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4.1.4. Садоводство, овощеводство, виноградарство и лекарственные культуры

ВЛИЯНИЕ КОНЦЕНТРАЦИИ АУКСИНА НА ЭФФЕКТИВНОСТЬ ТЕХНОЛОГИИ ВЫРАЩИВАНИЯ ГОЛУБИКИ МЕТОДОМ IN VITRO

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Микроклональное размножение в последние годы все шире внедряется в технологию выращивания качественного посадочного материала плодовых и ягодных культур. Применение данной технологии позволяет в более короткий период вырастить значительный объем безвирусного качественного посадочного материала. Однако, в данной технологии имеется ряд нераскрытых в полной мере технологических особенностей. В связи с этим, целью исследований являлось проведение оценки влияния концентрации ауксина на эффективность технологии выращивания голубики методом in vitro. Объектом исследований являлись микрорастения голубики высокорослой (*Vaccinium corymbosum L.*) сорта Bluecrop. В рамках разработанной методики были проведены учеты интенсивности ризогенеза микрорастений голубики и развития побегов в 2 периода учетов – через 4 и 8 недель культивирования. В результате проведенных исследований было установлено, что наиболее интенсивное укоренение микрорастений при всех концентрациях ауксина отмечалось после 8 недель культивирования. Сравнительная оценка эффективности изучаемых концентраций ИМК в опыте показала, что наиболее интенсивное наращивание вегетативных побегов и корешков в оба периода учета отмечалось на варианте с введением в питательный раствор 0,3 мг/л ИМК. Увеличение концентрации ауксина приводило к угнетению микрорастений и снижению их потенциала роста и развития

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4.1.4. Gardening, vegetable growing, viticulture and medicinal crops

INFLUENCE OF AUXIN CONCENTRATION ON THE EFFICIENCY OF BLUEBERRY GROWING TECHNOLOGY BY IN VITRO METHOD

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In recent years, microclonal propagation has been increasingly introduced into the technology of growing high-quality planting material for fruit and berry crops. The use of this technology allows for a shorter period of time to grow a significant volume of virus-free high-quality planting material. However, this technology has a number of technological features that have not been fully disclosed. In this regard, the aim of the research was to assess the effect of auxin concentration on the efficiency of blueberry cultivation technology using the in vitro method. The object of the research was highbush blueberry microplants (Vaccinium corymbosum L.) variety Bluecrop. Within the framework of the developed methodology, the intensity of rhizogenesis of blueberry microplants and shoot development were recorded in 2 periods of recording - after 4 and 8 weeks of cultivation. As a result of the studies, it was found that the most intensive rooting of microplants at all auxin concentrations was observed after 8 weeks of cultivation. A comparative assessment of the effectiveness of the studied IMC concentrations in the experiment showed that the most intensive growth of vegetative shoots and roots in both periods of recording was noted in the variant with the introduction of 0.3 mg/l IMC into the nutrient solution. An increase in the concentration of auxin led to the suppression of micro plants and a decrease in their growth and development potential

Ключевые слова: ГОЛУБИКА, IN VITRO, БЕЗВИРУСНЫЙ ПОСАДОЧНЫЙ МАТЕРИАЛ, СТИМУЛЯТОРЫ РОСТА, АУКСИНЫ, РИЗОГЕНЕЗ, РАЗВИТИЕ МИКРОРАСТЕНИЙ

Keywords: BLUEBERRY, IN VITRO, VIRUS-FREE PLANTING MATERIAL, GROWTH STIMULATORS, AUXINS, RHIZOGENESIS, DEVELOPMENT OF MICROPLANTS

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Introduction. Gardening in the Russian Federation is actively developing. Every year, positive dynamics of the area of fruit and berry plantations is noted [1, 2]. At the same time, consumers are showing increasing interest in non-traditional crops, especially berries. Blueberries are a valuable berry crop containing a large set of organic acids, mineral salts and phenolic compounds that have a beneficial effect on the development of the human body [3, 4].

