ACTIVATION OF BIOLOGICAL PROCESSES OF THE ROOT PART OF PLANTS IN CONDITIONS OF MODERN GREENHOUSES

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Abstract

Modern functional greenhouses equipped with automatic devices and controlled by modern software allow increasing the yield of vegetables. One of the important agronomic characteristics in protected soil is the development of the root system. The development of the root system is possible only with temperature regulation, creation of optimal conditions, use of growth regulators and plant protection products. Mineral nutrition plays a major role in the life of plants. One of the methods of regulating plant nutrition is the use of fertilizers. Deficiency or excess of nutrients can lead to changes in biological processes occurring in plants. Observations were made of the aboveground mass (number of shoots) and the root system of tomatoes using Lignohumate and Startec o fertilizers. Fungicides are used to treat plants or for preventive purposes. The discussion of the risk of using fertilizers, fungicides and other pesticides has shifted from considering toxicity not only for a specific object, but also to a wider range, including the environment and the ecosystem as a whole.

Keywords: *Modern greenhouses, root system, fertilizers, fungicides, pathogens.*

I. Introduction

Vegetables are important in the human diet as important sources of vitamins, minerals, antioxidants, and also as relatively affordable products. One of the most common crops grown in modern greenhouse complexes is the tomato, as it is distinguished by its high nutritional value, taste and dietary qualities, rich content of vitamins, minerals, antioxidants and the variety of their use.

obtained from protected soil. Modern functional greenhouses equipped with automatic devices and controlled by modern software allow increasing the yield of vegetables.

The relevance of the topic lies in the production of vegetables in protected soil and in providing the population with fresh, environmentally friendly vegetables all year round, especially in the winter-spring period.

To realize the bioresource potential for tomatoes and other crops, a comprehensive approach to the use of fertilizers, plant protection products, as well as the creation of favorable optimal conditions for the growth and development of plants (light, heat, water, air, food) is very important; experimental and theoretical substantiation of technological methods for growing tomatoes is required.

Research on identifying the best substrates, hybrids (varieties) of tomato, selection of the most optimal environmentally friendly fertilizers that are harmless to vegetation , plant protection products have been conducted for more than five years in hydroponics with supplementary lighting for the first time in the Chechen Republic in the greenhouse building of OOO TK YugAgroHolding.

One of the important agronomic characteristics in protected soil is the development of the root system. The root is an important organ that provides the plant with water, mineral substances, micro- and macroelements. Water enters the plant from the soil or mother liquor through the root system. A huge number of root hairs absorb water. Under root pressure, water enters the above-ground organs. Water evaporation can occur by transpiration (from the surface of the leaves) and guttation (water comes out through special openings - hydathodes in the form of drops and accumulates at the tip of the leaf).

II. Methods

The root system originates from the primary root, which develops during embryogenesis. The primary root produces lateral roots. Some studies have examined the effects of the environment on the initiation of lateral roots. An increase in the number of visible lateral roots is often described as increased initiation, while other phenotypes are reported as increased root density [2]. Signs of root system disorders include an abnormally formed system, a small number of lateral roots and root hairs, and damaged roots.

The bulk of the root system increases during the period of absence of fruit filling. When the first ovary appears, the growth of the root system stops. When the fruit grows, the roots die [4]. The root system has the property of constantly regenerating.

Development of the root system is possible only with temperature regulation, creation of optimal conditions, use of growth regulators and plant protection products.

Mineral nutrition plays a major role in the life of plants. Elements of mineral nutrition are classified into several groups:

- Potassium K, sodium Na , magnesium Mg , calcium Ca , manganese Mn , chlorine Cl . Come from the solution in the form of ions. Regulate the osmotic potential of the vacuole, the electrical potential of the membranes and their permeability, activate enzymes.

- Phosphorus P, boron B, silicon Si . From the nutrient solution they come in the form of phosphates, boric acid, borates, silicate. They participate in energy metabolism.

- Sulfur, nitrogen. Come from the soil solution in the form of NO_3^-, NH_4^+, SO_4^{2-}. They play an important role in the formation of organic compounds, perform structural and enzymatic functions, and participate in oxidation-reduction reactions.

- Iron Fe , copper Cu , zinc Zn , molybdenum Mo. Come from the solution in the form of ions and chelates. Are part of enzymes.

The suction activity of the root system is affected by a number of external factors. Such factors include temperature, light, oxygen availability, solution concentration, pH, and others.

In addition to the intake of water and mineral nutrition, synthesis processes occur in the root system. For example: ammonia nitrogen, which enters the plant with ammonium nutrition, is processed into amino acids in the root system. Excess ammonia nitrogen and a lack of potassium leads to the rate of ammonia intake exceeding the rate of processing into amino acids, as a result of which ammonia accumulates in plants, which can lead to poisoning. With an ammonia source of nitrogen, an increased level of potassium is necessary, with nitrate nitrogen, phosphorus is necessary.

