeding systems for improving sunflower seed production. He created 34 varieties of this crop (Kruglyk A-14, VNIIMK 3519, VNIIMK 6540, VNIIMK 8883, Peredovyk, Salyut, Zmena and others).

He established a new direction in sunflower breeding to improve the quality of oil using interline hybridization, which culminated in the creation of the world's first high-oleic variety "Pervistok". Successfully solved the problem of creating sunflower varieties resistant to lupus. Developed a new sunflower seed production system based on annual variety renewal.

Pustovoit managed the selection department of the institute until his death in 1972. His seminal work on modern high-oil, high-yield varieties is invaluable. In addition, the most prestigious world award in the field of sunflower breeding is called "International Pustovoit Award".

How the sunflower conquered the world. It was at this time that the emigration of Eastern Europeans to North America began. Among they were Ukrainian settlers who began importing sunflowers, mainly as protein-rich animal feed.

The popularity of the sunflower spread across the northern border, and in 1930 the Canadian government began a breeding program.

After the war, as sunflower cultivation continued to expand both north and south of the US border, more farmers began to incorporate it into their crop rotations.

The program of breeding varieties conducted by Vasyl Pustovoit remained the main and most successful, so the Canadian government received a license to use the Peredovik variety, the seeds of which gave good yields and had a high oil content - about 45%.

By the end of the 1960s, breeding programs were aimed not only at increasing yield and oiliness. Desirable characteristics, such as increased disease resistance, became the new target.

However, efforts to create true hybrids were limited by the ability of the sunflower with its male and female reproductive parts to self-pollinate. This meant that attempts to inoculate new traits from donor plants were diluted by the sunflower's own pollen.

Later, in 1969, French researcher Patrice Leclerc made a breakthrough and created the world's first sunflower hybrid.

While working at the French Agricultural Institute, Leclerc discovered a method of eliminating the male part of a flower through a process known as cytoplasmic male sterilization.

In addition, the following year, scientist Kinman from the US Department of Agriculture discovered how to re-incorporate male fertility into the resulting hybrid.All of these advances came at a time when the public was becoming interested in a healthier approach to their diet. Research from the 1970s showed that sunflower oil is a healthier alternative to saturated fat. Therefore, Europeans, in particular, switched to sunflower oil products, demand quickly exceeded supply, and sunflower became wildly popular.

Today, according to experts, the sunflower harvest in the world is $20 billion per year. Among the largest seed producers in the world are Syngenta, Bayer/Monsanto, Corteva, BASF and Limagrain, and in Ukraine, there are VNIS, YUG AGROLIDER and others. Ukraine is the leader in sunflower production and the largest exporter of sunflower oil in the world (5.6 million tons = 57percentage of all exports).

In addition, did you know?

• The familiar sunflower with a 2-meter stem and a huge basket with black seeds is already a cultivated plant bred by humans. In nature, the sunflower is not like that at all. This wild bushy plant has 20-30 flowers the size of a daisy.

• The sunflower always turns towards the sun. Even in cloudy weather, the sunflower cap shows where the sun is now relative to the horizon. There is a scientific explanation for this: the phytohormone auxin, which regulates growth, accumulates in the stems of plants. An increase for auxin in the part of the stem that is not illuminated by sunlight makes the plant reach for the light. Nevertheless, when the sunflower grows, its heliotropic properties are not so strong, and the yellow heads turn towards the east.

• The tallest sunflower in the world was grown in Germany in 2009, its height reached 8.03 meters. In Ukraine, the largest sunflower with a height of 4 meters and 17 cm was recorded, which was grown in 2011 in the village of Plesetsk, Vasylkiv district, Kyiv region.

VALUE AND PRODUCTION OF SOYBEANS IN THE WORLD AND IN UKRAINE

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Cultivated or bristle soybean is the most valuable crop of all leguminous crops, which has no competitors in terms of the content of vital substances in the grain. An important feature of soybean is its ability to endosymbiosis with nitrogen-fixing plants subbacteria – rhizobia. Thanks to nitrogen fixation, which occurs in the nodules formed in symbiosis with rhizobia, soybean can significantly or even completely satisfy its need for nitrogen through symbiotrophic nutrition. This makes it possible to grow soybeans at all without applying or with minimal doses of expensive and environmentally dangerous nitrogen fertilizers. Soy plants, as nitrogen fixers, enrich the soil with nitrogen, improving its structure.

Soy can be used in the form of flour, meal, green mass, hay, haylage, grass flour for feeding all kinds of animals and birds. It can also be consumed in the form of seeds, meal, oil, soy protein concentrate with a protein content of about 60–65%, soy protein isolate with the presence of 90–92% protein, soy milk powder and other types of its processing products. It is possible to obtain fodder that is characterized by a high nutritional value and a significant protein content. Soybean grain is enriched with high fat content (20–21%), trace elements (176–215 mg/kg of dry seeds), vitamins (B_1 – 11–

17; B_2 – 2–3; C – 100–200; biotin – 0,2; RR – 30; E – 600 mg/kg of dry seeds, etc.).

Eating soymilk and oil is recommended for many diseases. Medical preparations are made from soy lecithin. Due to the low cholesterol content in soy products, this culture is an ideal food for humans.

Soy protein is the only vegetable protein that contains almost all the essential amino acids necessary for the formation of protein in the human and animal body, and consists mainly of water-soluble globulins and albumins. Vegetable protein is the most important component of food and fodder resources, the use of which significantly affects the health of people, the duration and standard of their life. The demand for high-protein vegetable raw materials is growing, leading to an increase in prices on the world and domestic markets.

The recently introduced direction of scientific and technical progress in the food industry involves the development of technology for obtaining textured products from soybeans, the production of protein granules and fibers, followed by their processing into various types of food products – supplements or meat substitutes.

Recent decades have been characterized by impressive development of soybean production. It is the main leguminous crop in the world in terms of sown areas and gross grain harvests. It is grown in more than 40 countries on a total area of more than 50 million hectares. Such a significant range of distribution is explained by the universality of the use of soybeans as an important food, technical and fodder crop, which is due to the excellent combination of organic and mineral substances in the seeds.

In general, soybean production is considered as a method of solving three food problems in the world, including grain production, protein production, and fixation of biological nitrogen in the soil. According to A. O. Babich, soybeans should solve the same problems in Ukraine and, first, become an excellent precursor for grain crops, increasing their yield. The increase in the yield of cereals grown after soybeans is 3–4 t/ha. The expert believes that without soybeans, the task of obtaining 75-80 million tons of grain is impossible. Soy is also an indispensable component in the list of protein feed resources. If, hypothetically, animal husbandry is lefting without access to soybean meal, meat production can be reduced by a third, or even by half.

Soybean production is an important component of the world economy: 100 million tons of soy protein, 43 million tons of soybean oil, and 183 million tons of soybean meal were produced with its harvest. Its crops assimilate 20 ml t of biological nitrogen. This culture is quite attractive for farms in terms of cost-effectiveness: its commercial grain on the domestic market costs almost $300/t, and the profitability threshold of its production is about 10 c/ha (which is quite achievable for average Ukrainian agricultural enterprises). Thanks to soybeans, more than $128 billion per year came into the world economy.

In the global agricultural scale of production, soybean occupies a leading position as one of the important oil crops. It is one of the most widespread leguminous agricultural crops in the world, which is sowning on a large area every year. The significant spread is due to the particularly valuable content of nutrients, high economic efficiency of production, as well as the universal nature of use in food, fodder and technical needs.

The primary reasons for the change in the position of this culture in the world over the last twenty years were changes in the nutrition structure of the population of developed countries, which are associated with the transition from the use of animal fats to vegetable and oil; as well as the increase in its number in Asian countries and the rapid development of the livestock industry in the EU. In general, this led to the growth of global demand for soybeans and the reorientation of many countries to its cultivation, including our country.

Soy, as a highly profitable crop, is one of the best precursors for grain crops, which serves to increase soil fertility. Its extremely important role in the agrarian complex of Ukraine is determined by the noticeable growth of areas and gross fees. One of the main reserves for reducing the cost of soybean production and increasing profitability is an increase in the average yield, which has a considerable effect on the indicators of the competitiveness of production even under the conditions of unfavorable price conditions in the external and internal agricultural markets. Soy is called the "gold of the earth" for a reason. After all, this is an exceptionally strategic agricultural culture of the global and domestic agricultural sector.

QUALITY CHARACTERISTICS OF WINTER PEA SEEDS DEPENDING ON VARIETAL CHARACTERISTICS AND SOWING STANDARDS

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Leguminous plants are the basis of modern alternative agriculture - without the use of fertilizers or with the introduction of them in small doses. Without exaggeration, one of the important leguminous crops is pea, which is characterized by various directions of use: food, siderative and forage. This crop is valuable due to its high protein content, positive impact on soil fertility, variety of uses and the possibility of cultivation in different regions of Ukraine, feasibility of sowing as a catchment, intermediate and post-harvest crop. For food, peas are used in the form of unripe seeds (green peas), consumed in fresh, canned, dry and frozen form. Soups, side dishes for various meat dishes, mashed potatoes, and salads are prepared from it.

Peas are an extremely valuable food product. There is as much protein in it as in beef. And in terms of calories, it is twice as high as it is because it contains a lot of carbohydrates. Peas are also rich in vitamins A, B1, B2, B6, C, PP, K, E, carotene, inositol, choline, trace elements (salts of calcium, potassium, manganese, phosphorus), polysaccharides, starch (about 50%), fats (0.6-1.5%) [1].

The seeds also contain 26-27% easily digestible protein rich in essential amino acids (cystine, lysine, tryptophan, tyrosine, methionine, etc.). This is the value of peas not only as a food product, but also as a dietary and medicinal product.Peas have hypoglycemic properties and are used for kidney stone disease and diabetes. Green peas contain a lot of lecithin, which regulates cholesterol metabolism.

In Ukraine, the area of spring peas is intensively reduced and amounts to 40,000 ha. However, in recent years, varieties of winter peas have been introduced, which have a number of advantages over spring peas, namely: a constant crop of grain and green mass; soil protection from wind and water erosion; effective use of moderate temperatures or moisture in the late autumn and early spring periods. Winter peas are a relatively new leguminous crop [2].

It is known that peas act as the best predecessor for many agricultural crops, in particular for winter wheat. This is a typical nitrogen fixer, which is characterized by the ability of the roots to use poorly soluble and difficult-to-access mineral compounds from the arable layer of the soil from deeper layers.

The authors noted that after growing peas, more than 100 kg per hectare of bound nitrogen remains in the soil, humus mineralization decreases and soil fertility increases.

The winter variety has certain morphological features. Most researchers point out that the only drawback of growing winter peas is the unevenness of its ripening. Some of the seedlings appear in the fall, and some in the spring. Unlike spring, it is able to form two stems in the tillering phase and frequent internodes, which is effective against crop lodging and contributes to increasing the potential yield of the crop [3].The aim of the scientific work was to study the influence of varietal characteristics and sowing norms on the quality indicators of winter pea seeds.

Research has established that it is advisable to grow peas in crop rotation, because it cannot be grown in a monoculture. This is explained by the fact that under monoculture conditions, the number of pea weevils increases significantly, which negatively affects the yield and quality of seeds. Peas can be sown on the same plot only after 3 years.

Foreign varieties of winter peas are grown in Ukraine. This is the NS Moroz variety. (originator Serbia), which was included in the Register of plant varieties of Ukraine in 2016, and the Enduro variety (originator OSEVA company, Czech

Republic) and Balltrap (France). It should be noted that the quality indicators of winter peas are also significantly influenced by their predecessors. It has been established that the best are grain and row crops.

