References

1. Harry J. Klee and James J. Giovannoni. Genetics and Control of Tomato Fruit Ripening and Quality Attributes. Annual Review of Genetics. Vol. 45, 2011. Pp. 41–59.

2. Байкин Ю. Л., Карпухин М. Ю., Юрина А. В., Федоров А.Н. Керамзитовый почвогрунт для выращивания растений. Патент на изобретение RUS 2290388 25.03.2005 .

3. Карпухин М. Ю., Юрина А. В., Кирсанов Ю. А., Кивелева Т. В., Зимина В. И., Демчук О. А., Шаблин П. А. Способ выращивания растений в теплицах. Патент на изобретение RUS 2299539 11.10.2005.

4. Kain, A. 2009. Pyramid farm is a vision of Vertical Agriculture for 2060. Accessed May 20, 2017 [Электронный ресурс]. URL: http://inhabitat.com/pyramid-farm-vertical-agriculture-for-2060. Дата обращения: 23.05.2020.

5. Прошинский В. В. . Многоярусная вегетационная трубная установка (МВТУ) «Фитопирамида» — инновационный проект в АПК РФ. NovaInfo.Ru - No31, 2015 г. С. 1–5 .

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THE MULTI-TIERED VEGETATIVE PIPE PLANT (MVTU) "FITOPYRAMIDA" IS AN INNOVATIVE PROJECT IN THE AGRO-INDUSTRIAL COMPLEX OF THE RUSSIAN FEDERATION

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Summary: *More than five years of research and experimental work has allowed to obtain a very interesting result. We checked the tomatoes grown on the Fitopyramida plants. With a MPC of 300 mg / kg, the nitrate content in our case was 53.2 mg / kg, which is almost six times below the permissible value. The fruits have a characteristic tomato smell. The advantages of multi-tiered tomato cultivation are presented.*

Key words: *multi-tiering cultivation, tomato, yield, quality, innovation.*

Sudden changes in external conditions require the same quick response to maintain the balance of the system. But what can be done to radically change or at least correct the situation in the greenhouse business as soon as possible?

At the expense of new, non-traditional solutions, it is necessary to reduce the cost of producing greenhouse vegetables and significantly increase productivity.

It will focus on highly efficient growing of undersized plants using the example of tomato production.

Using new greenhouses equipped with modern engineering systems, applying low-volume hydroponics technologies and with a high organization of production in modern cultivation facilities, tomato yields of 50–55 kilograms per square meter of greenhouse per year can be achieved. And only individual farms can boast a yield of 60 or more kilograms.

But such productivity is already at the limit of the possibilities of modern hydroponic technologies for growing tomatoes in a protected ground.

Under the new technologies for growing indeterminate tomatoes, greenhouses are forced to purchase and build high greenhouses.

An increase in the height of the greenhouse increases its metal consumption and material consumption, and hence the cost. But most importantly, for heating high greenhouses, ceteris paribus, it is necessary to spend much more thermal energy in the heating period.

At current energy prices, the share of heating costs in new greenhouses of advanced farms is 50-60%, and even more in old greenhouses. But how to switch to low, inexpensive and economical greenhouses with a height of 3.5-3.7 m, if modern technologies for the production of salads require the construction of greenhouses with a height of columns of 5-6 and more meters? At the same time, the growth rate of productivity significantly lags behind the growth rate of the cost of greenhouses and equipment, the cost of energy.

Are these contradictions resolvable? Yes, they are solvable if the idea of cultivating low-growing plants, in particular tomato, is radically changed.

We have created and tested in real conditions a multi-tiered vegetative pipe plant (MVTU) "Fitopyramida" for hydroponic, non-fertile cultivation of plants by the airborne method (subirrigation aeroponics). We were fascinated by the idea of multi-tiering, which makes it possible to use all the more expensive areas and the volume of modern cultivation facilities incomparably more effectively.

More than five years of research and experimental work has allowed us to obtain a very interesting result. And on the basis of the acquired experience and knowledge, we can draw certain conclusions: future greenhouse technologies will inevitably be forced to apply multi-tiered. In what form, it is only a question of the competitiveness of ideas and the form of their expression. Thus, we can say that the concept of this technology today can be used as an alternative, and in the near future it may become dominant [1].