Currently, there is a shortage of high-quality blueberry planting material, without which it is impossible to establish effective production of this berry and increase self-sufficiency in the southern regions of our country. The use of microclonal propagation technology can solve this problem. However, the introduction of blueberries into tissue culture was made relatively recently, and therefore, there are a number of unresolved issues in the technology of its cultivation [5, 6, 7].

To solve a number of pressing issues of blueberry microclonal propagation technology, studies were conducted in 2023-2024 at the Scientific and Production Center for Nursery Growing of Fruit and Berry Crops of the Stavropol State Agrarian University.

The aim of the research was to determine the effectiveness of various concentrations of auxin IMC in the technology of growing blueberries using the in vitro method. The objectives of the research included determining the intensity of rooting of regenerant plants, taking into account the number and intensity of growth of formed shoots and roots in micro plants after 4 and 8 weeks of cultivation.

During the research it was established that the use of the considered concentrations of auxin IMC contributed to an increase in the intensity of development of blueberry regenerated plants relative to the control without introducing hormones into the nutrient solution. A comparative assessment of the effectiveness of the analyzed IMC dosages showed an advantage in all studied parameters of the variant using 0.3 mg/l IMC. An increase in the concentration of the hormone in the nutrient medium had a somewhat depressing effect on the development of regenerated plants and reduced the intensity of formation of microshoots and roots.

Objects and methods of research. Research on the presented topic was carried out in the conditions of the Scientific and Production Center for Nursery Growing of Fruit and Berry Crops of the Federal State Budgetary Educational Institution of Higher Education “Stavropol State Agrarian University” in 2023-2024.

The object of the research was regenerated plants of highbush blueberry (Vaccinium corymbosum L.) variety Bluecrop, grown by the method of microclonal propagation in the laboratory of agricultural biotechnology of the Stavropol State Agrarian University.

During the rooting of regenerated plants in the microclonal propagation technology, an agar nutrient medium according to the recipe of Debnath and McRae was used, saturated in accordance with the recommendations of the authors with macro- and microsalts, with the subsequent addition of vitamins in the concentrations of: B1 - 0.6 mg / l, B6 - 0.4 mg / l, PP - 0.5 mg / l, sucrose - 20 g / l. In accordance with the approved experimental design, against the background of the variant without the use of hormones, taken as a control, the efficiency of various nutrient substrates for the stage of rooting of micro plants was studied with the introduction of the following concentrations of indolebutyric acid (IBA) into their composition: 0.3; 0.5; 0.8; 1.0 mg / l.

After the introduction of the appropriate concentrations of the IMC hormone, the media were sterilized at a pressure of 1.0 atm for 15 minutes.

The obtained regenerated plants were cultivated in a light room on shelves with phytolamps with illumination of 2.5-3.0 thousand lux, at an average air temperature of plus 21-24 °C, with a photoperiod of 16/8 hours.

During cultivation, on the 4th and 8th weeks, the intensity of development of regenerated plants was recorded depending on the analyzed variants. During the records, the proportion of rooted micro plants and the activity of callus formation were recorded using generally accepted methods. In both periods of recording, the intensity of growth of shoots and roots in regenerated plants was determined. Statistical processing of the obtained data was performed in the Statistica 10.0 program.

Discussion of results. As a result of the observations and records, it was established that both analyzed factors (duration of cultivation and concentration of growth stimulants) had a significant effect on the intensity of root formation of regenerated plants. According to the analysis of the data obtained, after 4 weeks of development of micro plants, they had a fairly high intensity of root formation, rooting in the experimental variants averaged 31.4-86.2%.

The surveys conducted during the second observation period showed a significant increase in the intensity of rooting of regenerated plants relative to similar indicators in the 4th week of rooting. The share of rooting of micro plants in the eighth week of cultivation relative to similar indicators of the first survey period was significantly higher. Moreover, the most intensive increase in the share of rooted regenerated plants in the 8th week of cultivation compared to the indicator of the first time period from the analyzed variants was noted at an auxin IMC concentration of 1.0 mg/l, amounting to 59.9% (Figure 1).