It has been investigated that the quality indicators are significantly influenced by the width of the row spacing and the rate of crop sowing. Thus, it is advisable to sow winter peas with traditional planters with 15 cm row spacing. However, it is important to take into account the ability of winter peas to branch well. It is advisable to sow winter peas with a width of 30 cm, since the culture uses the area effectively enough, and as a rule, empty places are not formed among the crops. The rate of sowing is important for peas.

Sowing rate is the number of similar seeds sown per unit area. It depends on the crop being sown, the method of sowing, the state of the soil, climatic conditions, and the purpose of sowing.

The sowing rate depends on the weight of 1000 seeds, the required sowing density and the consumer value of the seeds, the weight rate is about 200 kg/ha. However, sowing rates also depend on varietal characteristics.

Thus, in the course of research, it was established that the quality indicators of winter peas are significantly influenced by the rate of sowing and varietal characteristics.

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SOWING PERIOD AND ITS APPLICATION IN MILLET CULTIVATION TECHNOLOGY

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According to the authors, the optimal period for sowing millet comes when the soil at a depth of 8–10 cm warms up to 10–15° and the threat of spring frosts passes. When sowing in unheated soil, part of the seeds rots, the seedlings come out liquefied, and the field is heavily over grown with weeds, because of which the development of plants deteriorates and the grain yield is sharply reduced.

Both during the early and late sowing period of millet, the grain yield decreases. Discussions on the issue of choosing a sowing date still take place today. Based on research, it was established that the best period for sowing millet is the third decade of May (in the absence of late spring cooling). Sowing in the second decade of May yields somewhat less (9.1% on average). The yield during the June sowing period decreases strongly (by 37.2% on average).

It was established that during the May sowing period, the largest mass of grain from 1 m and the largest mass of 1000 millet grains was obtained, while during the June sowing period, the preservation of plants before harvesting decreased and the share of straw in the total mass of the crop increased.

The June date of sowing millet leads to a decrease in the sowing and technological qualities of grain, an increase in the degree of damage to millet grain by melanosis and the degree of trips colonization of plants, and a decrease in the collection of crude protein by the grain harvest. This is explained mainly by unfavorable weather conditions for growth and, especially, the period of ripening and harvesting of millet crops according to the June sowing date.

According to a number of researchers, late sowing of millet shortens the interphase periods of vegetation and the size of the active assimilation apparatus of plants. The decrease in productivity of late crops is explained by the fact that the formation of generative organs occurs under the influence of harmful high temperatures.

The best productivity indicators of millet plants are formed during the second term of millet sowing (second decade of May). In this variant, the plants formed the largest number of grains in the panicle (172–193 pieces), the weight of one plant grain and the weight of 1000 grains were also expressed by the best indicators of productivity when sowing in the second decade of May.

When growing millet in the conditions of the Steppe, the highest grain yield is formed during sowing in the second decade of May – 3.71 t/ha, which is 0.46 t/ha more than during the first period of sowing.

When growing millet on the dark-chestnut soils of the Steppe, the difference in yield (0.2 – 0.3 t/ha) between the sowing dates was within the limits of the smallest significant difference in the experiment.

According to the researchers, the main reasons for the decrease in yield during later sowing of millet are as follows. A decrease in moisture content in the upper layer of the soil, an increase in temperature and a decrease in relative humidity of the air, increased damage to seedlings by pests and active overgrowth of crops with weeds, thinning of seedlings, a decrease in the coefficient of productive bushiness.

According to long-term research of the Mykolaiv State Agricultural Research Station of the Institute of Irrigated Agriculture of the National Academy of Sciences, millet must be sown when the soil temperature at a depth of 10 cm is 10°C.

However, the recommendations of this institution in recent years boil down to the following: the sowing period should be chosen depending on the difficult weather conditions in the spring, the field's littering, the type of soil, and the characteristics of the varieties. In years with a course of spring close to the average long-term norm, the optimal period will be the end of the second – the beginning of the third decade of May. If the spring is cold and prolonged, then sowing should be delayed so that the weeds germinate better. However, it is impossible to be late with the sowing period, in order to avoid drying out of the upper layer of the soil, especially in a dry spring, and the coincidence in time of the phase of throwing out the panicle with the mass flight of the beggar mosquito.

Therefore, it should be noted that the sowing dates developed in other zones and for different varieties of millet cannot be mechanically transferred to conditions of unstable moisture in the right-bank forest-steppe of Ukraine. Varieties adapted to local conditions should be used here and elements of growing technology should be used, including sowing dates that take into account the specificity of local soil and climatic conditions.

Despite the fact that the issue of the optimal sowing period is clear, it does not lose its relevance, based on the main purpose of millet as an insurance crop. This means that a lot of time can be lost between the decision on resowing winter crops, soil preparation and the moment of resowing. Considering this, it is necessary to correctly choose a variety with an appropriate response to the sowing period in order to minimize possible crop losses.

ORIGIN, DISTRIBUTION AND YIELD OF WINTER WHEAT

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Wheat is one of the oldest agricultural crops in the world. There are two centers of wheat origin: the East Asian (the western part of Iran, the northern part of Arabia and the southern part of the Balkan Peninsula, Asia Minor, Transcaucasia) and the African, located mainly on the territory of Ethiopia. According to archaeological excavations, wheat was grown in the Middle East as early as 10,000 to 15,000 years ago. N. e, in many areas of Asia, Europe, as well as in Egypt – 5-6 thousand years BC, in China – at least 3 thousand years BC.

In Ukraine, wheat has been known for a long time, even the Tryplian tribes grew it here (approximately 2-4 thousand years BC). The oldest traces of wheat in Ukraine were found in the Crimea, as well as in the Khmelnytskyi region – in the village of Luka-Vrublevetska. Even Herodotus (484–425 BC) described agriculture in the area of the middle course of the Dnieper almost a thousand years before the emergence of the Old Russian state. During excavations on the left bank of the Dnieper near the village of Bielska, Poltava Region, wheat grains of the VI century BC were discovered.

In agricultural production, spring wheat preceded winter wheat, because the introduction of winter wheat into the culture is associated with a higher level of agricultural culture and agricultural cultivation techniques, in particular, its spread was influenced by the emergence of a system of agriculture based on a three-field crop rotation.

At the beginning of the 20th century, winter wheat became one of the main grain crops, which gradually supplanted yarrow. During the period from 1881 to 1913, the area planted with winter wheat in Ukraine increased from 609000 hectares to 1204000 hectares, and in 1916 it exceeded the area planted with spring wheat for the first time.

Winter wheat can grow in a variety of soil and climatic conditions, which is why it is very widespread on the globe: wheat is grown annually on an area of more than 250 million hectares. In Ukraine, the main areas of winter crops are concentrated in the Steppe and Forest-Steppe zones.

Wheat is a representative of *the* Gramineae family *Roaceae)* genus *Triticum.* Today, 27 of its species are known. In Ukraine, mainly varieties belonging to two types of wheat are grown: soft (*Triticum aestivum* L.) and solid (*Triticum durum* L.). Soft and hard wheat differ in morphological features, chemical composition, technological qualities, as well as in the nature of use. Soft wheat is mainly used for baking bread, and hard wheat is used for the production of macaroni and noodles. Most of the varieties of soft wheat cultivated in Ukraine are mainly winter forms. Wheat grain, in terms of the content of the main nutrients, meets the needs of human nutrition more than the grain of other cereals. It contains many natural substances that are necessary for the normal development of humans and animals: half of the proteins and carbohydrates needed by the body, 70–80% of vitamin B_1 (thiamine), a large part of vitamins PP (nicotinic acid) and E (tocopherol), fats, mineral substances. Wheat gluten protein allows you to bake yeast bread.

Among other grain crops, winter wheat in Ukraine ranks second in yield after corn: in 2016, the average yield of wheat was 4.21 t/ha, and corn – 6.6 t/ha; in 2017 – 4.11 and 5.44 t/ha; in 2018 – 3.81 and 7.59 t/ha, respectively.

Under modern conditions in Ukraine, varietal resources of winter wheat have been formed, which in terms of genetic potential, biological, economic properties, adaptability to growing conditions and agroecological plasticity can, subject to compliance with the appropriate growing technology, ensure the formation of a grain harvest of 1–3 quality classes on a par with 6– 9 t/ha.

Currently, the further increase in the productivity of winter wheat is determined by a complex of agrotechnical measures, among which an important place is occupied by the correct choice of the predecessor, when determining which soil and climatic, organizational, economic and agrotechnical conditions should be taken into account. After all, the predecessors of winter wheat actively influence the main factors of plant life and, ultimately, the formation of the crop.

СЕКЦІЯ 2.
ГЕНЕТИКА, СЕЛЕКЦІЯ РОСЛИН ТА БІОТЕХНОЛОГІЯ

СТУПІНЬ ДОМІНУВАННЯ ТА АНАЛІЗ ГЕТЕРОЗИСНОГО ЕФЕКТУ СЕЛЕКЦІЙНО-ЦІННИХ ОЗНАК У ГІБРИДІВ *TRITICUM AESTIVUM* L. × *TRITICUM SPELTA* L.

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Залучення видового різноманіття роду Triticum L. до селекційного процесу створення нових форм пшениці – є одним із найперспективніших методів отримання вихідного матеріалу. Обов’язковою умовою успіху селекційного процесу є комплексне відслідковування закономірностей успадкування ознак, що дає можливість проведення цілеспрямованого добору в наступних поколіннях.

В Уманському НУС проведено гібридизацію видів Triticum aestivum L. × Triticum spelta L. в результаті чого отримано низку нових форм з різнем ступенем прояву ознак і властивостей. Метою досліджень було провести аналіз ступеню домінування та рівня гетерозисного ефекту селекційно–цінних ознак у отриманих гібридів.

Дослідження проведено на ділянках кафедри генетики, селекції рослин та біотехнології Уманського національного університету садівництва. У якості вихідного матеріалу до гібридизації залучали 12 районованих сортів пшениці м’якої озимої та сорт пшениці спельта озимої Зоря України. Гібридизацію проводили шляхом ручної кастрації квіток і наступного примусового запилення обмеженовільним методом.

Для встановлення характеру успадкування кількісних ознак за ступенем домінантності (hp), використовували формулу Б. Гріффінга та градацію Г. Бейла і Р. Аткінса. Ранжування створених матеріалів за ступенем домінування проводили за наступною градацією: 1) $hp < -1$ – від’ємне наддомінування (від’ємний гетерозис, або депресія); 2) $-1 \leq hp < -0{,}5$ – від’ємне домінування; 3) $-0{,}5 \leq hp \leq 0{,}5$ – проміжне успадкування; 4) $0{,}5 < hp \leq 1$ – позитивне домінування; 5) $hp > 1$ – позитивне наддомінування (позитивний гетерозис).

Отримане в результаті гібридизації насіння висівали в селекційному розсаднику для аналізу розщеплення та групування створених матеріалів за фенотипом. В окремих варіантах проведено беккросування з метою насичення форм генами, носіями господарсько–цінних ознак. Нащадки F1 оцінювали за рівнем успадкування господарсько–цінних ознак та проявом гетерозису.

В результаті проведених досліджень встановлено, що у п'яти із 16 виділених форм успадкування висоти рослин відбувається за типом проміжного успадкування, у чотирьох гібридів спостерігали від'ємне домінування, у двох – депресію. Три комбінації схрещування показали позитивне домінування і одна – позитивне наддомінування високорослої батьківською форми. У більшості виділених форм за довжиною колосу спостерігалось від'ємне домінування.

Найвищий рівень справжнього гетерозису зафіксовано у зразків, отриманих за гібридизації Краснодарська 99 × Зоря України (6,0 %), Панна × Зоря України (9,0 %), Зоря України × Фарандоль (4,3 %) за довжиною колосу.

