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Globulins α– and β– of the experimental groups exceed the control group, with the exception of only β–globulins of the third group, where their content was lower in relation to the control group by 1.45%. But γ–globulins of the control group exceed the second group by 5.43%, the third - by 25.98% (P <0.001).

Conclusions. 1. The introduction of a new feed factor into the diet of young chinchillas did not significantly affect the quantitative composition of blood cells, the amount of hemoglobin, but contributed to a probable increase in the second and third groups of color.

2. The leukocyte formula was not particularly affected by the drug, only caused an increase in the number of eosinophils and young forms of neutrophils in the second group.

3. The content of calcium, phosphorus and alkaline reserve remained unchanged. Similarly, the drug did not affect the protein content and the amount of albumin and globulins, with the exception of the third group, which recorded a decrease in the number of γ-globulins.

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ФЕНОЛОГІЧНІ ФАЗИ РОЗВИТКУ БУРЯКУ СТОЛОВОГО ЗАЛЕЖНО ВІД СОРТУ ТА ВОДОУТРИМУВАЛЬНИХ ГРАНУЛ

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PHENOLOGICAL PHASES OF DEVELOPMENT OF TABLE BEETS DEPENDING ON THE VARIETY AND WATER-CONTAINING GRANULES

Анотація.

Наведено результати досліджень урожайності сортів буряка столового залежно від внесення водоутримувальних гранул. Спостереження за ростом і розвитком рослин буряку столового показали залежність настання фаз росту та розвитку в часі від сортових особливостей та застосування суперабсорбентів. Фазу линьки коренеплоду відмічали на 1 добу раніше на варіанта із застосуванням водоутримуючих гранул. Тривалість міжфазних періодів буряку столового свідчить проте, що на них впливали досліджувані сорти та застосування водоутримуючих гранул. Період масові сходи – початок інтенсивного формування коренеплоду коротшим був на варіантах із застосуванням водоутримуючих гранул: у сорту Бордо Харківський – 27 діб, у сорту Опольський – 29 діб, що на 4 та 3 доби відповідно коротші порівняно з варіантами без гранул. Період від масових сходів до закінчення вегетації менш тривалим був на варіантах із застосуванням водоутримуючих гранул : у сорту Бордо Харківський – 138 діб, у сорту Опольський – 137

діб, що на 4 доби коротші порівняно з варіантами без гранул. Приріст урожаю на варіантах з використанням водоутримуючих гранул становив 23,0 – 17,5 т/га відносно контролів. На масу коренеплоду впливали водоутримуючі гранули, які забезпечили приріст маси у сортів Бордо Харківський та Опольський на 83,0 та 63,0 г.

Abstract.

The results of research on the yield of table beet varieties depending on the introduction of water-retaining granules are presented. Observations of the growth and development of table beet plants have shown the dependence of the onset of phases of growth and development over time on varietal characteristics and the use of superabsorbents. The moult phase of the root crop was observed 1 day earlier on the variant with the use of water-retaining granules. The duration of the interphase periods of table beets indicates, however, that they were influenced by the studied varieties and the use of water-retaining granules. The period of mass germination - the beginning of intensive root formation was shorter on the variants with the use of water-retaining granules: in the Bordo Harkivskiy variety – 27 days, in the Opolskiy variety – 29 days, which is 4 and 3 days shorter compared to the variants without granules. The period from mass germination to the end of the growing season was shorter on the variants with the use of water-retaining granules: in the Bordo Harkivskiy variety – 138 days, in the Opolskiy variety – 137 days, which is 4 days shorter compared to the variants without granules. The yield increase in the variants using water-retaining granules was 23.0 - 17.5 t / ha relative to the controls. The weight of the root was affected by water-retaining granules, which provided an increase in weight in the varieties Bordo Harkivskiy and Opolskiy by 83.0 and 63.0 g.

