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GROWING SWEET PEPPER PLANTS BASED ON EFFECTIVE ELECTRICAL TECHNOLOGY

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Abstract

In recent years, a number of biologically and physically stimulating stimulants have been developed and are being applied to seeds and plants, resulting in some positive results.

The article provides information on the use of ultraviolet light in hydroponic greenhouses to increase productivity through the use of advanced electrical technologies in the cultivation of agricultural products and to achieve resource and energy savings in plant growth. Provides information on the cultivation of vegetable seedlings for open and protected areas, the use of resource-efficient innovative technologies in the regulation and maintenance of microclimate conditions in the cultivation of seedlings.

Key words: *Sweet pepper, seedlings, resources, energy saving, innovative technology, phyto LED lights, food.*

Introduction. In recent years, the area under crops has been significantly expanded in order to provide the domestic market with quality products and increase the country's export potential by increasing food production. Practical measures are also being taken, such as specializing the districts in fruit and vegetable growing, uniting producers into fruit and vegetable clusters and cooperatives.

It shows that specialization of regions is the right way to grow competitive agricultural products that can meet the requirements of world markets.

Therefore, in the Resolution of the President of the Republic of Uzbekistan dated May 11, 2020 No. PP-4709 on additional measures to specialize the regions of the republic in the cultivation of agricultural products, at the initial stage 55 the district specialized in fruit and vegetable growing. However, despite the measures taken in this direction, the system of effective use of the potential of the regions has not been established, the diversification of agriculture, horticulture, viticulture, In order to increase the production of competitive products that meet the requirements of domestic and foreign markets by specializing in the cultivation of vegetables, potatoes and other food products, as well as the widespread introduction of scientific innovations and increase the material interest of producers: The Coordinating Council for the Implementation of the Development Strategy for 2020-2030 has been instructed to:

- Gradual specialization of the regions of the republic in the cultivation of certain types of agricultural products;

- In order to effectively organize the work of specialization of the regions of the republic to certain types of agricultural products, as an experiment to develop proposals for the specialization of a total of 116.3 thousand hectares of additional land in Jizzakh region for agricultural production in 2020-2022 tickle [1,5,18].

On the State Program of the President of the Republic of Uzbekistan "On the implementation of the Action Strategy for the five priority areas of development of the Republic of Uzbekistan in 2017-2021 in the" Year of Youth Support and Public Health " In order to ensure the implementation of the Decree No. PF-6155 of February 3, 2021, as well as the effective regulation of the field of agricultural seed production, the Cabinet of Ministers of October 12, 2021 "On some regulations on agricultural seed production" Appendix 6 in paragraph b: in cooperation with the Agency for the Development of Horticulture and Greenhouses, the Agency for the Development of Viticulture and Enology and the Research Institute of Vegetables, Melons and Potatoes " Scientific and practical research in the field of fruit and vegetable growing, viticulture, melons and potatoes in 2020-2023 and innovative scientific and technical projects "will be submitted to the Ministry of Innovation Development in due time. [15,17].

In Uzbekistan, about 60 percent of vegetable crops are grown from seedlings. In our sunny country, there is an opportunity to grow seedlings 2-3 times a year and make efficient use of protected land. This opportunity is important in meeting the demand of the population of our country for vegetables and preventing the global food crisis. In order to provide the population with cheap, high-quality food products, to increase the production of greenhouses in the country and the use of modern methods of growing seedlings of vegetable crops, it is important today. In horticulture, seedlings grown from seedlings are more advanced in growth and development than similar plants grown without seedlings [1,9]. This progress leads to faster ripening of the plant, better sales of the product in the market and higher economic efficiency. That's why many of our farmers know the benefits of growing vegetables in the open field and in greenhouses. However, some farmers and landowners lack the knowledge and experience to grow vegetable seedlings. [4,8,12].

To ensure the rapid development of modern production and social infrastructure, and on this basis to develop measures to create favorable conditions for the consistent and sustainable growth of the economy. It is also one of the most important issues today to conduct research in all areas of agriculture in order to increase the efficiency of production through the use of the latest achievements of science and technology in the economy. Nowadays, there is another way to increase the productivity of agricultural crops. This is the use of electric heaters in agriculture. [6,7,8].