ХАРАКТЕРИСТИКА ІНТРОГРЕСИВНИХ ЛІНІЙ ПШЕНИЦІ СПЕЛЬТА, СТВОРЕНИХ ЗА ГІБРИДИЗАЦІЇ З МАЛОПОШИРЕНИМИ ВИДАМИ ПШЕНИЦІ

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Генофонд малопоширених видів гексаплоїдної та тетраплоїдної пшениці широко використовується багатьма селекційними центрами в якості джерел господарсько–цінних ознак. Окрім того, малопоширені види пшениці можуть слугувати вихідним матеріалом для пошуку нових мутантних варіантів для генетичного аналізу або селекції.

Нами було проведено гібридизацію пшениці спельта з видами Triticum turgidum subsp. dicoccum (Schrank ex Schübl.) та Triticum compactum Host. В результаті створено нові генетичні джерела, що здатні збагатити існуючий генофонд пшениці спельта дефіцитними для селекції ознаками. Із створених форм сформовано колекцію вихідного матеріалу пшениці спельта, що об'єднує понад 70 зразків з різним рівнем прояву господарсько–цінних ознак.

Метою наших досліджень було розширення генетичного різноманіття пшениці спельта інтрогресією генетичного матеріалу видів Triticum turgidum subsp. dicoccum (Schrank ex Schübl.) Thell та Triticum compactum Host., створення і оцінка нового вихідного матеріалу, здатного покращити існуючий генофонд пшениці.

Дослідження проведено впродовж 2019–2021 рр. в умовах Уманського національного університету садівництва. Об'єктом досліджень слугували 14 інтрогресивних ліній пшениці спельта, створених за участю видів Triticum turgidum subsp. dicoccum (Schrank ex Schübl.) Thell та Triticum compactum Host.

У дослідженнях використовували загальноприйняту технологію вирощування озимих зернових культур. Сівбу проводили в оптимальні для зони строки – третя декада вересня. У роботі використовували систематичний метод розміщення ділянок за чотириразової повторності. Усі фенологічні спостереження та аналіз елементів структури колосу інтрогресивних ліній проводили відповідно до методичних вказівок із вивчення колекції зернових культур. Вміст білка в зерні визначали за ДСТУ 4117, вміст клейковини – ДСТУ ISO 21415–1, силу борошна – методом інфрачервоної спектроскопії на приладі Infratec. Після всіх обліків і вимірювань зерно обмолочували і визначали врожайність. Статистичний аналіз проводили за використання прикладної програми Microsoft Excel 2010.

Суттєвим недоліком багатьох інтрогресивних ліній, створених за участю виду Triticum turgidum subsp. dicoccum (Schrank ex Schübl.) Thell є їхня високорослість і пізньостиглість та схильність до вилягання. Більшість форм, створених за участю виду Triticum compactum Host. також були високо– або середньорослими і наближалася за цим показником до пшениці спельта. В результаті індивідуальних доборів частка високорослих форм поступово зменшувалась, але все ще залишалась значною.

Високорослість ліній, отриманих інтрогресивною гібридизацією, досить часто є причиною їх бракування в селекційних розсадниках. Відомо, що реалізацію високого генетичного потенціалу продуктивності на практиці можуть забезпечити лише форми з коротким і міцним стеблом. З метою збереження генетичного матеріалу кращих створених нами високо– і середньорослих форм проведено їх схрещування з низькорослими колекційними зразками пшениці спельта, одержаними в наших попередніх дослідженнях. В результаті отримано низькорослі (81–95 см) зразки.

Іншим недоліком, що притаманний міжвидовим гібридам, досить часто є їхня пізньостиглість. Адже культурні і дикі родичі пшениці найчастіше походять із гірських районів Передньої Азія, а тому мають більш тривалий вегетаційний період. Види Triticum spelta L. та Triticum turgidum subsp. dicoccum (Schrank ex Schübl.) Thell – пізньостиглі (вегетаційний період близько 300 діб). Вид Triticum compactum Host. хоч і дозріваю на 5–6 діб раніше, проте також є пізньостиглим.

В результаті гібридизації переважна більшість нащадків, отриманих за участю виду Triticum turgidum subsp. dicoccum (Schrank ex Schübl.) Thell були пізньостиглими. В той час, як більшість нащадків, за участю виду Triticum compactum Host. були середньостиглими. В результаті індивідуального добору вдалося відібрати невелику кількість середньостиглих ліній (вегетаційний період 275–285 діб) інтрогресивних ліній пшениці спельта, що дозрівали одночасно із середньостиглими сортами пшениці м’якої.

Нами було проведено аналіз ліній, створених за участю цього виду за показниками вмісту білка, клейковини і силою борошна. Більшість ліній характеризувалися високим вмістом білка в зерні (понад 16 %). А окремі зразки – понад 20 %. За вмістом клейковини в зерні переважна більшість зразків знаходились в діапазоні 38–42 %. Більшість інтрогресивних ліній пшениці за силою борошна (280–400 о.а.) відносилися до задовільних поліпшувачів. Виділено кілька ліній, що мають силу борошна понад 400 о.а. (добрі поліпшувачі) і характеризуються високим вмістом білка (понад 20 %) і клейковини (понад 46 %). Продуктивність створених ліній щорічно оцінюється на ділянках селекційного та контрольного розсадників.

За результатами оцінки врожайності зерна сортозразків пшениці встановлено, що в середньому за 2019–2021 рр. вона коливалася в межах 4,64–5,35 т/га. Форми створені за участю виду Triticum turgidum subsp. dicoccum (Schrank ex Schübl.) Thell характеризувалися вищою врожайністю порівняно з формами, створеними за участю виду Triticum compactum Host. Встановлено, що дев'ять досліджуваних зразків істотно не поступалися сорту Зоря України за врожайністю. Найвищу врожайність зафіксовано у зразка 230 – 5,35 т/га.

Отже, в результаті гібридизації пшениці спельта з малопоширеними видами пшениці сформовано колекцію вихідного матеріалу з широкою генетичною основою та виділено низку форм з високим рівнем прояву господарсько–цінних показників.

THE COMPOSITION OF THE NUTRIENT MEDIUM FOR THE PRODUCTION OF HAPLOIDS OF WINTER RAPE

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Rape is a valuable agricultural crop with a variety of uses – food, fodder and technical purposes. Rapeseed contain approximately 50 % oil and 20–25 % protein. Currently, about 80 % of cultivated rapeseed is processed into oil [1].

Edible oil is used for food and for the production of margarine, confectionery and bakery products, and canned goods. Rapeseed oil has medicinal and dietary properties [2].

It is a valuable raw material for the production of biodiesel, is used in metallurgical and other branches of industry, is an irreplaceable basis for the production of environmentally safe preparations for plant protection, plastics, lubricants, detergents, varnishes, paints, etc [3].

Low-glucosinolate varieties of rape are suitable for obtaining high-quality meal - a valuable protein feed for animals. Rapeseed meal contains 35–37 % protein, 10–13 % fiber, 6–8 % minerals [4].

Rape is a good precursor for winter crops. It improves the physico-chemical properties of soils, destroys root rot pathogens of grain crops [5].

Now, heterozygous hybrids of rape are mainly sowning in production, which are superior to varieties in terms of productivity and manufacturability. Parental components of heterosis hybrids are inbred lines. The process of creating self-pollinated lines is quite complex, costly and time-consuming [6].

To accelerate the process of obtaining homozygous materials, biotechnological methods are used. Using the culture *in vitro* provides control over parameters of biomaterial growing, allows manipulating with the objects at the cellular and molecular levels, receive new forms of plants with desired characteristics quickly. It is difficult to achieve it when working with intact plants [7].

A promising direction is the use of haploids in plant breeding. By doubling the number of chromosomes in haploids, homozygous lines are obtained without the use of multiple self-pollination. It is known from scientific sources that the process of androgenesis is influenced by many factors: genetic features and growing conditions of plant material, the composition of the nutrient medium, the presence and ratio of growth regulators in it, etc.[8–10].

The aim of our work was the selection of the optimal composition of the nutrient medium and its modification with growth regulators for the effective cultivation *in vitro* of anthers of winter rape.

The research was carried out in the biotechnological laboratory of the Uman National University of Horticulture. After sterilization, the biomaterial was grown on nutrient media according to the prescriptions of Murasige-Skug, Hamborg, Schenck-Hildebrant with their modification with growth regulators of auxin (2,4-dichlorophenoxyacetic acid) and cytokinin (6-benzylaminopurine) origin in different concentrations.

The biomaterial was cultivated under a 16-hour photoperiod (illumination intensity 4 kL), a temperature regime of 24–25°C and a relative humidity of 75%.

The Murashige-Skuga nutrient medium is the most optimal for the cultivation of winter rape anthers. Depending on the content of growth regulators in the nutrient medium, different types of explant development were observed. On hormone-free nutrient media, the morphogenic programs of anther development did not take place, and after some time they died. The induction of callusogenesis was observed on nutrient media containing increased concentrations of 2,4-D. Subsequently, regenerating plants were formed on part of the microcalli when they were transferred to regenerative nutrient media. Direct organo- or embryogenesis was noted when nutrient media were modified with cytokinins. Somatic embryoids were formed on the surface or in the surface layer of spring rape anthers in the form of white structures. The formation of embryoids began in a separate area of the explant and then gradually spread over the entire plane.

Therefore, the optimal composition of the nutrient medium for the cultivation of winter rape anthers was selected, the influence of growth regulators on explant development programs was determined.

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PROSPECTS OF FODDER BEET CULTIVATION

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Among the great variety of fodder crops, fodder beets deserve considerable attention. Beets come from the Mediterranean, where they have long been used as a medicinal and food plant. Fodder beet – obtained from table beet in the 18th century. Selection was aimed at creating forms with large root crops of white, yellow or orange-yellow color, suitable for feeding livestock [1].

The crop spread to Europe, was introduced into the USA in 1800 and is now cultivated worldwide in the cooler climates (Northern America, New Zealand and at higher altitudes (above 600–1000 m) in the tropics. Sugar beets were derived from fodder beets in Continental Europe during the 1800s as sugar cane was subjected to English blockades during the Napoleonic wars. In 2008, France was the main producer of fodder beets (13,000 ha) followed by the United Kingdom (10,000 ha) and Belarus (8,000–10,000 ha) [2].

Roots have good taste characteristics, have dietary and medicinal properties, are well eaten and easily digested by animals. Fodder beet has high nutritional qualities: 100 kg of it correspond to 12–14 fodder units and contain 0.9–1.1 kg of digestible protein. They contain carbohydrates, nitrogen-free extractives, mineral and vitamins necessary for the animals [3, 4].

An additional source of fodder for the cultivation of fodder beets is leaves. It is a valuable vitamin food both in fresh form and in silage. The leaves contain more protein, fiber, carotene and vitamin C than the roots [5, 6]. The yield of leaves is 20–30 % of the mass of roots. Therefore, with a root yield of 50–60 t/ha, 2–2,5 t/ha of fodder units are additionally obtained at the expense of leaves without additional costs. This corresponds to the yield of annual forage grasses [7]

Fodder beet is a high-yielding crop. With the appropriate agricultural technology, it is able to form a crop of root crops at the level of 80–100 tons per hectare, which provides a higher yield of fodder units than corn and perennial grasses [8, 9].

Recently, fodder beet has been used as an energy crop. Due to the high yield of roots and leaves, it is a promising crop for obtaining biogas. About 123 m^3 can be obtained from one ton of fodder beetroots, and up to 105 m^3 of biogas from one ton of leaves. Modern fodder beet hybrids accumulate up to 14% of sugars, which makes them a valuable source of raw materials for the production of bioethanol. About 3.3 t/ha of bioethanol can be obtained from one hectare of energy fodder beets (with a yield of 95 t/ha) [10, 11].

The cultivation of beet is of great agrotechnical importance, which increases the general level of agriculture. The use of deep plowing, the application of organic and mineral fertilizers improve the agrophysical and agrochemical parameters of the soil. As a row crop, beet help clear fields of weeds, so it is a valuable precursor in crop rotation [12].