Keywords: *буряк столовий, технологія, фенологічні фази, врожайність, біометрія.*
Keywords: *table beets, technology, phenological phases, yield, biometrics.*

Introduction. Beetroot (*Beta vulgaris L.*) is a valuable vegetable crop. Beet roots contain up to 15 % dry matter, many mineral salts, organic acids and vitamins. It has beets and medicinal properties, including the ability to prevent the development of malignant tumors. In order to provide the population with the necessary quantity and range of vegetables, including table beets, it is necessary to increase their yield and biochemical quality. It depends on many factors, the main of which are the variety of beets and the timing of their sowing. In the world of varietal technologies for growing beets are widespread [3].

Beet is an annual and biennial, cross-pollinated herbaceous plant, vegetable, as well as fodder and sugar crop. The shape of the root is round, flat and cylindrical. Contains up to 2 % protein, 14.5 % sugars, salts of potassium, calcium, magnesium, phosphorus. Unlike carrots, beets do not contain carotene, but more ascorbic acid. Root crops and leaves of young plants are eaten, salads, beets, borscht, pancakes, caviar, pickles, etc. are prepared. At early consumption (beets for beam products) use young leaves and petioles in fresh, boiled and stewed form [9, 10].

Table beets are widely cultivated in Ukraine, in terms of their taste and medicinal properties it occupies one of the leading positions among vegetables. The sown area under this crop in Ukraine in recent years remains at the level of 40 thousand hectares. Its roots are stored for a long time and used for various types of processing. Thanks to the original set of nutrients and food components, they are a necessary food for people of all ages. It is a valuable product for baby and diet food, as it contains easily digestible polypeptides, essential amino acids and vitamins, many minerals, dietary fiber [5, 9, 10].

To form a high marketable yield, table beets require proper care and the optimal ratio of the main factors: soil fertility, proper temperature, lighting, absence of weeds, fertilizer, loose soil, best varieties, large leveled seeds, optimal sowing dates, protection against diseases and pests, timely formation of plant density. In order to obtain sustainable yields with high quality and excellent taste properties, varieties should be selected according to climatic conditions and soil structure, as well as cultivation technologies, in which plants would be provided with all important factors for their growth and development [10].

Table beets are a very light-loving crop. Plants need light throughout the growing season, in its absence the yield is reduced by 30 %. Lack of light, reduction of its intensity worsen the chemical composition of roots.

Beetroot plants are characterized by a fairly high demand for soil moisture. This is due to the fact that its food organs include up to 86-87 % water. Particularly high demand for moisture is manifested during the sowing of seeds. During swelling, it absorbs 100 % of its weight from the soil. The optimum soil moisture during cultivation is 65-75 %. Deficiency of moisture during the period of intensive growth of aboveground mass and root crops leads to slowing down and stopping of growth and decrease in productivity. Excess moisture in the soil during the growing season also has a negative effect on plant productivity. Even short-term flooding (5-10 days) leads to their death [4].

High yields of vegetable plants in arid conditions can be obtained by providing them with optimal growth conditions. In the scientific literature, it is recommended to use absorbents to promote growth. In recent years, researchers have paid special attention to cross-linked polymers, so-called superwet absorbents or hydrogels. Due to a set of unique properties, hydrogels have found the widest application on the world market in medicine, industry, agriculture, in solving water and environmental problems. Due to climate change in the direction of warming, the problem of shortage of drinking and irrigation water is also facing Ukraine. High summer temperatures and prolonged lack of precipitation inhibit plant growth, reduce their productivity [1, 2, 6].

Absorbents – natural or synthetic compounds that are used for introduction into the soil in order to initiate changes in the processes of their life to improve product quality, increase yields, facilitate harvesting and storage of crops. The use of absorbents leads to changes in metabolism, similar to those that occur under the influence of external conditions. That is, absorbents are not nutrients, but factors in ensuring the growth and development of plants. Under their action accelerates the growth of green mass and root system, actively uses water and dissolved nutrients of soil and mineral fertilizers, their resistance to disease, temperature changes, drought, respectively, increases yields and improves the quality of vegetables. The use of absorbents makes it possible to more fully realize the potential of plants, inherent in nature and selection. The main requirement for absorbents is high absorbency relative to the absorbed component. A valuable quality of absorbents is the ability to regenerate them. In addition, the absorbent must be chemically indifferent and stable (not cleavable, not oxidized, not tarred, etc.), cheap and corrosively inactive [6, 7].