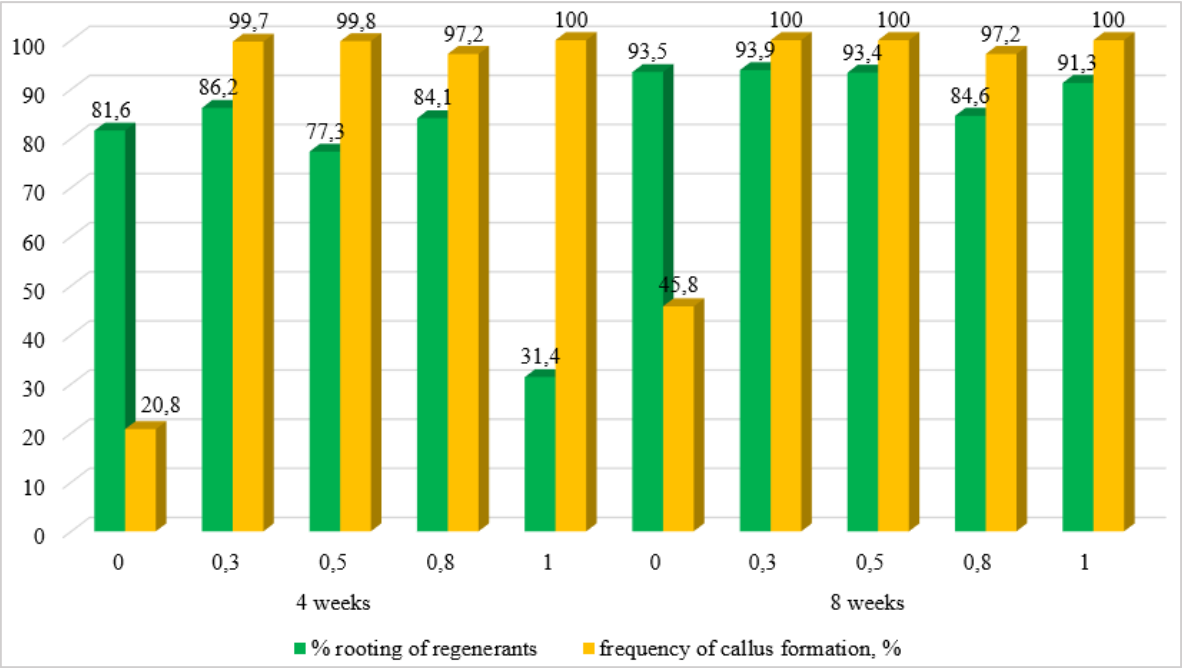

Figure 1 – Effect of IMC concentration and cultivation duration on the rooting intensity of blueberry regenerated plants

A comparative assessment of the effectiveness of the studied auxin concentrations showed that at both periods of the surveys, the most intensive rooting of regenerated plants was observed when IMC auxin was introduced into the nutrient solution at a concentration of 0.3 mg/l, the indicators of which significantly exceeded the results of the other experimental variants by 2.1-54.8% with a cultivation duration of 4 weeks, and by 0.4-9.3% in the second period of the surveys.

Observations of the intensity of callus formation in the analyzed regenerated plants showed that the use of all the considered concentrations of auxin IMC in both observation periods contributed to the formation of minor callus growths on the cultivated micro plants. At the same time, it should be noted that in the control without the use of auxin, the frequency of callus formation was at the level of 20.8-45.8% according to the experiment.

Along with the intensity of root formation in blueberries, the formation of a sufficiently powerful root system plays a major role in the technology of

growing high-quality virus-free planting material, which will significantly increase the survival rate of micro plants at the ex vitro stage.

According to the analysis of the obtained data, the highest intensity of rhizogenesis in the propagated blueberry microplants in the experiment was noted after 4 weeks of cultivation. Mathematical processing of the obtained data indicates that during this period, the use of all analyzed auxin concentrations contributed to a significant increase in the average number of formed roots relative to the control without the use of growth stimulants by 1.4-4.0 pcs. A comparative assessment of the indicators of the compared options with the introduction of auxin into the nutrient solution showed a significant advantage of the option with an IMC concentration of 0.3 mg / l, which reliably exceeded the results of the other experimental options by 0.5-2.6 mg / l (Table 1).