Fodder beet can grow at temperatures between 8°C and 25°C. Frost below -3°C can damage the seedlings. Soil pH should be higher than 6.5 because fodder beet is susceptible to acid soils that cause physiological yellowing. Soil liming is recommended but boron availability should be checked to prevent black heart disease. Fodder beet crops are moderately tolerant to soil salinity and can withstand irrigation with saline water. Fodder beet is drought tolerant and can provide fodder at the end of a dry summer when other plants have disappeared [5, 6, 12].

Therefore, fodder beet is a highly productive agricultural crop, which has important energy and fodder value. The creation of new yielding and adaptive varieties is important for increasing the efficiency of its cultivation.

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MODERN ASPECTS OF SOYBEAN SELECTION IN UKRAINE

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Soybean is the world's main grain legume crop. It is grown in more than 60 countries on a total area of more than 100 million hectares, the total volume of production varies within 360 million tons per year. The USA and Brazil are the leaders in soybean cultivation [1].

In Ukraine, soybeans are grown on an area of 1.3–2,0 million hectares, while the yield varies from 1.3 to 2.7 tons per hectare. Most soybeans are grown in Khmelnytskyi, Poltava, Zhytomyr, Kherson, Cherkasy and Kyiv regions [2].

Soybean seeds contain protein – 35–40%, fat – 13–24 %, carbohydrates – 25–30 %, ash elements (with a predominant content of potassium, phosphorus and calcium) – 5 %, enzymes, vitamins (A, B, C, D, E) and other important organic and inorganic substances [3, 4].

Currently, there are four areas of soybean use: grain (industrial processing of grain into soybean meal, oil or full-fat soy); grain fodder (use of compound feed and meal for fattening of poultry, pigs, cattle, sheep, goats, rabbits, fur animals animals and fish); forage (use of green mass, silage, hay, grass flour for feeding cattle); food (grain, unripe grain; soybean oil, flour, groats, coffee, sprouts, sauce, analogues of meat and dairy products); pharmaceutical (raw material for medicines) [5, 6].

Soybeans are of great agrotechnical importance. The positive role of soybean cultivation it consists in the fact that the culture is able to fix up to 100–150 kg of atmospheric of nitrogen, which is equivalent to applying 15–20 tons of organic fertilizers. Growing soybeans will allow to drastically reduce the cost of mineral fertilizers [7].

The creation and introduction of new varieties plays an important role in increasing the yield of crops. The main tasks in soybean selection include high and stable productivity, high product quality, adaptability to specific soil and climatic conditions, resistance to a complex of harmful organisms and negative environmental factors; suitability for mechanized cultivation and harvesting [8].

More than 250 soybean varieties have been added to the State Register of plant varieties suitable for distribution in Ukraine for 2023. Soybean varieties in the Register of varieties are represented by the selection of 10 countries of the world, the largest share is varieties of domestic selection – 55 % of the total number of soybean varieties, Canada – 17 %, France – 9 %, Serbia – 7 %, Austria – 5 %, Germany – 4 %. The most common varieties are Mentor, Hallek, Avatar, Arisa, Brook, Strive, Lakeview, Opus, Medoc, Sigalia, Lisbon, Kofu, Moravia [9].

The Institute of Oil Crops, the National Scientific Center «Institute of Agriculture», the V. Ya. Yuryev Institute of Plant Breeding, the Breeding and Genetic Institute – the National Center for Seed Science and Varietal Research, the Institute of Irrigated Agriculture, the Poltava State Agrarian Academy, Institute of Steppe Agriculture are the most engaged in soybean breeding among domestic scientific institutions [9, 10]. .

Despite the fact that domestic varieties are characterized by high adaptability and potential yield, foreign soybean varieties have recently dominated production. Therefore, domestic breeders need to focus on speeding up and increasing the efficiency of the selection process.

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DIRECTIONS OF BREEDING OF SPRING RAPE

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Oil crops are important in providing the raw material base of the agricultural industry. Rape has many positive biological and economically valuable characteristics, which makes its cultivation very profitable [1].

The oil contents of rapeseeds varied between 30.6 % and 48.3 % of the dry weight. The main fatty acids in the oils are oleic (56–65 %), linoleic (17–20 %) and palmitic (4–5 %) acids. Fatty acids contribute to lipid metabolism regulation. They are of primary importance in the diet. Apart from unsaturated fatty acids, there are nine functional components in rapeseed oil that contribute to its anti-microbial, anti-inflammatory, anti-obesity, anti-diabetic, anti-cancer, neuroprotective, and cardioprotective, among others. These nine functional components are vitamin E, flavonoids, squalene, carotenoids, glucoraphanin, indole-3-Carbinol, sterols, phospholipids, and ferulic acid, which themselves or their derivatives have health-benefiting properties. Thanks to this, the oil has high nutritional and dietary value [2–4].

Rapeseed oil is a valuable raw material for obtaining biodiesel, varnishes, paints, environmentally safe plant protection products, plastics, detergents, etc. [5, 6].

Rape is a valuable siderate, honey bearing and fodder crop. Cultivation of rape helps to improve soil fertility [7].

Rape is the main oil crop in more than 30 countries of the world. It is growning on an area of about 34 million hectares, providing 14% of world oil production. Winter rape is mainly sown in Ukraine - the area is more than one million hectares. Sowing of spring rape is about 30,000 hectares [8, 9].

Crop selection, depending on the direction of use of raw materials, is conducted in two main directions: the creation of high-oil varieties for food and technical use.

The seeds of edible rape varieties should have a high content of oleic and linoleic acids and a low content of erucic (less than 2.0 %), as well as linolenic acid, which during long-term storage gives the oil a bitter taste. In the selection of food-grade rape, preference is givening to yellow-seeded varieties, as they have a high protein and oil content and a low fiber content. Now 000-type varieties have been created, combining tuberless, low-glucosinolate and yellow-seeded. In terms of taste, the oil of such varieties resembles olive oil [10].

For biodiesel production, the oil must have a high concentration of eicosenoic and erucic fatty acids. The total amount of monounsaturated acids is in the range of 53–69 %, and polyunsaturated – up to 23 % [6].

In addition, rape varieties and hybrids should be high yielding, resistant to lodging, cracking of pods and shedding of seeds, resistant to diseases and pests, well able to tolerate negative environmental factors [5, 10].

For 2023, 36 heterozygous hybrids and 17 varieties of spring rape have been added to the State Register of varieties suitable for distribution in Ukraine. The share of domestic selection is 20 % [11].

Domestic scientific and research institutes of culture selection focused on the creation of varieties − 12 varieties were regionalized by six breeding institutions. The Ivano-Frankivsk Institute of Agro-Industrial Production of the National Academy of Sciences of Ukraine presents the widest assortment. High adaptability to growing conditions and resistance to environmental stress factors characterize domestic varieties.

Foreign breeding companies mainly conduct heterosis breeding. Compared to varieties, heterozygous hybrids are characterized by high manufacturability, productivity and product quality. Most of the positions in the State register of varieties are represented by foreign breeding brands: Lembke, Pioner and Bayer.

Therefore, heterozygous hybrids of foreign selection occupy the leading positions on the spring rapeseed market. To ensure competitiveness, domestic breeding institutions need to focus on the creation of highly productive, adaptive heterozygous culture hybrids.

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СЕКЦІЯ 3.
АГРОХІМІЯ І ГРУНТОЗНАВСТВО

ФОРМУВАННЯ ВРОЖАЮ КУКУРУДЗИ ЗА МІНІМАЛІЗАЦІЇ ЗЯБЛЕВОГО ОБРОБІТКУ ҐРУНТУ

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У системі заходів забезпечення високої культури землеробства, підвищення родючості ґрунту і врожаю сільськогосподарських культур важливою складовою є оптимальний обробіток ґрунту. Він сприяє поліпшенню його водного, повітряного, теплового, поживного та інших режимів. При цьому регулюються біологічні процеси і темпи мінералізації органічних речовин, забур’яненість, ураження хворобами і пошкодження шкідниками сільськогосподарських культур, поліпшується захист ґрунтів від водної ерозії і дефляції та умови проведення якісної сівби.

Інтенсивний обробіток призводить до погіршення властивостей ґрунту, слабо захищає його від ерозійних процесів, він малопродуктивний і енергоємний. Тому нині необхідно розробити такі способи обробітку, які б гальмували втрати ґрунту, відновлювали його родючість і за можливості скорочували енергетичні витрати на одиницю продукції. Одним з таких шляхів є розробка та впровадження способів мінімалізації обробітку ґрунту. Єдиної думки щодо мінімалізації механічного обробітку ґрунту під різні сільськогосподарські культури не існує, тому вивчення його впливу на конкретному підтипі ґрунту під певну сільськогосподарську культуру має як наукове, так і практичне значення для конкретного регіону.

Нині в окремих господарствах практикується повна відмова від механічного обробітку ґрунту на тлі використання сучасних високоефективних гербіцидів і освоєння технологій прямої сівби. За повідомленням В. Ф. Сайка та А. М. Малієнка [1], впровадження no-till системи дозволить у 3–5 разів підвищити продуктивність праці, проводити сівбу в оптимальні агротехнологічні строки, у два рази зменшити витрати пального. Питання актуальності проведення таких досліджень залишається очевидним, що пов’язано також зі зменшенням витрат на проведення обробітку ґрунту.

Метою досліджень було виявити найбільш раціональний спосіб зяблевого обробітку ґрунту під кукурудзу. Відповідно проведеного огляду літератури з чималої кількості заходів, які впливають на родючість ґрунту, одним з найважливіших є його обробіток. Цілеспрямованим регулюванням фізичного стану ґрунту, його режимів забезпечуються необхідні умови росту та розвитку сільськогосподарських рослин. Так, у досліді на чорноземі звичайному легкосуглинковому встановлено, що лише перед сівбою кукурудзи запаси вологи у варіанті без проведення зяблевого обробітку ґрунту були значно більшими, ніж після оранки та й то тільки у шарі ґрунту 0–50 см [2].

За даними [3] за «нульової» технології обробітку й покритті поверхні ґрунту близькому до 100 % влітку під кукурудзою запаси продуктивної вологи у кореневмісному шарі в 1,5 і більше рази перевищують відповідні запаси за традиційної технології, а за відсутності мульчі режим зволоження за технологією без обробітку ґрунту складається більш напружений порівняно з традиційною.

З трьох систем зяблевого обробітку ґрунту в 10-пільній сівозміні на Кіровоградській державній сільськогосподарській дослідній станції було встановлено, що за комбінованої системи (поєднання полицевої оранки та плоскорізного обробітку) запаси доступної вологи достовірно збільшувалися. Так, у шарі ґрунту 0–150 см вони складали відповідно 120, 126 і 146 мм за різноглибинній оранки, плоскорізного та комбінованому обробітку в сівозміні [4].

У дослідах С. П. Танчика [5], найвищу врожайність кукурудзи на силос і зерно одержано у варіантах полицевих та полицево-безполицевих обробітках ґрунту в сівозміні. Застосування постійних безполицевих обробітків зумовило істотне зниження врожайності через вищий рівень забур'яненості та погіршення фізичних властивостей ґрунту.

Серед агротехнологічних заходів, що вивчалися в дослідженнях І. Д. Ткаліча зі співавторами [6], суттєву перевагу мала оранка. При цьому всі культури у короткоротаційній сівозміні мали найвищу врожайність. Після плоскорізного розпушування на таку ж глибину зниження врожайності культур становило: кукурудзи – на 0,71 т/га, буряку кормового – на 8,0, а після мілкого на 10–12 см і особливо нульового – врожайність зменшувалася ще значніше. Порівняно з полицевим обробітком тут недобір врожаю становив, т/га: соняшнику – 0,59, кукурудзи – 2,38, гречки – 0,31, буряку кормового – 27,4.