III. Results

One of the methods of regulating plant nutrition is the use of fertilizers. Deficiency or excess

of nutrients can lead to changes in biological processes occurring in plants. With a deficiency of biogenic elements, growth may slow down, diseases may develop, or the plant may die [1]. Mineral nutrition of vegetables through the application of fertilizers can increase yields and the absorption of nutrients several times compared to the absence of fertilizers [5].

In the greenhouse building of OOO TK YugAgroHolding, experimental studies are conducted using methods of system analysis in accordance with generally accepted methods and guidelines. On the experimental site, experiments were conducted on a comparative analysis of Lignohumate and Startec fertilizers , a comparative analysis of the effect of fungicides on the development of diseases and prevention.

The Russian-origin fertilizer Lignohumate is gaining great popularity on the world market. This is an environmentally friendly fertilizer based on natural raw materials. Manufacturer: OOO NPO RET, Russia. Lignohumate is a multifunctional humic growth stimulator with microelements and an increased content of fulvic acids [9].

Startec o is an organic substance, a complex of beneficial soil microorganisms – bacteria, actinomycetes, saccharomycetes and their metabolic products: amino acids, organic acids, growth hormones, vitamins, etc. [10]. Country of origin: Russia.

Observations were made on the root mass (number of shoots, flowers, fruits) and the root system of tomatoes using the fertilizers Lignohumate and Startec o. During the first three weeks, no visible changes were observed. After four weeks, the number of shoots of plants using Lignohumate was maximum. These same plants had the most developed root system. The lowest indicators were in the control plants.

Recently, the trend towards more intensive development of the agro-industrial complex, the introduction of high-yielding hybrids have led to new diseases of agricultural crops, the causative agents of which can be microorganisms. Fungicides are used to combat plant diseases or for preventive purposes. The use of any chemical on agricultural crops or food products raises the question of risks and benefits. This discussion of risk has shifted from considering toxicity not only for a specific object, but also to a wider spectrum, including the environment and ecosystem as a whole.

Fungicides (lat. *fungus* "mushroom" *caedo "kill"* - are agents used to prevent or eradicate fungal infections of plants or seeds. Most fungicides have low or moderate toxicity. But some fungicides, such as alkyl dithiocarbamic acid (salts of manganese, zinc, ammonium), halogenated substituted monocyclic aromatic compounds, derivatives of carbamic acid (metabolites of manev and zineth and ethylenethiuram monosulfide), ferbam, benzidazoles (benomyl and carbendazine) and others. Fungicides provide broad protection against fungi, bacteria, viruses.

The drugs Previkur and BFTIM were used for the research. The chemical composition of these drugs was studied.

IV. Discussion

I. Subsection One

Previcur is a systemic fungicide for the prevention and treatment of vegetable crops [11]. This is an innovative technology of a combination of active substances propamocarb and fosetyl. The drug exhibits fungicidal activity against a wide range of pathogens, stimulates the growth of the root system of plants.

BFTIM is an effective biological agent for plant protection from fungal and bacterial diseases and prevention. Stimulates root growth.

Root rot and powdery mildew are among the most common diseases in protected soil in the Chechen Republic. They are fungal diseases.

Root rot often affects tomato and cucumber light crops when the water and temperature regime is disrupted. Signs of the disease mainly appear during periods of sharp fluctuations in temperature and humidity of the air and substrates, in low light or high air temperatures [6]. It leads to the death of young and adult plants. Pathogens such as Fusarium are the causative agents. oxysporum ,

Pythium debaryanum , Rhizoctonia aderholdii [8]. The symptom of this disease is the spread of necrosis in the central part of the root, the root collar and the lower part of the stem.

Powdery mildew is a major threat to plants in glass greenhouses under light culture. The pathogen is Oidium neolycopersici . Powdery mildew pathogens feed inside the living cells of the host plant and are biotrophs [7].

Research has shown that plants for which the preparations Previkur and BFTIM were applied to the root are distinguished by a powerful root system, linear growth, lighter roots, well-developed leaf surface, and are distinguished by high yields.

The widespread use of chemicals to combat pests, prevent and accelerate the growth of agricultural crops affects human health. Rational use of chemicals in modern greenhouse complexes is fundamental to the environmental friendliness and non-toxicity of the bioproduct.

In the modern world, the use of automated microclimate control systems in greenhouse buildings is promising. The expediency of using these preparations is relevant only with the correct and coordinated management of growing vegetables in protected soil. It is important to create and maintain optimal conditions for growing vegetables:

- PAR arrival – 75-90 J*cm ^{2} /hour
- Temperature – 20-22 ^{0} C. At night during the fruiting period 16-17 ^{0} C
- Carbon dioxide level 850-1500 ppm
- pH – 5.5-6.0
- EC 3.2-3.4 mS
- Humidity – 70-80%.

Weather conditions also have a significant impact on the climate conditions in protected soil. Solar radiation affects evaporation and plant growth, and temperature fluctuations affect energy consumption in greenhouse structures.

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