Water-retaining hydrogel granules are able to hold a mass of water hundreds of times greater than their own. They are compatible with all soils, increase their ability to retain water, prevent leaching of nutrients from the soil, reduce the stress of plants after transplanting. The hydrogel can be used when planting plants in a permanent place, when growing seedlings and in soil mixtures. It gives water to plants as needed and only when their roots germinate into swollen granules. Water-retaining granules are environmentally friendly, retain their properties at high and low temperatures and, after prolonged use, break down into harmless components [7, 11, 13].

At the same time, the use of hydrogel during seedling cultivation provides optimal conditions for plant growth and development with minimal moisture and nutrient consumption [4]. For more rational use of moisture, superabsorbents are used, which retain moisture and ensure its flow to plants during the growing season. Water-retaining granules are environmentally friendly, they can be used for planting vegetable plants in a permanent place and when growing seedlings [1, 14, 15].

The use of new supersorbents makes it possible for plants to rationally use moisture during the growing season of plants, reducing soil moisture differences in the absence of precipitation during short-term droughts that occur periodically in the Forest-Steppe zone. Akvod hydrogel is a new generation of materials that have a unique ability to absorb and retain up to 4 liters of water per 10 g of the drug when swollen. The hydrogel is non-toxic, retains its properties at high and low temperatures in the soil for up to 5 years. Saves water when watering up to 50-60 %. The drug is presented in the form of granules [1, 12, 13].

The purpose of research. Study of phenological phases of table beet development depending on the variety and water-retaining granules.

Methods. Studies on the study of phenological phases of table beet development depending on the variety and water-retaining granules were carried out in the experimental field of VNAU. The experimental field where the research was conducted is aligned by soil type and fertility level. In field experiments, the predecessor of table beet plants were zucchini. Agrotechnical measures were carried out in accordance with the requirements of culture (table beets) and the tasks set for research. The care of the plants consisted of systematic loosening of the soil, as well as weed control. Fertilizers were applied according to the norms recommended for the growing area, taking into account the availability of NPK soil [8].

Aquod water-retaining granules were used in the experiment as a superabsorbent. The experiment included 4 variants with four repetitions. The area of the accounting area is 10 m^2. In order to improve the moisture supply of plants. The granules were applied to the pre-sowing cultivation with the subsequent earning in the soil in the norm – 20 kg / ha. Field and statistical research methods were used in the experimental work. Phenological observations included: the beginning and mass emergence of seedlings, the appearance of the first, second, third and fifth pairs of true leaves, the beginning and mass phase of root moult, the beginning of intensive root growth and the end of the growing season of table beet plants. The beginning of each phenological phase was considered to be the time when 15 % of plants entered it, and the time of the mass phase was considered to be when it occurred in 75 % of plants. The vast majority of observations were performed visually [8].

The harvest was recorded in the technical maturity of table beet plants in accordance with the requirements of the current standard. The mass of roots from each plot was determined separately by weighing, the diameter of the fruit - with a caliper, the length - with a ruler [8].

Results and discussion. Observations of the growth and development of table beet plants showed the dependence of the onset of growth and development phases over time on varietal characteristics and the use of superabsorbents (*Table 1*).

Table 1

Dates of phenological phases of table beets depending on the variety and use of water-retaining granules, 2019-2020.

Version		Plant seedlings		The appearance of pairs of true leaves			
variety	application of granules	single	mass	1th	2th	3th	5th
Bordo Harkivskiy	without granules (control)	6.05	10.05	13.05	16.05	19.05	27.05
	with granules	6.05	9.05	12.05	15.05	18.05	26.05
Opolskiy	without granules (control)	6.05	11.05	14.05	17.05	19.05	28.05
	with granules	6.05	10.05	13.05	16.05	18.05	27.05

In the initial phases of growth and development of table beet plants, no significant influence of varieties and water-retaining granules on the onset of phases was noted. However, in the variants with the introduction of granules, a somewhat friendlier appearance of seedlings was observed, which further affected the passage of subsequent phases.