Отже, незважаючи на широке вивчення, питання мінімалізації зяблевого обробітку ґрунту під кукурудзу в певних ґрунтово-кліматичних умовах нині привертає значну увагу вчених і практиків виробництва. Неможливо вважати його достатньо вивченим насамперед тому, що ще не так багато зібрано матеріалу про вплив того чи іншого способу обробітку в конкретних умовах.

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ФОРМУВАННЯ ВРОЖАЮ ЯЧМЕНЮ ЯРОГО ЗА МІНІМАЛІЗАЦІЇ ЗЯБЛЕВОГО ОБРОБІТКУ ҐРУНТУ ПІСЛЯ БУРЯКУ ЦУКРОВОГО

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Традиційні технології вирощування сільськогосподарських культур, основою яких є оранка, потребують значних енергетичних ресурсів (що позначається на собівартості виробленої продукції), уже вичерпали себе внаслідок деградації ґрунтів і енергоємності. Енергоощадження для сільгоспвиробника має велике значення: потрібно застосовувати ефективніші ґрунтозахисні та енергоощадні технології, такі як: мінімальний і нульовий обробіток ґрунту, біологічні системи землеробства [1].

Нині все більше вчених привертає увагу питанню мінімалізації зяблевого обробітку ґрунту. Одностайна думка, щодо цього ще не склалась. Ще зібрано достатньо матеріалів про вплив певного способу обробітку в конкретних ґрунтово-кліматичних умовах. Тому це питання потребує подальшого вивчення.

Ячмінь ярий є чутливою рослиною до фізичного стану ґрунту, запасів доступної вологи, забур’яненості посівів тощо. Тому вимоги до зяблевого обробітку ґрунту є високими. Згідно з рекомендаціями під ячмінь ярий прийнято проводити зяблеву оранку на 20–22 см. При цьому зазвичай не враховується тип ґрунту та погодні умови. У зв’язку з цим є необхідність обґрунтувати найбільш доцільний варіант зяблевого обробітку ґрунту в конкретних умовах.

За розрахунками В. Ф. Сайка та А. М. Малієнка [2], впровадження No-Till системи дозволяє у 3–5 разів підвищити продуктивність праці, проводити сівбу в оптимальні строки, зменшити витрати пального та прямі витрати.

Ячмінь ярий характеризується високою посухостійкістю та продуктивною витратою вологи. Проте на початку вегетації недостатньо розвивається коренева система і рослини погано витримують весняну посуху. Тому потрібно забезпечити безперешкодне надходження вологи у ґрунт в осінньо-зимовий період і раціональне її розподілення впродовж вегетації культури.

Згідно результатів досліджень, проведених на чорноземі звичайному важкосуглинковому за полицевого обробітку перед сівбою в шарі 0–150 см формується більший (на 23–25 мм) запас доступної вологи, ніж за плоскорізного обробітку, однак до середини липня різниця стає несуттєвою. При цьому встановлена закономірність: оранка має перевагу за врожайністю за достатньої кількості вологи, а плоскорізний обробіток – в посушливих умовах [3].

Дещо інші результати наводять М. В. Калієвський і В. О. Єщенко [4]. Вони стверджують, що волога краще накопичується на тлі застосування плоскорізного розпушування ґрунту та ліпше зберігається зі зменшенням глибини обробітку, особливо за посушливих умов. Схожі результати отримала Н. В. Шелухіна [5], де більше накопичення вологи в осінньо-зимовий період спостерігалося за поверхневого та мілкого обробітків.

Зазначається [6], що на зміну вмісту доступної вологи у метровому шарі ґрунту впливають системи обробітку. Так, при заміні полицевого обробітку безполицевим на час сівби ячменю та гороху спостерігалось незначне зменшення (на 3–9 мм) запасів доступної вологи у метровому шарі ґрунту. В загальному по сівозміні найбільший вміст доступної вологи в орному шарі спостерігається за комбінованої і тривалої мілкої систем обробітку ґрунту.

Стверджується [7, 8], що обробіток ґрунту без перевертання пласту із залишенням пожнивних решток на поверхні зменшує випаровування вологи з ґрунту, знижує його температуру і захищає ґрунт від дефляції.

Одним з найважливіших показників ґрунту є його щільність, яка характеризує його агрофізичні властивості. Найбільша продуктивність більшості культур досягається за щільності суглинкового та глинистого ґрунтів у межах 1,1–1,3 г/см3. Проте рівноважна щільність ґрунтів дещо вища цих значень: у сірих лісових важкосуглинкових – 1,35–1,40, у виораного чорнозему опідзоленого — 1,34–1,36, чорнозему типового — 1,25–1,30 г/см3 [9].

У дослідженнях Ю. І. Накльоки і В. О. Єщенка [10], зі зменшенням глибини полицевої оранки щільність ґрунту в усіх частинах орного шару на час сівби мала тенденцію до підвищення, а в середині вегетації цей вплив полицевого обробітку уже не проявлявся. Зменшення глибини плоскорізного розпушення зумовлювало на початок вегетації незначне зростання щільності ґрунту лише в середній і нижній частині орного шару, а в середині вегетації ці зміни були уже зворотними.

Отже, з наведеного огляду літератури можна зробити висновок, що єдиного погляду щодо впливу способів зяблевого обробітку ґрунту на накопичення і збереження продуктивної вологи, на створення оптимальних параметрів щільності, на збереження й поліпшення родючості ґрунтів і як наслідок на рівень продуктивності культур серед учених не має. Це пов’язано з тим, що ячмінь ярий вирощується в різних ґрунтово-кліматичних умовах. Саме тому питання проведення таких досліджень залишається актуальним й надалі. Адже це пов'язано не тільки зі збільшенням врожайності, а й із зменшенням витрат на проведення зяблевого обробітку ґрунту.

Метою проведення досліджень було виявити раціональний варіант зяблевого обробітку ґрунту під ячмінь ярий вирішенням таких завдань:

встановити вплив різних заходів зяблевого обробітку ґрунту на зміну його агрофізичних властивостей; визначити забур'яненість посівів за різних варіантів зяблевого обробітку ґрунту; встановити вплив різних варіантів зяблевого обробітку ґрунту на формування врожаю; розрахувати економічну ефективність різних варіантів зяблевого обробітку ґрунту при вирощуванні ячменю ярого після буряку цукрового.

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ВПЛИВ УМОВ МІНЕРАЛЬНОГО ЖИВЛЕННЯ НА ФОРМУВАННЯ ПРОДУКТИВНОСТІ СОЇ

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Соя – одна з найцінніших бобових культур, яка є джерелом рослинного білка й вирощується у багатьох країнах світу.

В Україні впродовж останніх 10 років спостерігається стійка тенденція до зростання посівних площ та валових зборів насіння сої. Значне збільшення посівних площ викликане як зростанням попиту на рослинний білок у світі, так і появою на ринку нових сортів сої, придатних для вирощування практично на всій території нашої країни.

Важливою умовою в технології вирощування сої є система живлення рослин. Тому питання підвищення продуктивності сої у різних агроекологічних умовах залишаються актуальними, особливо що стосується ефективного застосування добрив, вартість яких в останні роки значно зросла.

Система удобрення – один з основних елементів вирощування, за допомогою якого можна регулювати процеси росту й розвитку рослин. Для формування 1 т насіння сої необхідно 70–75 кг азоту, 18–20 – фосфору і 22–25 кг калію, тому вона добре реагує на мінеральні та органічні добрива. З урожайністю 2,5 т/га соя виносить із ґрунту близько 180 кг азоту, 50 – фосфору і 55–60 кг калію.

Потреба в азоті на 60–70 % задовольняється за рахунок біологічної фіксації з повітря. Встановлено, що соя в симбіозі з бульбочковими бактеріями здатна фіксувати від 80 до 150–200 кг/га азоту. Тому для утворення листкової поверхні, яка забезпечуватиме фіксацію азоту з повітря бульбочковими бактеріями, необхідно вносити під сою стартові (10–30 кг/га) дози мінерального азоту. Внесення невеликої стартової дози (30 кг/га) мінерального азоту особливо важливе на бідних грунтах та після неудобрених попередників.

За вирощування високопродуктивних сортів сої з потенціалом урожайності 4,5–5,0 т/га рекомендують вносити під передпосівну культивацію помірні дози (30–60 кг/га) азотних добрив з проведенням інокуляції насіння ріст активуючими речовинами та N_{30-60} – на початку утворення бобів. Багаторічними дослідженнями встановлено, що інокуляція насіння бактеріальними препаратами виду Bradyrhizobium Japonikum є важливим чинником впливу на врожайність і якість насіння сої.

Поряд з азотними, важливу роль у житті рослин відіграє фосфорне живлення. Фосфор у рослинах сої міститься в органічних і мінеральних сполуках. Він сприяє швидкому утворенню кореневої системи рослин, яка забезпечує засвоєння з ґрунту води і поживних речовин. Фосфор впливає на запліднення квіток, зав'язування, формування і достигання плодів. Існує тісний зв'язок між азотним і фосфорним живленням. Так, за поєднання азотних добрив з фосфорними ($N_{30}P_{60}$) урожайність сої у зоні Лісостепу склала 2,62 т/га, а за дози $N_{60}P_{60}$ приріст урожаю зерна порівняно з контролем становив 0,61 т/га.

Для швидкого росту і розвитку соя потребує великої кількості калію, який бере участь в білковому і вуглеводному обмінах, активує діяльність більш як 60 ферментів, підвищує осмотичний тиск і тургор, знижує процес випарування. За даними досліджень окремих науковців калійні добрива не мають вирішального впливу на зміну врожайності сої, однак сумісне їх внесення з азотними і фосфорними забезпечує приріст врожаю на рівні 0,19–0,8 т/га.

В північній частині Лісостепу України максимальний рівень реалізації потенціалу сортів сої було досягнуто на тлі застосування добрив у дозі $N_{45}P_{60}K_{60}$ з ризоторфіном, який порівняно з контролем був більшим на 0,42–0,43 т/га. Утворення бульбочок залежало від температури й вологості повітря. Найінтенсивніше вони утворювалися за 12–14^{0} С, досягаючи максимуму при 24–30^{0} С. Через дефіцит вологи (за вологості нижче 40 %) нітрогеназна діяльність знижується. Оптимальною є вологість ґрунту 65–75 % повної польової вологоємності. Висока вологість ґрунту (більше 80 %) знижує інтенсивність азотфіксації через недостатнє постачання бульбочок киснем. Сприятливим для утворення бульбочок є також нейтральна або слабокисла реакція ґрунтового середовища.

В дослідах Інституту кормів та сільського господарства Поділля НААН України при внесенні добрив з розрахунку $N_{40\text{-}60}P_{60\text{-}80}K_{60\text{-}80}$ без поливу приріст урожайності насіння сої складав 0,39 т/га, а за поливу – 0,73 т/га.

У Центральному Лісостепу врожайність насіння 2,63–2,75 т/га забезпечило внесення мінеральних добрив у дозі $N_{45}P_{60}K_{60}$ + N_{45} та оброблення насіння ризоторфіном, стимулятором росту і молібдатом амонію, що більше на 0,73–1,05 т/га порівняно з контролем. Застосування біопрепаратів під сою

Отже, з аналізу літературних джерел можна зробити висновок, що удосконалення системи удобрення сої з метою їх раціонального застосування у різних грунтово-кліматичних умовах наразі є актуальним.

