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# CONTENTS

## ARCHITECTURE

<b>Заятдинов Г.В.</b> МОДУЛЬНОЕ СТРОИТЕЛЬСТВО В РОССИИ .....	4
<b>Zayatdinov G.V.</b> MODULAR CONSTRUCTION IN RUSSIA .....	4
<b>Заятдинов Г.В.</b> ПЕРСПЕКТИВЫ МОДУЛЬНОГО СТРОИТЕЛЬСТВА .....	5
<b>Zayatdinov G.V.</b> PROSPECTS FOR MODULAR CONSTRUCTION .....	5
<b>Іванова К.В.</b> ПРИНЦИПИ КЛАСИФІКАЦІЇ УНІВЕРСАЛЬНИХ СПОРТИВНИХ ЗАЛІВ .....	7
<b>Ivanova K.V.</b> PRINCIPLES OF CLASSIFICATION OF UNIVERSAL SPORTS HALLS .....	7
<b>Шамсадов М.С.</b> ЭКОЛОГИЧЕСКИЙ СЛЕД В МАРКЕТИНГЕ .....	9
<b>Shamsadov M.S.</b> ENVIRONMENTAL FOOTPRINT IN MARKETING .....	9
<b>Шамсадов М.С.</b> ПЕРСПЕКТИВЫ УРБАНИЗАЦИИ И РАЗВИТИЯ УСТОЙЧИВЫХ ГОРОДОВ В УСЛОВИЯХ ПАНДЕМИИ.....	11
<b>Shamsadov M.S.</b> PROSPECTS FOR URBANIZATION AND DEVELOPMENT OF SUSTAINABLE CITIES IN A PANDEMIC .....	11

## AGRICULTURAL SCIENCES

<b>Дудник Є.Г., Кравчук Г.І.</b> МОДЕЛЮВАННЯ НАДХОДЖЕННЯ ВАЖКИХ МЕТАЛІВ У ЛИСТКОВУ МАСУ ДЕРЕВНИХ РОСЛИН ПРИДОРОЖНІХ СМУГ.....	14
<b>Dudnyk Y., Kravchuk H.</b> SIMULATION OF HEAVY METALS INTO SHEET MASS OF TREE PLANTS BY ROADSIDE STRIPS .....	14
<b>Palamarchuk I.</b> INFLUENCE OF TECHNOLOGY ELEMENTS ON ZUCCHIN PLANT YIELD INDICES IN THE FOREST-STEPPE OF UKRAINE.....	19

## PHYSICS AND MATHEMATICS

<b>Носова М.Г., Фёдоров А.В.</b> МЕТОДЫ ДЕМОГРАФИЧЕСКОГО АНАЛИЗА И ПРОГНОЗА .....	24
<b>Nosova M.G., Fedorov A.V.</b> DEMOGRAPHIC ANALYSIS AND FORECAST METHODS .....	24

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Vinnytsia National Agrarian University, Vinnytsia, Ukraine*[DOI: 10.24412/2520-6990-2021-15102-19-23](https://doi.org/10.24412/2520-6990-2021-15102-19-23)**INFLUENCE OF TECHNOLOGY ELEMENTS ON ZUCCHIN PLANT YIELD INDICES IN THE FOREST-STEPPE OF UKRAINE****Abstract.**

*The results of research on the influence of variety, hybrid and water-retaining granules on the phenological phases of development, biometric parameters of plants and yield are presented. The duration of the interphase periods was influenced by varietal characteristics and the action of water-retaining granules. The duration of interphase periods with the use of water-retaining granules was reduced. However, the fruiting of zucchini with the use of pellets for 15 days was longer compared to the options without pellets. A higher indicator of leaf area was obtained in plants of the Sorcerer variety and the Mostra F<sub>1</sub> hybrid with the introduction of water-retaining granules into the pre-sowing cultivation, which is more than the control by 1.1 thousand m<sup>2</sup> / ha and 1.2 thousand m<sup>2</sup> / ha. Yield increase due to the use of water-retaining Akvod granules in the Chaklum variety and the Mostra F<sub>1</sub> hybrid, where the increase relative to control was 9.3 and 8.5 t / ha, respectively.*