Table 1 – Effect of IMC concentration on the intensity of rhizogenesis of blueberry microplants after four weeks of cultivation

IMC concentration, mg/l	Average number of roots, pcs.	Average length of roots, mm
0 (control)	1.8	1.9
0.3	5.8	4.1
0.5	4.8	3.3
0.8	3.2	3.0
1.0	5.3	3.8
HSR_{05}	0.3	0.3

The calculation of the length of the formed roots showed a similar trend. Against the background of the use of all analyzed auxin concentrations, an advantage was noted over the control without the introduction of a growth stimulator. The most intensive increase in the length of the roots in the experiment was noted against the background of the use of an auxin concentration of IMC at a concentration of 0.3 mg / l, significantly exceeding the results of other options by 0.4-1.1 mm.

The calculations of the intensity of growth of vegetative growths of blueberry micro plants showed a slightly different picture after 8 weeks of cultivation. The introduction of auxin in minimal concentrations (0.3 and 0.5 mg/l) into the nutrient solution contributed to an increase in the intensity of development of blueberry micro plants relative to the control variant. However, increasing the concentration of IMC to 0.8 and 1.0 mg/l caused a decrease in growth processes in regenerated plants.

The highest average shoot length in the experiment was observed in the variant with the introduction of IMC into the solution at a concentration of 0.3 mg/l, exceeding the indicators of all other experimental variants by 0.09-0.52 cm. In addition, this variant demonstrated the most intensive average shoot growth from the period before rooting to the 8th week of the process, the advantage of which relative to the indicators of other variants was 0.14-0.44 cm (Table 2).

Table 2 – Effect of IMC concentration on the intensity of blueberry microplant development after eight weeks of cultivation

IMC concentration, mg/l	Average shoot length, cm	Average shoot growth, cm	Length of spines, mm	
			maximum	average
0 (control)	3.43	1.27	18.2	13.9
0.3	3.63	1.62	20.5	15.8
0.5	3.54	1.48	19.2	15.0
0.8	3.40	1.32	18.1	14.3
1.0	3.11	1.18	16.5	13.1
HSR_{05}	0.17	0.08	1.0	0.7

The analysis of the rhizogenesis intensity on the 8th week of microplant cultivation showed that the greatest maximum rootlet length in regenerated plants was observed in the variant with the introduction of IMC into the nutrient solution at a concentration of 0.3 mg/l, the indicator of which exceeded the results of the other experimental variants by 1.3-4.0 mm. The calculations of the

average rootlet length in the experiment showed a similar picture. At the same time, it should be noted that the smallest average rootlet length in the experiment was observed against the background of the use of IMC auxin at a concentration of 1.0 mg/l, the indicator of which was lower than the other experimental variants and the control without the use of growth stimulants.

Conclusions. In recent years, the importance of the microclonal method of propagation of fruit and berry crops, especially those unconventional for certain soil and climatic conditions, has been increasing. Increasing the efficiency of growing high-quality seedlings by the microclonal propagation method is possible due to the use of plant growth stimulants. Analysis of various concentrations of auxin IMC in the experiment showed that the most intensive rooting of regenerated plants in both accounting periods was noted when IMC was introduced into the nutrient solution at a concentration of 0.3 mg / l, the indicator of which exceeded the results of other experimental variants by an average of 0.4-54.8 mg / l. Despite a fairly high percentage of callus formation in micro plants in all analyzed variants, rooting of micro plants was quite intensive.

The analysis of the intensity of rhizogenesis of micro plants in the experiment after four weeks of cultivation showed a significant advantage of all variants with the introduction of IMC into the nutrient solution relative to the control result. The maximum average number of roots and their length were noted in the variant with the use of IMC at a concentration of 0.3 mg/l, exceeding the results of other variants by 0.5-4.0 pcs. and 0.4-2.2 mm.

The surveys conducted after eight weeks of cultivating blueberry micro plants showed that the most intensive growth of shoots relative to the indicator before the start of rooting in the experiment was noted in the variant with the use of 0.3 mg/l IMC, which reliably exceeded the results of the other variants by 0.14-0.44 cm. At the same time, a further increase in the concentration of auxin

contributed to the suppression of micro plants and a decrease in the intensity of development of both shoots and roots.

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