YIELD AND QUALITY OF GRAIN SOYBEAN UNDER THE INFLUENCE OF INOCULATION

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The value of soy as a crop that contributes to solving the problem of vegetable protein and fat, improving the nitrogen balance of the soil and increasing food production, is beyond doubt. Soy extracts a significant amount of nutrients from the soil, therefore, it requires a balanced fertilization system, taking into account the biological characteristics of the variety and the existing soil and climatic conditions, so only a properly designed fertilization system will allow obtaining a high yield of soybean seeds [1, 8]. Among the criteria for evaluating the effectiveness of fertilizer systems, one of the main ones is their impact on the quality of agricultural products. Therefore, the system of fertilizing agricultural crops should be considered not only as a means of increasing their productivity, but also as a powerful regulator of crop quality.

Soy consumes more nutrients to form a crop than cereals, unevenly absorbs nutrients during the growing season, is able to absorb nitrogen from the air, use sparingly soluble phosphorus and potassium compounds from the soil, and recycle their stocks from stems into seeds [5].

Among a number of measures aimed at realizing the genetic potential of modern intensive soybean varieties, pre-sowing preparation of seeds for sowing deserves special attention. In the cost structure for growing soybeans, the share of seed is 10-15%. To obtain a friendly, uniform and complete germination with subsequent high nitrogen-fixing capacity of crops, special attention should be paid to pre-sowing preparation of seeds [2, 6].

One of the important features of soybean is its ability to endosymbiosis with nitrogen-fixing subbacteria – rhizobia. Thanks to nitrogen fixation, which takes place in the tubers formed in symbiosis with rhizobia, soybeans can fully satisfy their need for nitrogen through symbiotrophic nutrition, which makes it possible to grow soybeans with minimal doses or without nitrogen fertilizers at all, which are expensive and environmentally dangerous [7].

As nitrogen fixers, soybean plants enrich the soil with nitrogen, improving its structure and increasing yields by 3–4 c/ha. The use of inoculants containing modern, highly effective, culture-specific strains of rhizobial bacteria with increased viability at high concentrations ensures the formation of the maximum number of tubers on the plant root system [3, 12].

To maintain and stimulate the physiological processes of soybean development, foliar fertilizing with micronutrient fertilizers, which include microelements in a biologically active (chelated) form, should be carried out in those phases of the vegetation of soy plants, when they are especially sensitive to a lack of nutrients [5, 9].

The practice of using mineral fertilizers for a long time knew only such ways of applying fertilizers to the soil: in the main cultivation or under pre-sowing cultivation; when sowing or during root dressing with various implements in the topsoil, which dried up in the second half of summer with the formation of deep cracks, through which moisture evaporated intensively, and the mineral fertilizers applied under such conditions became inaccessible to plants. Fertilizers applied six months or several months before the start of their intensive absorption by plants inevitably come into contact with the soil. At the same time, a significant part of salts in the composition of fertilizers decomposes into ions, enters into hydrolysis reactions, is absorbed by soil colloids and passes into insoluble or slightly soluble forms, is absorbed by soil microflora, therefore, only a small percentage of the initial amount reaches plants [4, 10].

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GROWING CONDITIONS AND YIELD OF SOYBEANS AFTER CORN WITH MINIMIZED SOIL TILLAGE

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In the conditions of a market economy, the main ways of increasing the profitability of the production of all crops are to increase the yield and reduce the costs of their cultivation. The latter is possible due to the introduction of minimization of soil cultivation by replacing the labor-intensive shelf plowing with less energy-intensive cultivation methods or by reducing the depth of their implementation.

Increasing processes of biological and physical degradation of soils, deterioration of ecological conditions of the environment, issues of safe food production cause the need to change traditional approaches in farming. Under such conditions, there is a need to study and clarify ecologically safe, adapted to certain conditions management systems, which should combine the features of intensive (industrial) and organic (biological) agriculture.

The influence of various tillage mechanical tillage on agrophysical and agrobiological indicators of soil fertility has been extensively studied in various natural conditions of Ukraine, but the directions of minimization of tillage tillage have been studied little, and in the northern part of the Steppe, few such studies have been conducted, which indicates their relevance.

Under the current farming conditions, significant changes are taking place - the latest technologies are being introduced, the basis of which is surface, minimal mechanical tillage, as well as direct sowing.Their introduction is due to a number of factors: the growth of urbanization, which leads to a decrease in the number of the rural population, the suspension of the physical degradation of soils, the preservation and increase of their fertility, energy and cost savings in the conditions of the economic and financial crisis [1].

Important agrophysical indicators of soil fertility include its structure. Measures for its improvement are replenishment with organic substances, soil reclamation, as well as providing the arable layer with a fine-grained structure by mechanical tillage [2].

Studies conducted on ordinary chernozem showed that the largest number of water-resistant aggregates was formed on the background of plowing. For other treatments, a slight decrease in their number is observed – by 0.6—2.7% [3].

A decrease in the depth and intensity of cultivation of ordinary heavy loamy chernozem showed that the content of aggregates with a size of 0.25–10 mm in a layer of 0–30 cm was greater for cultivation to a depth of 4–5 cm and was 62–71%, while for direct sowing it was 58 –71, and against the background of plowing – 49–67% [4].

Studies conducted on chernozem opizolized heavy loam found that in the arable layer when plowing was replaced by flat-cut loosening under corn and sugar beet, the structure of the soil decreased by 1.1 and 0.3%, respectively [2].

Currently, the attention of scientists is drawn to the search for optimal agrophysical indicators for various soils and cultures. It is believed that the density of the soil should be considered from the point of view of meeting the needs of agricultural crops with water and air, which will contribute to the effective functioning of their root systems. The highest productivity of most crops is achieved with the density of loamy and clay soils in the range of 1.1–1.3 g/cm3. Usually, even under fallow soil density is higher [5].

A study of various tillage measures found [6] that immediately after their implementation, the density of heavy loamy black soil on the background of flat-cut tillage was higher, compared to plowing in the arable layer, but did not exceed the optimal values.

In the studies of V.M. Kozak [7], plowed areas were characterized by the lowest density indicators during the soybean vegetation. At the same time, the critical values of the density were observed for shallow and varied-depth plowless cultivation in the dry growing season in the zone of formation of the "underground sole" - 1.75–1.84 g/cm3.In case of unstable and insufficient moistening of the Northern Steppe, the limiting factor in obtaining high yields of agricultural crops is the supply of moisture. Therefore, all components of agricultural technologies for growing crops, including soil cultivation, should contribute to the accumulation, preservation and rational use of moisture by plants.

On chernozem of light loam granulometric composition, reserves of available moisture at the time of sowing and the seedling phase of peas in the arable layer were almost independent of tillage [8]. However, in other studies, a greater amount of moisture under different treatments was on the background of plowing [9].

Long-term studies (from 5–6 to 10 years) [10] established that the moisture-accumulating effect of soil protection technologies in a meter-long soil layer is 13–15 mm, and already in the 8–10th year — 24–28 mm.

This brief review of the literature shows that there is no single view on tillage measures for soybeans. That is why it became necessary to study this issue. The purpose of the research was to solve the following tasks:

- to establish the impact of various tillage measures on the change in its agrophysical properties;

- determine the weediness of soybean crops;

- to determine the effect of different tillage options on soybean yield;

- to calculate the economic efficiency of using different tillage options for growing soybeans after corn.

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INFLUENCE OF GROWTH REGULATORS AND FERTILIZERS ON THE CONTENT OILS IN TUNKA HYBRID SUNFLOWER SEEDS

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Sunflower production in Ukraine increases annually due to the expansion of areas, however, its yield remains low. At the same time, sunflower hybrids and varieties entered into the State Register of varieties have a potential yield of 3.5–5.0 t/ha. As experts note, the gross collection of seeds still does not provide the available capacity of the domestic oil industry, which requires 20 million tons of raw materials annually [1]. Therefore, the issue of finding ways to further increase the yield of this crop remains relevant. The solution to this problem is possible because of improving the existing elements of sunflower cultivation technology, including through the use of plant growth regulators.

The use of growth regulators makes it possible to more fully realize the potential of plants laid down by nature and selection, to regulate ripening periods, to improve the quality of products and to increase the yields of agricultural crops, and there are a significant number of them on the market of Ukraine. Currently, more than 50 regulators and liquid organic fertilizers with growth-stimulating substances made on a humic basis are registered in the "State Register of Pesticides and Agrochemicals Approved for Use in Ukraine" [2].

It has been proven that some plant growth regulators of the new generation have good fungicidal properties and it is advisable to apply them in combination with protoxins, which significantly enhances the effect of the latter on pathogens. They can be used together both for pre-sowing treatment of seeds and for spraying crops [3]. In addition, the combination of plant growth regulators with pesticides makes it possible to reduce the dose of the latter (by 25–30%) without reducing their protective effect [4].

Therefore, the purpose of our research was to study the effect of different plant growth regulators and fertilizers on the oil content of seeds of mid-early Tunka sunflower hybrid in the conditions of the Right Bank Forest Steppe. In the experiment, plant growth regulators were studied: 1. Pennant K-2 is a stimulant that increases plant resistance to stress: cold, drought, diseases, accelerates seed germination, root and shoot growth, and increases productivity. 2. Architect - the drug optimizes plant architecture, transport and absorption of nutrients and water. 3. Ceron - prevents sunflower from laying down, stimulates the growth of the root system, provides favorable conditions for harvesting and increasing productivity. The option where no fertilizers were applied was taken as the control.

Scientists have established that mid-early hybrids are characterized by higher oil content, especially under the conditions of high temperatures of seed formation. It was found that a high oil content (49%) was observed at temperatures from 24 to 33°C. At the same time, early-ripening and early-maturing hybrids tend to reduce sunflower oil content by 2 abs. %.

According to the results of our research, it was established that in the control version, where no fertilizers were applied, the oil content was the lowest. For the introduction of mineral fertilizers in the form of nitroammofoska at a dose of 30 kg/ha d.r. it increased by 1.0%, which can be explained by sufficient phosphorus-potassium nutrition.

The introduction of plant growth regulators somewhat affected the quality of sunflower seeds of the Tunka hybrid, namely, the oiliness index. We observed a trend towards increased oiliness compared to the control. In the variants where Ceron (0.5 l/ha) and Architect (0.5 l/ha) preparations were applied, the increase in oiliness was the highest and amounted to 3.4 and 3.9 percentage points. The use of Vimpel K-2 (0.7 l/ha) contributed to an increase in oiliness by only 1.5 percentage points.

Based on yield and oil content data, we calculated the conditional collection of oil per 1 ha. It was established that this indicator varied under the influence of feeding systems from 951 kg/ha in the control version of the experiment to 1441 kg/ha when applying the drug Architect. On average over the years of research, in the control version of the experiment, this indicator was 1011 kg/ha and was the smallest. Application of nitroamophoska at a dose of 30 kg/ha d.r. increased conditional collection of oil by 20%. The use of RRR Vipel K-2 helped to increase the yield of oil from 1 ha by 27%, with the application of the drug Architect - by 40%, and the drug Ceron - by 39%.

So, in terms of influence, the feeding system with the use of the drug Architect at a dose of 0.5 l/ha, which provided conditional collection of oil by 1419 kg/ha, was better.

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ЕКОНОМІЧНА ЕФЕКТИВНІСТЬ ЗАСТОСУВАННЯ МАКРО- І МІКРОДОБРИВ У ПОСІВАХ СОНЯШНИКА

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Відносно невеликі витрати на гектар, невибаглива технологія вирощування і приваблива ціна реалізації робить соняшник однією з найрентабельніших культур для вирощування в Україні.

На думку фахівців навіть нині, коли ціни паливно-мастильні матеріали, логістику, сушіння і добрива б’ють рекорди, вирощування олійних залишається економічно вигідною справою.

У більшості фермерів України собівартість соняшнику прирівнювалась до врожайності від 1 до 1,5 т/га. Нині реалізаційні ціни залежать від переробників, трейдерів, ціни логістики та ще низки чинників.