The topic is devoted to the application of new environmentally friendly electrical technologies in the production of crops (sweet peppers, tomatoes, cucumbers, etc.) in the autumn-winter and spring-autumn seasons in closed heated rooms. The introduction of this agro-electrical technology in agriculture is a topical issue today. It is a scientifically advanced new technology aimed at increasing the productivity of agricultural crops in indoor heated rooms, disease prevention and environmental cleanliness. [10,13].

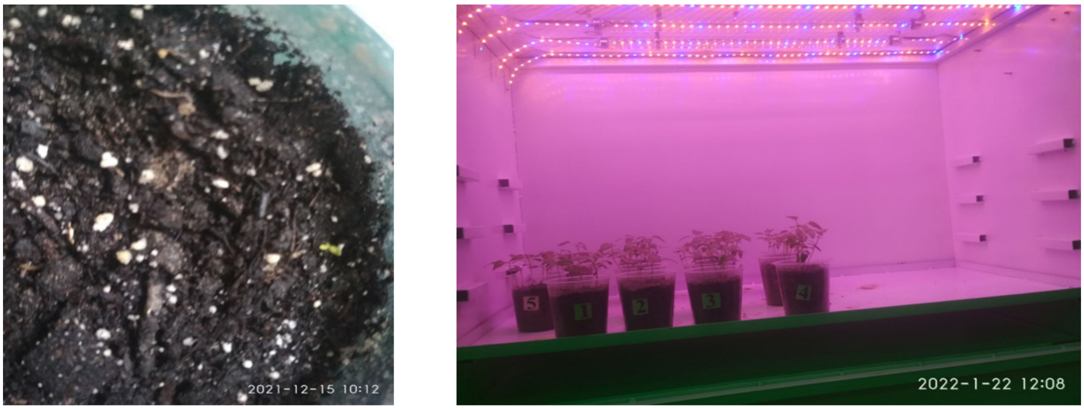

Figure 1. Irradiation of sweet pepper seedlings in the growing chamber.

In recent years, a number of biologically and physically stimulating stimulants have been developed and are being applied to seeds and plants, resulting in some positive results. But these methods are not widely used in production.

A variety of machines and mechanisms are used in crop production. But few of them are machines based on electrical processing technology, and almost all of them are stationary. [1,3,6]. 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 of determining the optimal method of ultraviolet irradiation of sweet pepper plants was assigned (Figure 1).

Materials and Methods. It is important to improve the environment by increasing the productivity of plants and reducing the use of chemicals as a result of the use of electrification.

The use of lighting devices is an important task of irradiating plants, the second chapter of which discusses their main technical and economic indicators. The efficiency coefficient determined from the light intensity curve of the irradiator, the coefficient of luminous flux utilization, i.e., the change in the light intensity curve when irradiating the lighting medium and plants, the concentration of the luminous flux on the irradiated surface should be increased by adjusting. [8,9,11].

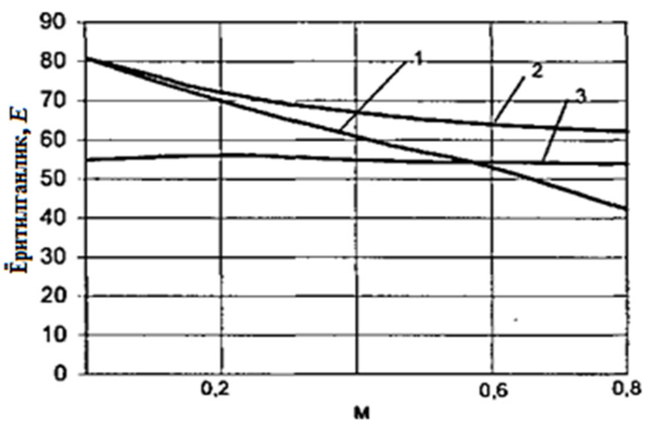

Figure 2. Graph of the effect of artificial radiation on plants with lighting devices.