Previously, the appearance of mass seedlings of table beets was observed in the variants with the use of water - retaining granules: in the Bordo Harkivskiy variety – on the 13th day after germination, in the Opolskiy variety – on the 14th day, which was 1 day earlier compared to the variants where the granules were not used (*Table 2.*).

Table 2

Duration of interphase periods of table beets depending on the variety and application of water-retaining granules, days, 2019-2020.

Version		Plant seedlings		The appearance of pairs of true leaves			
variety	application of granules	single seedlings of plants	mass seedlings of plants	1th	2th	3th	5th
Bordo Harkivskiy	without granules (control)	10	14	3	6	9	17
	with granules	10	13	3	6	9	17
Opolskiy	without granules (control)	10	15	4	7	8	17
	with granules	10	14	3	6	8	17

Table 3

Dates of phenological phases of table beets depending on the variety and use of water-retaining granules, 2019-2020.

Variety	Application of granules	Plant seedlings		Root moult phase		Intensive root formation	
		single seedlings of plants	mass seedlings of plants	beginning	masses	beginning	the end
Bordo Harkivskiy	without granules (control)	6.05	10.05	17.05	20.05	10.06	26.09
	with granules	6.05	9.05	16.05	19.05	6.06	21.09
Opolskiy	without granules (control)	6.05	11.05	18.05	21.05	12.06	29.09
	with granules	6.05	10.05	17.05	20.05	9.06	24.09

The appearance of the first pair of true leaves was observed on the 3rd day after the appearance of mass shoots. However, in the variety Opolskiy without the use of granules – for 4 days. The same pattern is observed with the appearance of the second pair of true leaves. The appearance of the third pair of true leaves was influenced by the variety factor. Thus, in the Bordo Harkivskiy variety this phase was observed on the 9th day after the appearance of mass seedlings, in the Opolskiy variety – on the 8th day, which is 1 day earlier than the previous variety. The appearance of the fifth pair of leaves was observed in all studied variants on the 17th day.

A more noticeable effect of water-retaining granules was noted at the appearance of subsequent phases of growth and development of table beet plants (*Table 3.*). This is due to the fact that the summers of 2019-2020 were quite hot and there was less precipitation compared to the average long-term data. The granules provided the plants with a certain amount of moisture, which had a positive effect on the phase of the plants of table beets.

The moult phase of the root crop was observed 1 day earlier on the variant with the use of water-retaining granules. However, the beginning of the phase of intensive root formation was recorded: in the Bordo Harkivskiy variety 4 days earlier, in the Opolskiy variety 3 days earlier compared to the variants without granules. The end of this phase was also noted earlier in the variants where granules were applied: in the Bordo Harkivskiy variety for 5 days, in the Opolskiy variety also for 5 days.

The duration of the interphase periods of table beets indicates, however, that they were influenced by the studied varieties and the use of water-retaining granules (*Table 4*).

The interfacial period of mass germination – the molting phase did not differ between the studied variants and amounted to 10 days. However, the influence of the studied factors was observed in the subsequent phases. The period of mass germination – the beginning of intensive root formation was shorter on the variants with the use of water-retaining granules: in the Bordo Harkivskiy variety – 27 days, in the Opolskiy variety – 29 days, which is 4 and 3 days shorter compared to the variants without granules.The period from mass germination to the end of the growing season was shorter on the variants with the use of water-retaining granules: in the Bordo Harkivskiy variety – 138 days, in the Opolskiy variety – 137 days, which is 4 days shorter compared to the variants without granules. Thus, water-retaining granules accelerated the onset of phases of development of table beet plants and helped to reduce interphase periods.

Table 4

Duration of interphase periods of table beets depending on the variety and use of water-retaining granules, 2019-2020.