Середня собівартість класичної технології вирощування соняшнику в 2022 році склала 21 тис. грн з урахуванням обробітку ґрунту (лущення стерні, оранка, боронування, культивація) і захисту посіву. Таким чином, при середній урожайності в 2,1 т/га і середній ціні в 14,5 тис. грн/т прибуток склав 9,45 тис. грн. Як зазначають економісти, витрати при інтенсивній технології можуть бути на рівні 900 $/га, а врожайність повинна бути не нижче 2,5–3 т/га. Тому прибуток в цьому кейсі буде 100–200 $/га при ціні на товарний соняшник 400–420 $/т» [1].

Схема досліду включала п’ять варіантів досліду. За контроль, було взято варіант, де добрив не вносили. 2. Варіант $N_{30}P_{30}K_{30}$ (фон) передбачав застосування Нітроамофоски N16:P16:K16 по 188 кг/га ф.в. під основний обробіток грунту та N_{30} весною під передпосівну культивацію. 3. Варіант – Фон + мікродобриво Найс Бор. 4. Фон + мікродобриво Найс Цинк. 5. Варіант – Фон + мікродобриво Найс Олійний. Повторність триразова, розміщення повторень – систематичне. У досліді вирощувався гібрид Сумико.

Чисельними дослідженнями встановлено, що рівень врожайності культури соняшнику напряму залежить від вмісту поживних речовин у ґрунті. Тобто на всіх етапах росту і розвитку рослини повинні бути забезпечені елементами живлення. Тож у контрольному варіанті досліду врожайність соняшника була найменшою і становила 21,0 ц/га. За внесення під основний обробіток нітроамофоски дозою $N_{30}P_{30}K_{30}$ + N_{30} в передпосівну культивацію вона підвищилась на 6,5 ц/га або 27 %.

Позакореневе підживлення мікродобривом Найс Бор на фоні внесення традиційних добрив підвищувало врожайність на 44 % по відношенню до контролю та на 14 % – до варіанту $N_{30}P_{30}K_{30}$ + N_{30}. Це пояснюється тим, позакореневе підживлення бором активує ріст пилкових трубочок і проростання пилку, збільшує кількість квіток та зав'язі, сприяє формуванню повноцінного кошику. Він також сприяє засвоєнню азоту, кальцію та магнію. А це, в свою чергу, сприяло підвищенню продуктивності цієї культури.

Ефективним було й дворазове позакореневе підживлення мікродобривом Найс Цинк на тлі $N_{30}P_{30}K_{30}$ + N_{30}, що дало змогу підвищити урожайність гібриду Сумико, порівняно з контрольним варіантом досліду, на 7,7 ц/га або 36 %. Адже за своїм впливом на інтенсивність цвітіння ту утворення зав'язі він подібний до дії бору. Дещо менший вплив цинку на врожайність соняшнику, порівняно до мікроелементу бору можна пояснити достатньою його кількістю у ґрунті.

Найвищу врожайність насіння соняшника (32,6 ц/га) було одержано за позакореневого підживлення мікродобривом Найс Олійний на тлі $N_{30}P_{30}K_{30}$ + N_{30} у фазу 2–3 пар справжніх листків та у фазу «зірочки».

Зі збільшенням врожайності підвищувалась і вартість валової продукції. У контрольному варіанті досліду, де добрив не вносили, вона становила 33600 грн/т. За внесення мінеральних добрив дозою N60P30K30 цей показник підвищився 8950 грн/га. На тлі застосування мінеральних добрив позакореневі підживлення мікродобривами Найс Бор вартість додаткової валової продукції становила 14880 грн/га, Найс Цинк – 12320, Найс олійний – 18560 грн/га. було одержано додаткову

В той же час збільшувалась матеріально-грошові витрати на придбання макро- і мікродобрив та їх застосування. Собівартість 1 т насіння соняшнику була найменшою у варіанті з внесенням Найс Олійний, поскільки його вартість становить лише 150 грн/т, а найвищою – у варіанті з внесенням мінеральних добрив – становила 11215 грн/т. У цьому ж варіанті досліду було одержано найменший умовно-чистий прибуток – 12729 грн/га, що на 890 грн/га менше, ніж у контрольному варіанті досліду.

Максимальний прибуток було одержано у варіанті Фон + Найс Олійний і становив 22029 грн/га в т.ч. додатковий склав – 8410 грн.

Отже, в умовах господарства ефективним виявився варіант з дворазовим позакореневим підживленням мікродобривом Найс Олійний на тлі $N_{30}P_{30}K_{30}$ + N_{30}.

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THE NEED FOR MINERAL NUTRITION OF LENTILS DURING THE GROWING SEASON

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The value of leguminous crops lies in the ability to symbiosis with nodular bacteria of the genus Rhizobium, which is an important factor in connection with the modern price policy for mineral fertilizers.

A valuable, unjustly forgotten leguminous crop is the lentil, which was grown in Ukraine for a long time. For its successful and effective cultivation, it is necessary to take into account the peculiarities of the culture's biology, its need for nutrients during the growing season to ensure high and stable yields, conditions for effective symbiotic nitrogen fixation [5]. The assimilation of nitrogen from the atmosphere in the process of symbiotic fixation determines a certain specificity of mineral, and especially nitrogen, nutrition of leguminous crops [2]. Mineral nutrition of plants is one of the important factors that regulates the growth and development of plants. Thus, according to scientists [5], on average, for the formation of 1 ton of grain, lentils remove from the soil, kg: N – 58, P_2O_5 – 20 and K_2O – 28. However, it is also known that lentils can partially provide themselves with nitrogen thanks to symbiotic nitrogen fixation [5].

Analysis of scientific research related to nitrogen nutrition of leguminous plants showed different data, both in domestic and foreign literature. Many scientists adhere to the opinion of both the complete denial of the need to use nitrogen mineral fertilizers and the transfer of plants to the use of only symbiotic nitrogen, and the use of high doses of their introduction.Phosphorus and potassium are important elements for legumes, which have a positive effect on symbiotic nitrogen fixation. All forms of phosphorus fertilizers, including sparingly soluble phosphates, are effective for leguminous crops when applied under tillage of the soil [2]. Phosphorus is part of many enzymes and vitamins. Optimum supply of this nutrient has a positive effect on the development of the root system, because of which the use of water and nutrients by plants improves.

Most scientists consider $P_{40–90}K_{40–90}$ to be the optimal dose of phosphorus and potassium fertilizers for leguminous crops, including lentils [1, 3, 4].

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FEATURES OF NUTRITION AND FERTILIZER OF CORN

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Corn is one of the most important and profitable agricultural crops, which exceeds all grain crops in terms of productivity. High yield and demand on the world market cause an increase in the area of sowing and the volume of its production in Ukraine. One of the important factors affecting the yield and quality of corn is the use of fertilizers. It has been established that the increase in the yield of agricultural crops from fertilizers is 30–50%.

Corn, unlike other spring crops, has a long growing season and requires much higher doses of mineral fertilizers, and is quite sensitive to the application of organic fertilizers. For the formation of 1 ton of grain with the corresponding amount of leaf stalk mass, corn on average assimilates 15–30 kg of nitrogen, 6–12 kg of phosphorus (P2O5), 20–30 kg of potassium (K2O), 6–10 kg each of magnesium and calcium, 3–4 kg of sulfur, 11 g of boron, 14 g of copper, 110 g of manganese, 0.9 g of molybdenum and 85 g of zinc and 200 g of iron.

In the development of corn, two important stages can be distinguished in terms of providing them with macro and microelements: phases 3–5 and 7–8 leaves. Before the formation of the first aerial node, although it grows slowly, it already forms generative organs that determine the future harvest. Therefore, the number of cobs on the plant and their grain size depend on the level of nutrition during this period, especially phosphorus. Improved mineral nutrition in the first period of intensive growth increases the grain size of the cobs and improves grain quality. Insufficient nutrition of plants in the period from seedlings to 7–8 leaves cannot be compensated by top dressing.

The assimilation of nutrients by plants reaches a maximum before the panicle and pistil receptacles are thrown out.

The level of nitrogen nutrition has the greatest influence on the formation of the corn crop. Nitrogen fertilizers not only increase the yield, but also improve its quality, increase the content of green mass and grain protein.

Corn assimilates phosphorus more evenly over a long period until the harvest is reached. Phosphorous fertilizers stimulate the development of the root system, the establishment of reproductive organs, contribute to the earlier formation of cobs, and accelerate the ripening of the crop. With a deficiency of phosphorus, plants form a deformed cob.

Corn, like other crops rich in carbohydrates, has an increased need for potassium. It assimilates potassium throughout the growing season. Normal nutrition with this element increases the resistance of plants to lodging. Potassium affects the formation of cobs, the accumulation of starch and sugar.

The corn fertilization system consists of three methods: main, row and top dressing. Doses of fertilizers are determined taking into account yield, the content of mobile compounds of nutrients in the soil, and the efficiency of diagnostics of plant nutrition.

For growing grain, 10 t/ha doses of mineral fertilizers, depending on the soil and climatic conditions, are N150–200 P60–90 K100–150. Phosphorous and potash fertilizers are applied under tillage. This ensures their placement in the zone of guaranteed moisture throughout the corn-growing season. Nitrogen fertilizers are applied under tillage, before leveling the tillage or during pre-sowing cultivation. It is advisable to apply high doses of nitrogen fertilizers on soils of light granulometric composition and on slopes in small quantities, before sowing 50% of the dose, and the rest after 35–40 days (in the phase of 6–8 leaves). On loamy soils, even in conditions of sufficient moisture and irrigation, the transfer of part of nitrogen from the main fertilizer to top dressing reduces the yield or does not give an additional effect.

In a four-field short-rotational crop rotation in a stationary long-term experiment on a dark gray podzolized coarse silt-light loam soil with a very low level of availability of mobile forms of nitrogen, an increased and high content of mobile compounds of phosphorus and potassium, the influence of fertilizer and crop care methods on the yield and quality of corn grain was determined . Research has established that the technology with the complex application of intensification factors, which includes the introduction of N240P120K240 against the background of byproducts of the predecessor, the use of soil and insurance herbicides, plant growth stimulants, and microfertilizers, is the most suitable for growing corn for fodder and food purposes in terms of the volume of products obtained and the quality of grain.

This technology provides a stable yield at the level of 12.1 t/ha of grain with a protein content and collection of 10.56% and 1.28 t/ha, fat – 4.29 and 0.52 t/ha, starch – 71.27% and 8.62 t/ha. To obtain high-quality grain for processing into bioethanol, the most effective method is to grow corn with the addition of N180P120K180, precursor byproducts, soil herbicide, and biostimulants.

Research conducted at the Bilotserki National University in a five-field grain-row crop rotation on a typical deep low-humus chernozem established that under the organo-mineral fertilization system, the difference in the average yield of corn was the highest and amounted to 0.67 t/ha in variants without fertilizers, with application of 20 t/ha of manure + N30P40K40 – 0.76; 40 t/ha of manure + N60P80K80 – 0.72 and 60 t/ha of manure + N90P120K120 – by 1.23 t/ha.In Umansk NUS, the use of different doses and systems of fertilization on podzolized chernozem had a positive effect on the yield of corn. With their application, the productivity increased in the mineral system by 21–40%, in the organo-mineral system by 22–42%, and in the organic system by 20–31%.

Therefore, from the review of literary sources, it can be concluded that there is no consensus among researchers regarding the doses of fertilizers for corn. It depends on both the soil and climatic conditions, varietal characteristics of the culture, and the duration of the conducted research.

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СЕКЦІЯ 4.
ЗАГАЛЬНЕ ЗЕМЛЕРОБСТВО

THE INFLUENCE OF CULTIVATION TECHNIQUES ON THE PRODUCTIVITY OF SUNFLOWER HYBRIDS

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Sunflower is a relatively young agricultural crop; it has been grown as an oil crop for about 150 years. Among oil crops in Ukraine, sunflower occupies a leading place. Sunflower production should be increased not by expanding its sown areas, but by increasing yields. In order to obtain consistently high yields of seeds, it is necessary to perform a complete technological complex of crop cultivation.