1-LED phyto-strip lamps Intensity of the light distribution curve, 2- Intensity of light distribution curve of DNaT type lamps, 3- Intensity of the light distribution curve of incandescent lamps.

The light intensity curves for each type of luminaire were determined on an experimental stand for the five positions of the side-reflecting surfaces and the three positions of the light source relative to the horizontal axis (shown in Figure 2). [6,7,11,12,13].

The light intensity is determined as follows:

$$I_\alpha = \frac{E_\alpha * l^2}{\cos \beta} \qquad (1)$$

Where: E_α -is the illumination or phytonurization of the plane perpendicular to the direction under consideration, lk or fit / m^2;

l -is the distance from the light source to the measuring point, m;

β- is the angle of incidence of the radiation flux on the photocell (this angle is taken as 0°).

In order to calculate the parameters of the micro-climate chamber for growing sweet pepper seedlings, we need to pay attention to the agrotechnology of growing sweet pepper seedlings. According to agrotechnology, sweet peppers are just as demanding on fertile land as tomatoes, and sweet peppers love moisture and heat. Crops: grasses are planted when 5-6 true leaves appear. Seedlings need 55-60 days for the autumn-winter season, 50 days for the winter-spring season and 35-40 days for the summer-autumn season. After planting, when the plant reaches a height of 20-25 cm, the water point is removed to develop the side branches. When forming a plant, 2-3 strong side branches are left. Sweet pepper is a light-loving plant, so it can not be planted in the greenhouse. When planted thick, the flower does not pollinate and the yield decreases. Care should be taken to irrigate the area during the sweet pepper harvest. No reservations are required. Sweet pepper seedlings should usually be planted 70x40, with a row spacing of 70 cm and a spacing of 40 cm. Therefore, it is recommended to take deep watering during this period and water less frequently, often every 5-6 days.

As can be seen from Figure 2, the minimum point of intersection of the light scattering curves is close to 60 cm, so we can set the height of the camera to be adjusted every 10 cm to 70 cm, width 50 cm, length 1 m we define as We can place 6 of 48 cell cassettes with 4x4 cm in 0.5 m2 area. The total number of cells is 288. If we grow 4 seedlings in each cell, we can grow 1152 seedlings. According to the standard, 36-40 thousand seedlings can be planted on 1 hectare of land, and 1080-1200 seedlings can be planted on 3 hundred square meters. Given the large number of 2-3-storey private greenhouses in our conditions, it is a

Figure 3. A device for irradiating sweet pepper seeds and irradiating seedlings and controlling the irradiation process.

very convenient device for small farms (Figure 3). It can be designed as a two- or three-story for large greenhouses.

Sweet pepper seedling plant Minimum dimensions 50x100x70 cm Radiation power R_{max} = 112 W, if you need to control the temperature of the chamber, use an additional infrared incandescent lamp R_{max} = 100 W and up to R_{max} = 212 W increases. The total installed power of the irradiator is Rmax = 212 W, which means that in areas where centralized electricity is not available, seedlings can be grown using non-traditional renewable energy sources.

The device is automatically controlled by the control switch via 2 automatic circuit breakers. FS-2 time relay from the first automaton with the command 1 second to 1 hour, UV-S 20 W 2 ultraviolet λ = 200-250 nm wavelength fluorescent lamps for ultraviolet irradiation treatment of plant seeds and co. 'chats are used and controlled for processing for 10 seconds when they start to grow 4 ... 5 leaves. The second machine controls the temperature of the chamber through the SMD5050 series LED phytolent irradiation process and the thermal relay to illuminate the plants through the ALION TB388 24-hour time relay. The SMD5050 series LED phytolent can be used to illuminate the plants, the characteristics of which are given in Table 1.

