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THE INFLUENCE OF EXTRA-ROOT FERTILIZING WITH MICRO-FERTILIZERS ON BIOMETRIC INDICATORS OF SUNFLOWER PLANTS IN SOUTHERN OF UKRAINE

**ВПЛИВ ПОЗАКОРЕНЕВИХ ПІДЖИВЛЕНЬ МІКРОДОБРИВАМИ НА
БІОМЕТРИЧНІ ПОКАЗНИКИ РОСЛИН СОНЯШНИКА
В УМОВАХ ПІВДНЯ УКРАЇНИ**

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Анотація. В роботі розглядається особливість формування біометричних показників рослин гібридів соняшника Дарій, НК Камен, Тутті, залежно від позакореневого підживлення мікроелементами в ґрунтово-кліматичних умовах Миколаївської області зони південного Степу України.

Існує пряма залежність в динаміці формування вегетативної маси рослин досліджуваних гібридів та її формування від оптимального поєднання погодно-кліматичних умов та елементів живлення сільськогосподарської культури.

За результатами досліджень рекомендовано виробництву проводити сівбу в польових сівозмінах в якості кращого варіанту гібрид соняшнику НК Камен за умови позакореневого підживлення мікродобривом Квантум з нормою витрати робочої рідини 4 л/га у фазі 6-8 листків у культури, яка формувала найбільш розвинені рослини з максимальною площею листкового апарату (33,82 тис. м²/га).

Ключові слова: соняшник, мікродобрива, позакоренева підживлення, висота рослин, площа листкової поверхні.

Abstract. The article considers the peculiarity of the biometric indicators formation of sunflower hybrids Darius, NK Kamen, Tutti, depending on foliar feeding with trace elements in the soil and climatic conditions of the Mykolayiv region of the southern Steppe zone of Ukraine.

There is a direct dependence in the dynamics of the plants vegetative mass formation of the studied hybrids and its formation on the optimal combination of weather and climatic conditions and nutrients of agricultural crops.

According to the results of the research, it is recommended for the production to carry out sowing in field crop rotations as the best option of NK Kamen sunflower hybrids under the condition of foliar feeding with Quantum microfertilizer with a rate of working fluid consumption of 4 l/ha in the phase of 6-8 leaves in crops that formed the most developed plants with the maximum area leaf apparatus (33.82 thousand m²/ha).

Key words: sunflower, microfertilizers, foliar fertilization, plant height, leaf surface area.

Introduction. Agricultural crops require different assortments and amounts of trace elements. Both a shortage and an excess can cause a negative reaction of plants not only because of their own toxicity, but also because of blocking the supply of necessary nutrients to plants. This significantly affects the yield and quality of the crop itself [1-2].

The nutrition regime is very important in the technology of growing field crops. This important agricultural measure of operational and powerful help to the plant is used by our farmers by no more than 15-20%. In addition to macroelements, microelements also play an important role: boron, copper, iron, manganese, zinc, molybdenum, etc. After all, it is important to give the plant nutrients not only at the required time, but also in a balanced ratio. Deficiency of each of them can lead to disturbances in metabolism and physiological processes, which in the future can cause a decrease in the yield and deterioration of its quality. Therefore, fertilizers for foliar fertilization, containing trace elements, are becoming more and more relevant [3-7].

The use of trace elements is important for sunflower. Boron and copper increase the content of fat, zinc - phospholipids, boron and zinc - organic acids. In addition, boron significantly reduces damage to sunflowers by white rot and other diseases, which contributes to the preservation and improvement of the quality of the crop [8-10].

The land use territory of the experimental field is located in the southern part of the Mykolaiv region in the Southern Steppe zone of Ukraine, the climate of which is characterized by severe aridity with the presence of significant thermal resources and limited provision of atmospheric precipitation.

The soil cover of the experimental field is represented by chernozem, southern low-humus silty-heavy loam. The soil-forming rock is loess loam of brownish-fawn color, finely porous, compacted, saturated with calcium carbonates. Groundwater lies at a depth of more than three meters. The thickness of the humus horizon is 30 cm, the humus-transition horizon is 60 cm. The reaction of the soil solution is close to neutral (Ph 6.5-6.8), the hydrolytic acidity is within 2.00-2.52 mg equiv. per 100 g of soil. The amount of absorbed bases is 32-35 mg equiv. per 100 g of soil, the degree of saturation with bases is 95.7%. The presence of humus in the arable layer of the soil

is 2.8% (according to Tyurin), nitrate nitrogen - 30.0 (according to Kravkov), mobile phosphorus - 146.0 (according to Chirikov), exchangeable potassium - 357.0 mg per 1 kg of soil (according to Chirikov). According to the content of mobile elements, the soil is characterized by an average content of nitrogen and phosphorus and a very high content of potassium. In general, this characteristic is typical for southern chernozems. The soils of this region are best supplied with potassium, enough phosphorus, and satisfactorily with nitrogen.