Variety	Application of granules	Mass germination - the phase of molting	Mass seedlings - the beginning of intensive root formation	Mass seedlings - the end of the growing season
Bordo Harkivskiy	without granules (control)	10	31	142
	with granules	10	27	138
Opolskiy	without granules (control)	10	32	141
	with granules	10	29	137

The accounting of table beet yield was carried out in the phase of technical maturity according to the current standard. The positive effect of water-retaining granules on the yield was established (*Table 5*.).

Table 5

Commodity yield of table beets depending on the variety and use of water-retaining granules

Variety	Application of granules	Yield, t / ha		Average	± to control
		2019	2020		
Bordo Harkivskiy	without granules (control)	63,7	62,6	63,2	-
	with granules	86,7	85,6	86,2	+23,0
Opolskiy	without granules (control)	56,7	55,6	56,2	-
	with granules	74,2	73,1	73,7	+17,5
HIP_{05}	A	1,3	1,2	–	
	B	1,3	1,2		
	AB	1,8	1,9		

The yield increase in the variants using water-retaining granules was 23.0 – 17.5 t / ha relative to the controls. Comparing the studied varieties, it was found that the Bordo Harkivskiy variety was characterized by higher yields. The analysis of variance showed that the increase in yield relative to controls is significant.

When conducting research, biometric measurements of table beet products were also performed (*Table 6*.). The Bordo Harkivskiy variety was characterized by a larger diameter of the root crop - 7.5 - 8.4 cm, which is 2.9 - 2.6 cm larger than the Opolskiy variety, respectively. However, the plants of the Opolskiy variety showed a longer root length relative to the Bordo Harkivskiy variety by 4.8 - 6.0 cm, respectively. Larger mass of root crop was formed by plants of Bordeaux Kharkiv variety – 228 - 311 g. Also, the mass of root crop was influenced by water-retaining granules, which provided weight gain in Bordo Harkivskiy and Opolskiy varieties by 83.0 and 63.0 g.

Thus, the accounting of the harvest and the biometric measurements of table beet production showed that these indicators are influenced by both varietal characteristics and the use of water-retaining granules. Studies have shown that the Bordo Harkivskiy variety forms rounded roots, and the Opolskiy variety is elongated**.**

Table 1

Biometric indicators of table beet production depending on the variety and application of water-retaining granules, 2019-2020.

Variety	Application of granules	The diameter of the root, cm	The length of the root, cm	Mass root, g
Bordo Harkivskiy	without granules (control)	7,5	9,1	228
	with granules	8,4	9,7	311
Opolskiy	without granules (control)	4,6	13,9	203
	with granules	5,9	15,7	266

Conclusions. According to the results of research conducted in 2019-2020 on the formation of the yield of table beets, depending on the variety and use of water-retaining granules, the following conclusions can be made:

1.Water-retaining granules accelerated the onset of phases of development of table beet plants and helped to reduce interphase periods. The period from mass germination to the end of the growing season was shorter on the variants with the use of water-retaining granules: in the Bordo Harkivskiy variety – 138 days, in the Opolskiy variety – 137 days, which is 4 days shorter compared to the variants without granules.

2.The highest plant height was recorded in the Bordo Harkivskiy and Opolskiy varieties using water-retaining granules, where the increase was 3.2 cm relative to the control.

3.The largest leaf area was recorded in the phase of intensive root formation in all studied variants. In the variants where water-retaining granules were used, the

increase was 0.5 thousand m^2 / ha in the Bordo Harkivskiy variety, 0.3 thousand m2 / ha in the Opolskiy variety.

4.The highest yield was recorded in the Bordo Harkivskiy variety – 86.2 t / ha. The yield increase in the variants using water-retaining granules was 23.0 – 17.5 t / ha relative to the controls.

5.Larger mass of root crop was formed by plants of Bordo Harkivskiy variety – 228 – 311 g. Also, the mass of root crop was influenced by water-retaining granules, which provided weight gain in Bordo Harkivskiy and Opolskiy varieties by 83.0 and 63.0 g.

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