**Keywords:** zucchini, water-retaining granules, variety, hybrid, yield.

**Introduction.** Zucchini belongs to the family *Cucurbitaceae*. Providing the population with fresh and processed vegetable products in an unfavorable external and internal environment is one of the most important problems of the modern food market. The supply of vegetables in the domestic market is formed mainly due to domestic production. Zucchini culture in recent years is increasingly attracting the attention of both producers and consumers. High fruit yield and unsurpassed taste qualities make it extremely popular, especially at a time when our usual vegetables such as tomatoes, cucumbers and peppers are not yet on the table. Currently, zucchini is well known and widespread in our country. However, few people know that the homeland of zucchini is America, where only the seeds of this plant were eaten [1, 3, 15].

Useful properties of zucchini are very diverse. Yes, zucchini are in the first lines of the list of dietary products, as they have a really low caloric content. These vegetables have all the ingredients for a proper and balanced diet. Zucchini is used as a diuretic, which reduces the appearance of edema. This property is possessed not only by pulp, but also by seeds of fruits, and also flowers. This vegetable contains vitamin C, which is involved in the production of collagen, which has a positive effect on the skin. In addition, it contains vitamin A, which has a positive effect on the vision and condition of hair, as well as nails and teeth [2, 4]. The advantage of zucchini is also a simple technology of their cultivation, which does not require significant costs. Zucchini plants can grow in areas where other vegetables can not be grown. The zucchini plant can also tolerate slight salinization of the soil.

Zucchini plays an important role in human nutrition, as it is one of the first vegetables to enter the consumer's table. It is also a dietary and medicinal culture. However, every year the climate changes towards warming. This increases the dry season in summer. Therefore, to address these issues it is necessary to apply new technological techniques, which include the use of water-retaining granules. Thus, the study of new technological methods for growing zucchini is relevant [1, 2].

Zucchini is a unique vegetable in its composition and medicinal properties. And although it is almost 95 % water, yet its natural potential is endless. This is caused by the content (even in small quantities) of the mass of useful micro-macronutrients, vitamins, minerals and other substances necessary for health [11, 12].

Zucchini, as a food and dietary crop, is widely known around the world. Zucchini has both a bush and a climbing form, is valued as a dietary food of various ways of preparation. Zucchini fruits contain from 4 to 8 % dry matter, 2.5-4.7 % sugar and ascorbic acid 35-38 mg / 100 g, 0.6 % protein, 15-40 mg; vitamin C, carotene 0.5-0.7 mg%, a number of vitamins. Given such a rich chemical composition, zucchini have medicinal properties, in particular in the diet, kidney disease, liver, high sugar and blood pressure. Vitamins present in zucchini fruits increase the body's resistance [7, 14].

The growing area of this crop is 24-28 thousand hectares, but they change every year. Most (60-65 %) of the areas are in the steppe and south, parts of the Forest-Steppe, where weather conditions are more favorable for them. The gross harvest of fruits is 460-550 thousand tons. Today the yield of zucchini in the zones is low – 17-20 t / ha. The genetic potential of this crop is much higher and averages 90-120 t / ha. The low yield is influenced by technological methods that are not performed qualitatively. Outdated technologies that are forgotten in European countries are often used, so the study of new elements of technology, in particular the use of water-retaining granules will increase yields and improve product quality [7, 12, 13, 14].

In conditions of intensification of agricultural production, especially in the cultivation of vegetable crops, priority is given to increasing yields and extending the time of receipt of fresh produce. Over the past few decades, humanity has faced a growing number of unpredictable natural disasters. Most scientists around the world recognize the existence of climate change on the planet. Climate change, in particular in Ukraine, entails dry periods, which are growing every year [14].

In Ukraine, droughts are observed even in the northern and western regions, which are considered areas of sufficient moisture. Scientists say that if this

trend continues, Ukraine may lose climate diversity and have one arid climate zone similar to the current steppe, and in the south of the country without irrigation it will not be possible to grow any crops. Therefore, agriculture faces the task of finding ways to maximize the efficient use of moisture. To achieve this, it is possible to use water-retaining granules [11].