Table 1

Characteristics of SMD5050 series LED phytolent

Technical characteristics of SMD 5050 series LED phytolent tape	*Technical units characteristics of phytolenta*
Voltage	*12 V*
Power	*14.4 W/m*
Can be cut at a distance	*5 sm*
The width of the belt	*10 mm*
The length of the belt	*5 m*
The number of diodes	*60 pcs / m*
The diode placement sequence	*3: 1, 4: 1 and 5: 1*
Protected IP20, IP67.	*IP20, IP67.*
Radiation flux strength	*620 lm/m*
The colors of the light spectrum	*Red (600-780nm), Blue (430-490nm)*

Phytolenta is an LED strip that can be used to provide additional lighting and to continue the process of photosynthesis in greenhouses, special cameras or individual or home-grown vegetable seedlings, flowers and similar plants. Ideal for both growing and flowering plants. The diodes in the phyto-band are arranged in such a way that they can transmit the spectrum of light needed for plants to grow. [4,6,16,17].

Several studies have been conducted to develop effective electrical technologies for growing sweet pepper seedlings.

Results and Discussion. On December 9, 2021, in order to increase the germination of sweet pepper seeds and ensure faster germination, UV-S ultraviolet radiation intensity with lamps with wavelength l = 200-250 nm and duration t = 1 min; 5 min; 10 min; For 15 minutes, the illumination and irradiated surface area (distance to the seed) h = 0.3 m; 0.45 m; Cultivated at 0.6 m ditches and planted with control (table 2). Sweet pepper seeds were planted in numbered pots on December 9, 2021 and monitored. The observations were irradiated with SMD5050 series LED phytolents for 5 hours after 1700 to artificially extend the daylight hours during the winter to accelerate photosynthesis from the day the sweet pepper seedlings began to germinate, and the following results were obtained. The experimental results obtained were placed in Table 3 and processed.

Table 2

Illumination and irradiated surface area

Illumination Site Location	***Duration***			
	1min	***5 min***	***10 min***	***15 min***
0.3 metr	*1*	*2*	*3*	*4*
0.45 metr	*5*	*6*	*7*	*8*
0.6 metr	*9*	*10*	*11*	*12*

Table 3

Experimental results

		15	16	17	18	19	20	21	22	23	24	5.01	22.01.22
		c	c	c	s	s	s	s	s	s	s	c	
0.3 meters	Experimental samples serial numbers												
1minut	1	0	0	0.1	0.8_4	1.9_7	2.7	3.4	3.9	4.4	4.4	6.8	9.2_6^6
5minutes	2	0	0	0.1	0.9_4	1.9_6	2.6	3.3	3.9	4.3	4.5	7.4	10.3_6^5
10 minutes	3	0.1	0.2	0.3	1.1_5	1.8_7	2.6	3.3	3.8	4.2	4.4	6.9	9.6_7^5
15 minutes	4	0	0	0.1	0.8_4	1.6_7	2.4	3.1	3.7	4.4	4.9	9	10.4_7^6
0.45 meters													
1minut	5	0	0	0.1	0.8_5	1.7_8	2.3	3.1	3.8	4.3	4.6	8.2	8.9_6^5
5minut	6	0.2	0.5	0.8	1.6_6	2.1_9	2.7	3.3	3.9	4.4	4.8	7.98	9.8_8^6
10 minutes	7	0	0.1	0.2	1.3_5	2.0_9	2.9	3.6	3.9	4.2	4.5	7.2	11.3_8^6
15 minutes	8	0.2	0.5	0.8	1.4_6	2.0_8	2.8	3.4	3.8	4.2	4.6	7.5	10.2_7^6
0.6 meters													
1minut	9	0	0.1	0.2	1.1_6	1.8_7	2.6	3.1	3.7	4	4.2	6.8	8.9_6^5
5minut	10	0.1	0.3	0.5	1.4_6	2.0_7	2.7	3.3	3.8	4.3	4.7	7.5	9.3_7^6
10 minutes	11	0	0.2	0.4	1.2_5	1.9_9	2.6	3.4	3.8	4.1	4.4	7.2	9.5_7^6
15 minutes	12	0	0.1	0.3	1.1_5	1.8_6	2.5	3.1	3.6	4.0	4.3	7.2	8.6_6^6
Control	13	0	0	0	0	0.1	0.5	1.2	1.9	2.5	2.9_2	3.9_4	4.8_3^2
Soaked in salt water	14	0	0	0	0	0.1	0.3	0.8	1.2	1.7	2.4_2	3.8_3	Quridi
Soaked for 24 hours in plain water	15	0	0	0	0.1	0.3	0.6	1	1.6	2.0	2.6_3	4.1_4	5_3^3

The Xx-index x is the number of seedlings germinated from 10 seeds in each pot.
Xy -is the number of leaves on each seedling.
c, s - cloudy or sunny days.