In the field experiment, the agricultural technique of sunflower cultivation was generally accepted for the zone, with the exception of the options studied according to the experiment scheme. During all years of research, sunflower was preceded by winter wheat. After harvesting winter wheat, the stubble was husked with a LDH-10A disc husker in a unit with an MTZ-80 tractor, to a depth of 6-8 cm, repeated husking was carried out by an LDH-10A two weeks later, to a depth of 12-14 cm. In October, shelf plowing was carried out with a plow PLN-8-35 to a depth of 25-27 cm. Mineral fertilizers were applied in the doses recommended for the zone under plowing.

In the spring, when the soil was physically ripe, it was harrowed with heavy BZTS-1.0 tooth harrows, diagonally to the direction of plowing. Pre-sowing treatment was carried out with a KPS-4 cultivator, to the depth of seed wrapping (5-6 cm). Under the pre-sowing cultivation, the herbicide harnes 90% k.e. was applied at the rate of 2.5 l/ha.

Sunflower hybrids were sown at a soil temperature of 8-10°C at a depth of 10 cm with pre-treated seeds (the drug Colfugo super was used at the rate of 1.5 l/t) with a SUPN-8 planter at a speed of 5-6 km/h, to a depth of 5-6 cm. After sowing, the soil was rolled with ring-spur rollers 3KKSH-6, which contributed to an earlier and friendly emergence of seedlings.

On the variants where microfertilizers were studied, foliar fertilization of sunflower hybrid plants was carried out according to the experiment scheme.

One inter-row cultivation was carried out at a height of sunflower plants of 30-40 cm, with a KRN-5.6 cultivator with harrows, to a depth of 6-8 cm. The protective strip was 10-15 cm. Sunflowers were harvested when the baskets turned brown in at least 75% of the plants, and seed humidity of 12-14%.

In a two-factor field experiment during 2020-2021, the yield and quality of seeds of high-oleic sunflower hybrids were studied depending on the timing of application of microfertilizers.

The scheme of the field experiment included the following options: by factor A (Hybrids): 1. Darius (St); 2. NK Kamen; 3. Tutti. By factor B (Microfertilizers): 1. Without trace elements (control); 2. Quantum (4 l/ha) in the phase of 6-8 leaves; 3. Sprout (4 l/ha) in the phase of 6-8 leaves; 4. Reacom (4 l/ha) in the phase of 6-8 leaves; 5. Nanomix (2 l/ha) in the phase of 6-8 leaves.

Crops were treated with a knapsack sprayer at the rate of 300 l/ha of working fluid. The experiment was laid out by the method of splitting areas. The sown area of the plot was 56 m², the accounting area was 30 m², the experiment was repeated four times [11].

All sunflower hybrids taken for study in the field experiment are listed in the State Register of Plant Varieties of Ukraine and are recommended for cultivation in the Steppe zone.

Research in the field experiment was carried out in accordance with generally accepted methods and DSTU.

Field, laboratory, statistical and calculation-comparative methods were used to achieve the goal. In a field experiment, the effect of microfertilizers on the growth, development, phenological and biometric parameters of sunflower hybrids was studied. Laboratory methods were used to examine soil and plant samples for the content and removal of nutrients, product quality. The statistical method was used to assess the reliability of the research results [7, 12]. The economic efficiency of the studied factors was determined by the computational and comparative method.

Research results. The biological feature of hybrid sunflower plants is their growth and development rates, which can vary depending on the vegetation conditions - the level of moisture supply, feeding regime, and individual agrotechnical measures. In particular, the duration of the growing season largely depends on weather conditions, as well as their level of plant productivity, the longer the period during which plants can assimilate and absorb nutrients and moisture from the soil, the more they will accumulate dry matter, that is, the higher the yield will be.

An important varietal feature of plants of hybrids and varieties is their height. This feature is characterized by alignment due to their morphological features. But their manifestation, as a result of the interaction and mutual influence between plants and growing conditions, in particular, the level of nutrition regime, moisture supply, may have certain differences. In particular, plants of the same sunflower hybrid in different years, due to the influence of different conditions of nutrition and moisture supply, especially from seedlings to flowering, may differ in height.

