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INTELLIGENT CONTROL SYSTEM PARAMETERS OF THE GREENHOUSE

Аннотация: В работе проведен анализ существующих современных технологий, применяемых при строительстве и работе сооружений защищенного грунта.

Ключевые слова: умная теплица, технологии IFarm, гроубокс

Annotation: The paper analyzes the existing modern technologies used in the construction and operation of protected soil structures.

Keywords: smart greenhouse, IFarm technologies, grow box

Nowadays, the cultivation of vegetables and other crops in greenhouses (protected ground systems) cannot be imagined without automated control systems for the processes associated with watering plants, regulating the microclimate, etc.

A modern greenhouse complex is a complex structure with its own microclimate. Maintenance personnel must pay sufficient attention to all production processes, even if they are fully automated. The construction of greenhouses is currently carried out according to the most modern technologies, taking into account important scientific discoveries and developments. [1]

There are many greenhouse automation technologies. Themselves modern and popular are:

- grow boxes;
- IFarm technology;
- smart greenhouse.

A growbox is a box-like structure specially equipped with light and ventilation to maintain the required microclimate in order to effectively grow various plants at home (indoor).

Growbox can be of different sizes, from 30 square centimeters and more, depending on the size of the plants and the goals pursued by the grower (the person who works with the growbox). Small dimensions allow, if necessary, to hide the box from prying eyes, large grow boxes are always convenient and practical.

The main task of a properly equipped grow box is to maintain the necessary conditions for plant development. To achieve the creation of optimal conditions, 2 main elements are used in the construction of the correct system - they are lighting and ventilation.

Lighting in grow boxes can be sodium lamps used for street lighting and crop production; compact fluorescent lamps; energy-saving lamps, as well as special LED lamps for growing plants (Fig. 1).



Figure 1. Types of grow box lighting lamps

Ventilation can be any, most importantly, the selected fan must cope with the task at hand - updating the air in the box and removing the high temperature from the heating lamp. When choosing a fan, the goal is to create a constant temperature in the growth chamber in the range from +22 to +27 degrees (Fig. 2). Figure 2 shows: yellow - technical department, green - growth chamber. The

numbers indicate: 1 - socket, 2 - plug, 3 - automatic (L - phase, N - zero), 4 - mains filter, 5 - power supply unit of a 12 V cooler, 6 - electronic timer, 7 - tee, 8 - fan, 9 - electronic ballast, 10 - cooler, 11 - cartridge E-40, 12 - HPS lamp.



Figure 2. Wiring diagram for electrical equipment in the grow box

iFarm technologies are vertical farms for indoor cultivation of garden products. [2]

iFarm offers several automated technologies, including:

- Growtune vertical farm management software
- Salad vertical farms,
- Strawberry vertical farms,
- iFarm Cropper greens growing module.

The iFarm vertical farm is a factory with several automated modules. These technologies allow you to grow plants all year round, which are environmentally friendly.

The automated climate, specially selected power system and LED lighting developed by iFarm provide plants with everything they need to grow quickly - the crop ripens twice as fast as in the field.

The software monitors the microclimate in production, manages plantings (forecasting demand, accounting for product sales) and provides clear instructions for farm personnel, controlling their implementation.

Vertical trusses are easy to scale: they can be built in any configuration - from 50 to > 1000 m².

The standard equipment of the IFarm vertical truss includes:

- multi-tiered iron structures;
- equipment (LED lighting and power supplies for lamps, a solution unit, industrial osmotic installations for water purification, pallets and covers for them, IoT sensors, surveillance cameras, etc.);
- germination chamber;
- consumables (seeds, peat, fertilizers, cups, etc.)

Smart greenhouse - technology of the future:

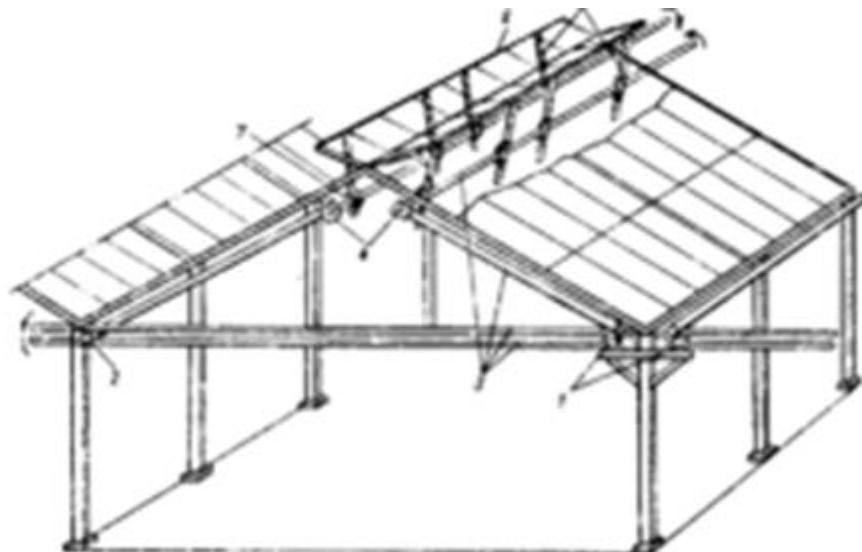


Figure 3. Ventilation scheme for a block greenhouse

Figure 3 shows: 1 - geared motor; 2 - cylindrical gearbox; 3 - drive shafts; 4 - worm gear; 5 - slats; 6 - vents; 7 - clip with an asterisk.

The “smart” greenhouse has fully automated control of all elements. New technologies for heating the soil perform the functions of controlling and maintaining the temperature of the soil. For effective heating of fertile soil, experts recommend using a power of no more than 100 W per 1m² and laying the cable in increments of 14-15 cm.

The heating system for such greenhouses in most cases is represented by ceiling-type infrared heaters. For illumination, LED lamps are used, which have the advantages of fluorescent and sodium lamps. The emission of an LED is determined by the composition of the phosphor; the light output of modern systems is capable of reaching 130-150 lm / W. When assembling an LED luminaire, LEDs of various spectra are placed in it, which makes it possible to provide the required spectral composition of the luminous flux, while maintaining high luminous efficiency. Selective illumination of plants reduces energy costs and increases the efficiency of light exposure.

New technologies in greenhouse ventilation are based on a system that includes a temperature sensor and a drive. When a certain temperature is reached, the sensor gives a command to the drive, which opens the windows. [3]

The air humidity control system is designed in such a way that when the threshold value of air humidity is reduced or exceeded, the device for supplying humid air and water is turned on (off). A soil moisture sensor has a similar effect, which, if necessary, connects the greenhouse irrigation system.

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