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Effective Use of Ultraviolet Irradiation in Hydroponic Greenhouses

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ABSTRACT: With the development of new innovative technologies, it is necessary to study the operating conditions of energy sources that can be used by consumers, their service life, and their structure. The article provides information on the use of ultraviolet radiation in hydroponic greenhouses to increase yields and fight plant diseases through the use of new electrotechnological methods of growing them to overcome the shortage of agricultural products. The topic is devoted to the use of new environmentally friendly electrical technologies in the production of agricultural crops (sweet peppers, tomatoes, cucumbers, etc.) In the spring-autumn period in closed heated rooms.

I. INTRODUCTION

Ensuring the rapid development of modern industrial and social infrastructure, on the basis of which to develop measures to create favorable conditions for consistent and sustainable economic growth. Also, one of the most important issues today is research in all sectors of the economy in order to improve production efficiency through the use of the latest achievements of science and technology in the national economy [1,2].

Today, in order to improve the living conditions of the population, to meet the demand for vitamin-rich vegetables throughout the year, it is necessary to use advanced foreign and resource-saving technologies in this area. Tasks and assignments have been set to grow and improve the quality of vegetables, as well as to increase exports, and to develop vegetable growing in open and greenhouses. Greenhouses produce seedlings of vegetable crops for more open space. About 70-80% of sweet peppers are grown from seedlings. The only promising way to increase the yield of vegetable crops and improve the quality of fruits is vegetative grafting. In recent years, there has been a growing interest in this method, which has been widely used by vegetable growers in Western Europe, Southeast Asia and the United States. One of the methods of electrophysical exposure to plants is to intensify them using intensive ultraviolet and infrared radiation and accelerate the process of entering the crop[5].

Currently, there is another method that has a positive effect on increasing crop yields. This is the use of an electric heater in agriculture [2,3,4].

The introduction of this agroelectric technology in agriculture is a pressing problem today. This is a scientifically advanced new technology aimed at increasing the productivity of agricultural crops in closed heated premises, preventing diseases and environmental friendliness [4,8].

In recent years, a number of biologically and physically active stimulants have been developed that are used to treat seeds and plants, with some positive results. However, these methods are not widely used in production [4,6].

II. ANALYTICAL INDICATORS

Examples of this are electrophysically stimulating stimuli such as GMM and gradient charges with various techniques (gradient magnetic field) and seed and plant treatments [3]. This effective method not only improves the quality of the seeds, but also achieves quality and high yields. These techniques are especially useful in the changing conditions of Uzbekistan. But its widespread use depends on the level of the crop. In the spring-autumn period, indoor plants suffer from a lack of sunlight, therefore, in this study, the task was set to provide tomato plants with ultraviolet light in special greenhouses with hydroponics [2,3,8].

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A variety of machines and mechanisms are used in crop production. But there are only a few machines based on power processing technology, and almost all of them are stationary. In this study, it is important to note that for the first time in hydroponic special greenhouses using an electric accelerator designed to treat plants with ultraviolet light, the task was to determine the optimal performance of the ultraviolet radiation method for tomato plants (Fig. 1).

It is important to improve the environment by increasing the productivity of plants as a result of the use of electrification, reducing the use of chemicals [5,7].

Research goals:

Study of the method of ultraviolet irradiation of sweet pepper plants in greenhouse conditions;

- To study the effect of ultraviolet radiation on sweet pepper plants during their growth and development during the growing season;
- to determine the effect of electrification on plant productivity;
- consider the issue of compliance with electrical safety rules when using an electric heater;
- To determine the economic efficiency of the application of sweet pepper processing technology to sweet pepper varieties [3,6,].

1-picture. Overview of an electromagnet that gives ultraviolet light to plants.

III. RESULTS AND ANALYSIS

According to the standard, sweet pepper seeds germinate in the fall after 12-14 days. Sweet pepper seedlings are cared for in the fall for 90-100 days, and seedlings prepared for re-sowing are cared for for 60-70 days. Sweet pepper seeds sweetness 35-45%. Germination of seeds of sweet peppers and other vegetable crops takes place in 3 stages.

The first stage is seedlings that germinate in 1-2 days.

The second stage is seedlings that germinate in 3-4 days.

The third stage is the germination of seedlings in 5-6 days.

According to literature data, seedlings germinating at the third stage often die.

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2-picture. Process of processing and germination of seeds in the laboratory.

Table 1. The results of measuring the germination of treated seeds, sm.

	Days of the month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1metr	Number of cups															
1 minutes	1	0	0	0	0	0	0	0	0,3	0,5	3	4,3	4,5	4,5	5	5
5 minutes	2	0	0	0	0	0	0,5	1	2	4	4,7	5,5	6,3	6,3	6,4	7
control																
untreated	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,5
fermented 24 hours	0	0	0	0	0	0	0	0	0	0	0	0	0,5	1	2	2,7

Sweet pepper seeds were used as the object of the study. To speed up the germination of sweet pepper seeds, we treated them with a cultivator with two bulbs. We got them in hydroponic greenhouse baskets and got the following results from Table 1.

It was proposed to use as a criterion for comparing installations the cost of a unit of photosynthetic energy and be limited to taking into account several significant factors:

$$G_{\phi}= q\eta_{\phi}^{-1}+C(P^* \eta_{\phi}{}^*\tau)^{-1}$$

Where: q- is the electricity tariff, sum / kWh; η_{ϕ} - coefficient of beneficial effect photositic active radiation source emitter, relative units \ photon flux, mol·s^{-1}\ mol·(m^{2}·s)$^{-1}$; C-is the cost of the source-emitter, rubles; P-is the power of the source-emitter, kW; τ-is the service life of the source - emitter, h.

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The critical values of the coefficient of beneficial effect of photosynthetic active radiation, at which the LED source-emitter can compete with traditional ones, is proposed to be estimated by the formula:

$$(\eta_{\phi 2})_{\text{kritik}} = \eta_{\phi 1} \prod_{i=1}^{2} (q + Ci * Pi - 1 * \tau i - 1)^{-ai}$$

Where: i=1 is an alternative emitter source, i=2 is an emitter LED source,
$a_i=(-1)^i$[3].

IV. CONCLUSION

We observed that the treated seeds began to germinate on the 6th day after sowing, and 2-3 out of 5 seeds in each basket germinated. We observed that after 8-9 days from the date of sowing of seeds, 3-4 seeds germinated, in some cases 5 seeds. In the first and second stages, 70% of the seeds germinate. The use of ultraviolet light allows you to increase the efficiency of growing seedlings of vegetable crops.

The profitability of a lighting fixture can be calculated as follows. Evaluation of the efficiency of an irradiation facility by the method of reduced costs is very laborious. It covers many factors, contains cumbersome calculations, but comes down to comparing the cost of installations, installation costs, operation, etc., however, it does not take into account the spectral composition of radiation, which is of indisputable importance for plants. In fact, when comparing the installations, the illumination is taken into account, which is incorrect due to the difference in the spectral photosynthetic radiation efficiency and the spectral luminous efficiency of radiation for a standard photometric observer.

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