Aquod is a superabsorbent that can hold water 500 times its own weight. It is introduced into the pre-sowing cultivation into the soil or added to the soil mixture, which is filled with cassettes for sowing seeds and subsequent cultivation of seedlings. In addition to water, the hydrogel also absorbs nutrients present in the soil. After the granules hit the soil, they absorb water and increase in size. The root system of plants that grow from pre-sown seeds or plants planted from seedlings grows and reaching the granules germinates in them. In the future, in the absence of sufficient soil moisture, the plant takes moisture from the granules, which significantly improves its nutritional conditions and promotes more intensive growth of vegetative mass and crop formation [5, 6, 10].

**Methods.** Studies to study the impact of water-retaining granules on the growth, development and yield of zucchini plants were conducted in 2019-2020 in the research field of Vinnytsia National Agrarian University. Field experiments were established (randomized blocks), which makes it possible to better investigate this factor. Before conducting research, an experimental scheme was developed according to which phenological observations, biometric measurements, and crop accounting were subsequently performed [8].

The effectiveness of Aquod water-retaining granules in the cultivation of zucchini. The experiment consisted of 4 variants, the experiment was repeated four times. The area of the accounting plot was equal to 40 m<sup>2</sup>. Aquod water-retaining granules were used in the experiment, which have a water-absorbing effect. Granules were introduced into pre-sowing cultivation, earning them into the soil, at a rate of 20 kg / ha.

Experimental work consisted of biometric measurements, phenological observations. These experiments were performed for each replication on 10 accounting plants [9]. Field, statistical and laboratory research methods were used during the research work. Individual observations were performed visually.

Collection of zucchini fruits was carried out as they were formed from 3 to 4 times a week according to the requirements of the standard – "Fresh zucchini. Technical conditions – DSTU 318 – 91 "[8].

**Results and discussion.** As a result of research it was found that the duration of the interphase periods of zucchini plants is influenced by the studied variety and hybrid, as well as water-retaining granules, which in turn improve the moisture supply of zucchini plants (*Table 1*).

In the germination phase and at the appearance of the first, third and fifth true leaves, the influence of the variety, hybrid was revealed. Shorter interphase periods were recorded in the F<sub>1</sub> hybrid hybrid. In particular, the appearance of single seedlings was observed on the 8th day, mass on the 9th day, which is 1 day earlier than in the variety Sorcerer. Preservation of the pattern of growth and development of zucchini plants was noted in subsequent phases.

*Table 1*

**Duration between phase periods in zucchini plants depending on varietal characteristics and water-retaining granules, 2019-2020.**

Version		Stairs		Leaf appearance		
variety, hybrid (A)	application of granules (B)	single	mass	1th	3th	5th
Chaklun	without granules (control)	9	10	5	10	13
	with granules	9	10	5	10	13
Mostra F <sub>1</sub>	without granules (control)	8	9	4	9	12
	with granules	8	9	4	9	12

This pattern can be explained by the fact that in the initial stages of plant development in the soil there is still a sufficient amount of moisture, and therefore the plants are in the same conditions.

However, with the development of zucchini plants, their moisture supply becomes unstable due to insufficient rainfall. Therefore, in all other phases of plant development, the effect of water-retaining gran-

ules was also noted. It should also be noted that the subsequent phases of growth and development of zucchini plants took place in conditions with elevated temperatures, which significantly affected the passage of the phases.

In the variants using water-retaining granules, the interphase periods in zucchini plants were shorter as the onset of phases was influenced by the moisture contained in the granules (*Table 2*).

Table 2

**Duration of interphase periods in zucchini plants depending on varietal characteristics and water-retaining granules, days, 2019-2020.**

Version		Germination, beginning of fruit formation b	Beginning of fruit formation, technical ripeness	Duration of yield coming, days
variety, hybrid (A)	application of granules (B)			
Chaklun	without granules (control)	31	4	69
	with granules	30	4	84
Mostra F <sub>1</sub>	without granules (control)	30	3	72
	with granules	29	3	87

It is noted that the difference in the duration of the interphase periods relative to the control was 1 day, in particular in the periods "seedlings – the beginning of fruit formation" and "the beginning of fruit formation – technical maturity". However, a more significant difference was observed in the interphase period "duration of fruiting". The duration of fruiting is the most important indicator on which the yield of zucchini depends. The longest period was with the use of water-retaining granules Akvod: in the variety – 84 days, in the hybrid – 87 days, with an increase relative to control, respectively 12 and 15 days.