The modern resource- and energy-saving technology of sunflower cultivation involves the complex and precise execution of relevant operations in the established terms to create optimal conditions for the development and growth of plants during the growing season. In agricultural production, the correct selection of hybrids that are well adapted to local conditions and ensure the highest yields and high quality products is of great importance [1].

In the process of developing the elements of sunflower cultivation technology, it is also necessary to take into account such features as the duration of the growing season and individual phases of development; productivity – seed yield and oil collection and kernel oil content; alignment according to the height of the stem, the inclination of the inflorescences and simultaneous ripening. Significant importance is given to the signs: the size of the inflorescences; drought resistance; resistance against downy mildew and fungal diseases - white rot, powdery mildew, rust, verticillosis, etc. They are not only genetically determined, but can also be corrected in a certain way by changing the elements of technology and the correct selection of factors.

Among agrotechnical measures aimed at increasing the yield of sunflower, an important place is the choice of the optimal method of sowing and the rate of sowing seeds, which are related to the area of plant nutrition and its configuration [2].

Sowing density is one of the most effective means of influencing the plant due to environmental factors. In thinned crops, certain environmental factors may be in excess due to insufficient demand for them from the plants. When sowing rates are increased, there is competition between plants for life factors. It is mandatory to observe the sowing of seeds at the same depth, at an equal distance from each other, because this will allow you to get friendly, leveled seedlings and uniform development of plants.

From an economic point of view, the most important task is to ensure a significant collection of oil from each hectare of sunflower crops. Two indicators determine the collection of oil: the yield of kernels and the content of oil in them. In turn, the yield of kernels depends, first, on the level of seed yield and the ratio between kernel and husk. As the flakiness decreases and the oil content in the core increases, the oil productivity will also increase.

The period when the soil temperature at a depth of 10 cm is +8–10°C is considered the optimal period for sowing sunflower. Sowing at this time ensures an improvement of the nutritional regime, an increase in the field germination of seeds and the friendliness of seedlings due to the optimization of the ratio of temperature and soil moisture; reduction of weediness by almost half compared to the early period, the area of the leaf surface and the photosynthetic potential of the crop increase.

Both genetic features and weather conditions determine biometric indicators of plants, yield and oiliness of seeds of sunflower hybrids. Therefore, in order to obtain high gross harvests of grain of this crop, it is necessary to sow stably high-yielding hybrids adapted to certain conditions that ripen without desiccation. Therefore, one of the factors restraining the increase in sunflower productivity in Ukraine is mainly not the genotypes of hybrids, but the violation of the cultivation technology.

Sunflower cultivation technologies are constantly being improved in order to obtain consistently high yields. However, even under modern growing conditions, the genetic potential of new hybrids is not fully realized.

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INTENSIFICATION OF SUNFLOWER GROWING TECHNOLOGY

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Modern ecologically safe, resource- and energy-saving technology of sunflower cultivation involves the complex implementation of proper mechanized operations in the established terms to create optimal conditions and plant growth during the growing season. It was established that when sunflower crops are placed on the same field, after 6–8 years, the possibility of damage by diseases and pests almost completely disappears, and after 4–5 years, it leads to significant weeding and damage to plants by pests and diseases, which reduces yield and worsens seed quality.

The best precursors for sunflower are those that leave more water and nutrients in the soil. In the steppe, the most effective links of crop rotation are where sunflower is sown after corn or winter wheat, in the forest-steppe, where there is more precipitation and enough fertilizers are applied in the crop rotation, high yields are obtained when sunflower is placed not only after winter wheat, but also after barley. It is inappropriate to sow sunflower after Sudan grass, sugar beets, and in the Steppe also after barley and oats [1].

In Ukraine, high-yielding varieties and hybrids of sunflower with a significant content of oil in the seeds, low huskiness (22–27%) and high resistance to the most well known races of downy mildew, pests and diseases are common. Early-maturing varieties and hybrids are inferior to early-maturing and medium-maturing ones in terms of seed yield and oiliness. However, the short vegetation period of precocious types makes it possible to grow them in the south of Ukraine in repeated sowings with irrigation.

Medium-ripening and medium-early sunflower varieties and hybrids are characterized by high yield and high oil content in the seeds. Farms should grow not one, but two or three varieties or hybrids of sunflower. This makes it possible to use the ecological potential of the region and harvesting equipment and vehicles more efficiently.

When growing sunflower varieties, conditioned seeds are used, the germination of which is not less than 87 %, purity of 98 %, and hybrids (F1) – 85 and 98 %, respectively. Against diseases (rust, false powdery mildew, rot, fomosis, etc.), the seeds are treated. High-oil sunflower varieties should not be sown very early in all zones of Ukraine. In the southern and northern steppes, as well as in the eastern part of the forest-steppe, when sowing in the middle season, when the soil at a depth of 10 cm warms up to 8-12 °C, the largest seed yields are obtained. In the northern forest-steppe, preference is given to early sowing times (at the same time as early spring crops). At the same time, a larger seed yield and oil yield are obtained. In the Steppe and Eastern Forest-Steppe areas, it is recommended to differentiate the average sowing dates depending on the soiling of the field [2].

In relatively weed-free fields, the best time to sow sunflower is when the soil warms up to 8–10 °C at the depth of seed wrapping. Finish sowing at a temperature not higher than 12–14 °C. In heavily littered fields, sunflower should be sown a little later, when the soil warms up to 10–12 °C, and the bulk of the weeds that have sprouted should be destroyed by pre-sowing cultivation. The depth of wrapping sunflower seeds is 6–8 cm.

A condition for obtaining a high seed yield is compliance with the recommended sowing density and uniform placement of plants on the area. With intensive technology, when the density of plants is regulated not by breaking through, but by the rate of sowing, it is necessary to sow only high-quality seeds. When adjusting the seeder to the seeding rate, it should be taken into account that field seed germination is 20–25% lower than laboratory seed germination, and up to 10% of plants die during harrowing along the seedlings. Therefore, the insurance premium to the sowing rate should be 30–35%. Sunflower seeds are sown in a dotted pattern with row spacings of 45 and 70 cm. After sowing, it is advisable to roll the soil.

An important care measure for sunflower crops is harrowing before and after emergence. Pre-emergence harrowing is carried out with medium harrows 5–6 days after sowing, when the sunflower seedlings are at a depth at which the harrow teeth do not damage them, and the weeds are in the "white thread" phase.

Post-emergence harrowing of sunflower is carried out in the phase of 2–3 pairs of true leaves. It is advisable to carry out this measure with wide-grip aggregates in order to prevent its excessive compaction and destruction of the soil structure. On relatively clean crops, shallow tillage is carried out, and on clogged ones, inter-row cultivation should be started at a greater depth, gradually reducing it [3].

The yield of sunflower depends on the time of harvesting, which is determined by the degree of ripeness and moisture of the seeds. For long-term storage of sunflower seeds, their moisture content should not exceed 7–8%.

Thus, the intensification of sunflower cultivation technology is one of the decisive factors in increasing the yield of the crop. At the same time, it is important to take into account the soil and climatic features of the growing region and the duration of the growing season of sunflower varieties and hybrids.

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FEATURES OF THE FORMATION OF PRODUCTIVITY OF SUNFLOWER HYBRIDS IN THE CONDITIONS OF THE RIGHT-BANK FOREST STEPPE OF UKRAINE

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The increase in the production of agricultural products in recent years is achieved due to the intensification of agricultural technologies. Excessively intensive and not always scientifically justified use of land has led to a number of problems related to the degradation of the soil cover, environmental pollution, and a decrease in the quality of products, which leads to the deterioration of the health of the population.

Among the important tasks of modern agricultural science is scientifically based farming, increasing the profitability and sustainability of agrophytocenoses, obtaining stable harvests and high-quality products. Modern sunflower hybrids differ in both morphological features and adaptation to changing growing conditions depending on soil and climatic conditions and agrotechnical factors [1].

In this regard, the width of the rows and the density of sowing are important. Studies conducted in different regions of sunflower cultivation showed that an increase in the density of plant stands on plots was accompanied by a decrease in the leaf surface area per plant, but the leaf surface area increased in proportion to the increase in the level of seeding density.

At the same time, an increase in the density of sowing per unit area actively affects the morphological and yield indicators. As the density decreases, the diameter of the inflorescence, the area of the leaf surface, the diameter of the stem at the base increases, and the height of the plants decreases. Moreover, with an increase in the density of sowing, the number of leaves on the plant decreases. In this regard, increasing the seeding density of more than 90,000/ha leads to a deterioration of the productive and quality indicators of plants, and the use of a seeding density of less than 50,000/ha sharply reduces the productivity and yield of oil per unit area. The density of plants directly affects such indicators as the weight of 1000 pcs. of seeds, weight of seeds from one inflorescence and total sowing productivity [2].

The contamination of sunflower seeds is the main problem that negatively affects its yield and seed quality. The impact of this negative factor is particularly noticeable in connection with the expansion of sunflower areas and the deterioration of the crop rotation factor. Nevertheless, thanks to the correct and timely use of the necessary elements of agricultural technology for new hybrids, this issue is resolved.

Environmental conditions and agrotechnical factors are among the conditions that also affect the formation of the sunflower crop, first, due to the change of specific situations in crops, which largely depend on the density of the plant stand and the uniformity of their distribution on the area. The stand density varied from 50,000 to 90,000 units/ha. A critical thickening limit is established for each genotype. The most variable indicator was plant height and leaf surface area. Abiotic factors determine the mutual influence of plants and their competition for light, water, assimilation of compounds of nitrogen, phosphorus, potassium and other factors of growth and development. Moreover, this happens even in those soil and climate areas that are favorable for growing this culture.

The feeding area is a factor that greatly affects the relationship of plants in the agrocenosis. In a sparse stem, more conditions that are favorable are created for the development of each plant; their potential productivity is more fully realized: more flowers are laid in the basket, less empty grains, larger seeds. However, the maximum crop yield cannot be achieved only if the needs are best met and the potential productivity of each plant is fully realized.

Studies show that as the density of sunflower crops decreases, their illumination increases, but the coefficient of use of light by crops decreases, the same is observed when the supply of plants with moisture and the rest of other environmental factors, except for temperature, changes. Nevertheless, it is quite obvious that for agricultural production, obtaining a high yield per unit area (from a hectare of arable land) is an incomparably more important task than the realization of potential yield.

With excessive seeding, the yield of sunflower decreases due to increased competition between plants. The denser the sowing, the greater part of the moisture reserves are used up before the onset of the generative period.

With uniform placement of plants on the square, their mutual suppression begins later. It was also established that when the rows are narrowed and in denser crops, the mutual inhibition of plants begins to negatively affect the formation of the vegetative mass of the agrocenosis only from the budding phase.

Therefore, a certain mutual suppression of plants due to competition and underdevelopment of some elements of the crop structure also occurs in high-yielding sunflower crops.

Competition for life factors in the agrocenosis is largely determined by the soil and climatic conditions of the growing area. Plants compete, first, for the factor that is at the lowest level and limits growth to the greatest extent. Thus, the minimum factor for sunflower in the southern part of the forest-steppe is primarily soil moisture, and in the northern part - the intensity and amount of light and soil fertility. But even in the most favorable areas for growing sunflower, the needs of each plant in sowing are not fully satisfied, since this is possible in sparse sowings, and they are less productive [3].

Therefore, the structure of agrophytocenosis and agricultural technology should ensure the maximum efficiency of the use of environmental factors by the photosynthetic cropping system as a whole, and not by each individual plant. Under such conditions, the highest yield of seeds is collected from a unit of sowing area.

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