The growth of plants in height, the formation of vegetative and generative organs determine their power, which will further determine the yield of seeds, its quality and the collection of oil per hectare. Sunflower belongs to a group of tall crops, in the crops of which certain features of air, water and light regimes are formed, which also affect the final result - the formation of plant productivity.

In addition to weather conditions during the growing season, the height of sunflower plants is also affected by agrotechnical factors, such as their mineral nutrition with macro- and microelements.

The results obtained by us from the research of foliar fertilizing with microfertilizers on the height of sunflower hybrid plants showed that their effect was not the same. It should be noted that the height of the plants of the studied hybrids varied, which is due to their morphological features. In particular, plant height indicators, on average for 2020-2021, when applying Quantum at the 6-8 leaf phase, were: in the Darius hybrid, 170.9, in the NK Kamen hybrid, 161.4, and in the Tutti hybrid, 157.3 cm. in this variant, their marked morpho-biological feature manifested itself to the greatest extent, compared to the control. However, it should be noted that the height of all studied hybrids was also influenced in a certain way by microfertilizers. In particular, the height of Tutti hybrid plants was 154.8 cm in the variant with the introduction of Nanomix in the 6-8 leaf phase, 156.4 cm in the application of Reak in the 6-8 leaf phase, and in the variant with Sprout in the 6-8 leaf phase it was 153.9 cm, which is more than the control, respectively, by 2.1; 3.7 and 1.2 cm.

Thus, the height of the plants of hybrids Darius, NK Kamen, and Tutti was formed depending on their morphological and biological characteristics and

microfertilizers.

The leaf surface of sunflower hybrids, like all agricultural crops, its area and duration of productive life are decisive in forming the yield level. At the same time, it is known that different cultures have certain features of the formation of the leaf surface. In particular, the leaf surface area of sunflower hybrid plants is mainly determined by such factors as their precocity and conditions during the growing season. The better they are, especially the level of moisture supply, the larger the area of the leaf surface is formed by sunflower hybrid plants. It is known that moisture supply and its level are practically decisive in the conditions of the Southern Steppe of Ukraine. It is natural that over the years of research, the indicators of the leaf surface area of plants of the same hybrids can vary significantly due to different weather conditions.

Therefore, many factors are taken into account for the formation of crops with certain photosynthetic indicators, among which the biological characteristics of hybrids, weather conditions and the entire complex of agrotechnical measures that are carried out during the growing season are important.

Taking into account the dependence of the photosynthesis process on the size of the leaf surface, the duration of its work and the determining influence on the formation of the crop yield, it is important to study this issue on new sunflower hybrids.

The results obtained by us established that the plants of the studied hybrids had certain morpho-biological features, and therefore their leaf surface was formed differently. Thus, on average in 2020-2021, on the version with Nanomix, when applied in the phase of 6-8 leaves, the area of the leaf surface in the flowering phase was: 31.25 in the Darius hybrid, 33.82 in the NK Kamen hybrid, and 33.82 in the Tutti hybrid 32.94 thousand m²/ha.

The size of the leaf surface area of all hybrids was also influenced by foliar feeding with microfertilizers and weather conditions, which differed in the years of research, especially in terms of the level of moisture supply. For example, on average over the years of research, the area of the leaf surface in the phase of basket formation in the NK Kamen hybrid was: for the use of Quantum in the phase of 6-8

leaves, 23.56 thousand m²/ha., for the application of Sprout in the phase of 6-8 leaves - 22, 32 thousand m²/ha., on the option using Reacom in the 6-8 leaf phase – 22.93 thousand m²/ha. and using Nanomix in the 6-8 leaf phase – 22.51 thousand m²/ha, which compared to control (without microfertilizers), respectively, more by 2.12; 0.88; 1.49 and 1.07 thousand m²/ha. Such a feature of the influence of microfertilizers on the area of the leaf surface was also manifested in the Darius and Tutti hybrids. It should also be noted that the largest area of the leaf surface in all studied hybrids, depending on the microfertilizers, was formed in the flowering phase, and naturally, due to the gradual drying of the leaves during the subsequent vegetation of the plants, their area decreased.

Conclusion. So, according to the results of our research, the best results were provided by the cultivation of the NK Kamen sunflower hybrid and the use of foliar feeding of crops in the phase of 6-8 leaves with Quantum microfertilizer, which contributed, compared to the control (without the introduction of trace elements), to the formation of plant height on average over the years of research - 161.4 cm, and the size of the leaf surface area was 33.82 thousand m²/ha.

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