Therefore, phenological observations of the development of zucchini plants have shown that water-retaining granules are able to improve the moisture supply in the period when the plants need it. The difference in the duration of interphase periods was not significant, but the duration of fruiting increased significantly.

Conducted biometric measurements of zucchini plants in the phase of three true leaves showed the influence of varietal characteristics and superabsorbents on the biometric parameters of plants (Table 3).

Table 3

**Biometric parameters of zucchini plants in the phase of three true leaves depending on varietal characteristics and water-retaining granules, 2019-2020**

Version		Height of plants, cm	Thickness of stem, mm	Area of leaves, thousands m <sup>2</sup> /ha
variety, hybrid (A)	application of granules (B)			
Chaklun	without granules (control)	16,5	3,8	47,3
	with granules	16,7	3,9	48,6
Mostra F <sub>1</sub>	without granules (control)	16,6	3,8	49,7
	with granules	16,9	4,0	50,8

The positive effect of water-retaining granules on both the length and thickness of the stem and the area of plant leaves has been established. A longer stem length was observed in the hybrid Mostra F<sub>1</sub> with the introduction of water-retaining granules – 16.9 cm, which is 0.3 cm more than the control. The increase in stem length under the influence of water-retaining granules was recorded in the variety.

The smallest difference between the studied variants was observed when measuring the thickness of the stem. This figure did not differ significantly and was 3.8 and 4.0 mm. Leaf area has the greatest influence among the studied biometric parameters on yield. Comparing the variety and hybrid, the highest indicator was recorded in the plants of the hybrid Mostra F<sub>1</sub> – 49.7 – 50.8 cm<sup>2</sup> / plant.

The positive effect of water-retaining granules on biometric parameters was also observed in the flowering phase of zucchini plants (Table 4). Comparing the variety and hybrid, it should be noted that higher biometric indicators were recorded in the variety Chaklun. However, there was an increase in these indicators for the introduction of water-retaining granules. The greatest length of the stem was in plants with the introduction of water-retaining granules, in particular in the variety Chaklun – 65.6 cm, in hybrid Mostra F<sub>1</sub> – 48.5 cm, with an increase relative to the control variant, respectively 4.1 and 1.8 cm. the largest indicator of stem thickness, where the increase compared to the control was in the variety Chaklun – 1.3 mm, in the hybrid Mostra F<sub>1</sub> – 1.8 mm.

Table 4

**Biometric parameters of zucchini plants in the flowering phase depending on varietal characteristics and water-retaining granules, 2019-2020.**

Version		Height of plants, cm	Thickness of stem, mm	Number of leaves, pieces /plant	Area of leaves, thousands m <sup>2</sup> /ha
variety, hybrid (A)	application of granules (B)				
Chaklun	without granules (control)	61,5	25,5	21,5	7,2
	with granules	65,6	26,8	23,5	8,3
Mostra F <sub>1</sub>	without granules (control)	46,7	24,8	17,6	5,4
	with granules	48,5	26,5	19,5	6,6

The use of granules contributed to the formation of more leaves, by improving soil moisture conditions. The largest number of leaves was recorded in the variety Chaklun – 23.5 pieces / plant and hybrid Mostra F<sub>1</sub> – 19.5 pieces / plant, which is 2.0 and 1.9 pieces / plant more than the control variants.

According to the experiment, the leaf area ranged from 6.6 thousand m<sup>2</sup> / ha to 8.3 thousand m<sup>2</sup> / ha, depending on the studied variant. A larger indicator of leaf area was obtained in plants of the Chaklun variety for the use of water-retaining granules – 8.3 thousand m<sup>2</sup> / ha, which is more than the control by 1.1 thousand m<sup>2</sup> / ha. An increase in this indicator was obtained in the hybrid Mostra F<sub>1</sub> with the introduction of pre-

sowing cultivation of water-retaining granules by 1.2 thousand m<sup>2</sup> / ha.