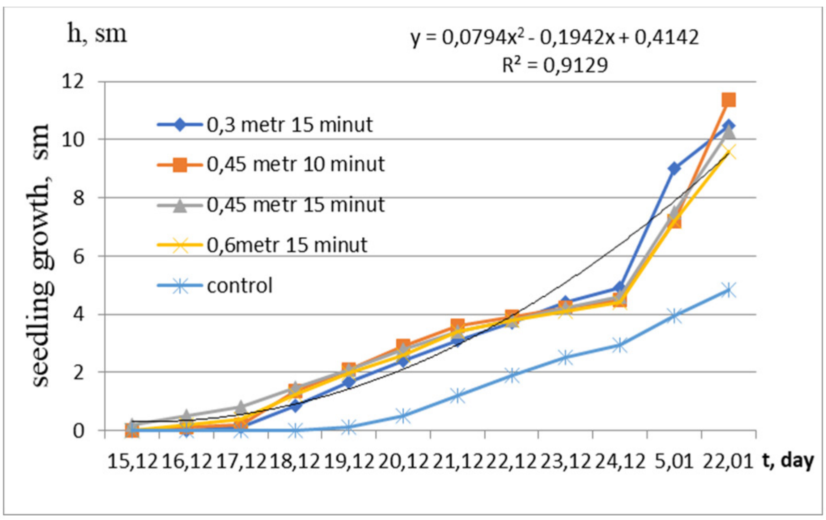

Figure 4. Growth of sweet pepper seedlings over time.

According to the results of the experiments, the most favorable conditions for growing plants were created. The criteria for the optimal regime are the minimum energy consumption, the minimum growth time of the plant, the maximum number of harvested fruits. Studies have shown that the optimal regime for growing plants with minimal energy consumption and minimal loss of radiation flux. The following energy-saving irradiation mode is proposed. In the early stages of growth (green mass formation), 5 strips of light source must be used to maximize irradiation. As the weight of the fruit increases, the radiation dose should be reduced to avoid elongation of the sweet pepper roots.

Analysis of control data showed that there were differences in the qualitative and quantitative indicators of sweet pepper plant growth data and yield data at harvest time. In all variants, the advantage of modified irradiators was observed: an increase in plant height, fruit weight and amount of green mass was observed compared to controlled plants. Irradiation at an altitude of 0.6-0.7 m under the SMD5050 series LED phytoleptic irradiator is 1.5 times higher than the control (up to 8 hours per day under control and 6.7 kilo-lux for 14-15 hours per day when recommended), which allows to increase the yield of seeds and 'is very important in the cultivation of wires. This allows us to draw conclusions about the efficiency of redistribution of the radiation flux.

The ripening period under the proposed irradiator was shortened. In the SMD5050 series LED phyto-tape version, the first 40% of the crop appeared on the 60th day, and

98% - on the 80-85th day. In the control version, the first 40% of the crop appeared on days 90-95, and 96% on days 110-120. The energy saved is reflected in the reduction of the lamp life by 6 days.

Conclusions. The SMD5050 series LED phytolent illuminator is based on a device that has the same luminous illumination sources by redistributing the luminous flux transmitted from above and adjusting the light intensity curve of the light.

When plants are grown using the SMD5050 series LED phyto-strip irradiators, the products are also grown faster due to the acceleration of plant growth in the autumn-winter and winter-autumn seasons. Efficiency is achieved by saving energy sources for heating (gas, coal, electricity), reducing the cost of the product.

At the same installed power, the working area produces a 1.5-fold increase in radiation. Acceleration of ripening of nirin pepper "Tashkent" was observed for 110-120 days. The use of such irradiators increases the cost-effectiveness of growing crops in greenhouses by accelerating the ripening of products and can be easily applied to agriculture.

Figure 5. Irradiation of sweet pepper seedlings in the growing chamber.

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