For a more detailed assessment of the studied options, biometric measurements were performed in the phase of technical maturity (Table 5.). Higher biometric indicators of plants were recorded in the variety Chaklun with the introduction of water-retaining granules, where the increase compared to the control was the length of the stem – 2.3 cm, stem thickness – 0.5 mm, number of leaves – 3.2 pcs / plant, leaf area – 2.6 thousand m<sup>2</sup> / ha. In zucchini plants, an increase in biometric parameters was also observed in the hybrid Mostra F<sub>1</sub> with the use of water-retaining granules.

Table 5

**Biometric parameters of zucchini plants in the phase of technical maturity depending on varietal characteristics and water-retaining granules, 2019-2020**

Version		Height of plants, cm	Thickness of stem, mm	Number of leaves, pieces /plant	Area of leaves, thousands m <sup>2</sup> /ha
variety, hybrid (A)	application of granules (B)				
Chaklun	without granules (control)	71,5	32,5	24,5	14,2
	with granules	73,8	33,0	27,7	16,8
Mostra F <sub>1</sub>	without granules (control)	63,4	28,5	19,8	13,6
	with granules	63,4	29,0	23,2	14,3

Therefore, according to the conducted biometric measurements and phenological observations, the influence of water-retaining granules on biometric parameters was revealed, as the plants are more fully provided with moisture during the vegetation period.

According to the size of the harvest, there is a clear dependence of yield on the studied varieties and water-retaining granules and yield (Table 6.).

Table 6

**Commodity yield of zucchini depending on varietal characteristics and water-retaining granules, 2019-2020.**

Version		Yield capacity, t/ha			before control
variety, hybrid (A)	application of granules (B)	2019	2020	average	
Chaklun	without granules (control)	60,5	58,3	59,4	-
	with granules	69,5	67,8	68,7	+9,3
Mostra F <sub>1</sub>	without granules (control)	51,1	48,8	50,0	-
	with granules	59,2	57,7	58,5	+8,5
HIP <sub>0,5</sub>	A	0,3	0,3		
	B	0,3	0,3		
	AB	0,4	0,4		

The highest yield was provided by the variety Chaklun with the use of water-retaining granules Akvod, where the increase relative to control was 9.3 t / ha. A positive effect of the use of water-retaining granules was observed in the hybrid Mostra F<sub>1</sub> with an increase relative to the control of 8.5 t / ha. Zucchini plants in the Mostra F<sub>1</sub> hybrid were characterized by the lowest yield – 50.0 t / ha. The effect of the factor grade, hybrid was at the level of 55 %, the factor of application of granules at the level of 45 %.

The use of water-retaining granules caused an increase in the biometric parameters of zucchini plants (Table 7.). The largest number of fruits was obtained by using water-retaining granules, in particular in the variety Chaklun – 18.5 pieces / plant, in the hybrid Mostra F<sub>1</sub> – 16.5 pieces / plant, where the increase relative to control was 2.2 and 2.1 pieces / plant. The indicator that affects the size of the crop is the weight of the fruit. The highest given indicator was recorded in the cultivar Chaklun with the introduction of water-retaining granules – 312 g.

Table 2

**Biometric parameters of zucchini depending on varietal characteristics and water-retaining granules, 2019-2020.**

Version		Number of fruit, p/plant	Weight of fruit, g	Fruit diameter, cm
variety, hybrid (A)	application of granules (B)			
Chaklun	without granules (control)	16,3	306	4,9
	with granules	18,5	312	5,0
Mostra F <sub>1</sub>	without granules (control)	14,4	292	4,8
	with granules	16,5	298	4,9

**Conclusions.** Thus, research has shown that the use of water-retaining granules creates optimal conditions for the formation of biometric indicators and yields in general. The introduction of water-retaining granules into the soil creates more optimal conditions for the growth, development and yield of zucchini plants. Variants with the introduction of granules provided an increase in yield relative to control. Given the range, it should be noted that the more productive was the variety Sorcerer.

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