The method of subirrigation aeroponics, implemented on Phytopyramids, eliminates the conditions for the accumulation of excess salts in the root zone, makes it easy to control and manage nutrition, while the roots of the plants are in ideal aeration conditions, which contributes to a significant improvement in the nutritional benefits of fruits.

In the SES laboratory, we checked the tomatoes grown on the Fitopyramida plants. With a MPC of 300 mg / kg, the nitrate content in our case was 53.2 mg / kg, which is almost six times (!) Below the permissible value.

The fruits have a characteristic tomato smell. The taste is no different from the usual, summer. These are delicious sweet and sour fruits, the meatiness and juiciness of which depends on the variety.

The plant has neither a mouth nor a stomach. It does not eat land, humus, or dung. The plant feeds on mineral salts, which are formed during the destruction of natural and unnatural organic compounds by soil bacteria [2].

Growing plants in completely isolated rooms under electric lighting (light culture of plants) eliminates the influence of external factors and year-round grow various plants in the most comfortable conditions for them, which means that they will receive high returns from plants with high quality products. Light culture of plants becomes relevant due to rapidly growing climate change, in remote regions with adverse and extreme climatic conditions, as well as in connection with rapidly growing logistics costs.

Light culture provides unique opportunities for the selective use of light sources of various spectra. By combining light sources with various spectral features, one can control the growth and development of plants. Light culture in opaque rooms also provides great opportunities for controlling plant growth by changing the photoperiod, that is, changing the length of the "day" and "night". It is known that different plants perceive the ratio of light and dark periods differently.

Using these tools, you can build various combinations, thereby affecting the growth and development of plants and significantly increasing productivity. Traditional greenhouses are deprived of this unique opportunity [3].

Table

Production capabilities

1.	Number of installations	98
2.	Of which in the departments, pcs .	
	salad	72
	- green crops	8
	- seedlings	18
3.	Number of seats:	
	salad	39168
	- green crops	10338
4.	Daily output, pcs. plants:	
	salad	1958
	- green crops	345
5.	Monthly production , pcs.	
	salad	58712
	- green crops	10338
6.	Production per year, units (at 12 months of cultivation)	
	salad	704544
	- green crops	124056

Note: the yield was determined by calculation, possible deviations of ± 10%.

The main part of the technological equipment is a multi-tiered hydroponic installation of the Fitopyramid type with a modular design scheme that allows the installation to be placed in any type of greenhouses. The plant is an integral part of the line for growing lettuce and green crops and should work in conjunction with the following systems:

— system for maintaining optimal microclimate parameters;

— automated mineral nutrition unit with a nutrient solution collection and collection system;

— electric lighting system.

The project involves equipping the greenhouse with a salad line. The products of the salad line are leaf lettuce and other green crops.

Production capabilities of the salad line at Phytopiramids for growing lettuce and green crops in the greenhouse, S = 1300 sq. m (table).

Key product qualities (design, packaging). The product complies with all necessary standards and norms for quality. Finished products are packaged individually in plastic bags and corrugated cardboard boxes.

The production process technology consists of 5 stages: cup filling with substrates; sowing seeds; moving the seeded cups into the chamber; moving the cups to the system where the cultivation takes place; selection and packaging of products.

Customers and sales. The product is aimed at a wide range of consumers with both medium, high and low income. Seasonal effects on the sale of products fall on the summer-autumn period (Q3). This period accounts for an average of 35% of sales compared to other periods. The main potential customers are: trade organizations in the field of food products, fruit and vegetable bases, warehouses and others located within the region. The share in total sales is: 80% wholesale flow, 20% retail chains. The regional market share that is planned to be taken is 100%. This is due to the lack of competitive manufacturers in the region. Distribution channels will be based on the development of its own distribution network, distribution development. Product advertising will be carried out through regional media, advertising companies.

References

1. Селянский А.И. За такими теплицами будущее // Картофель и овощи. 2018. №7. С. 21–23.

2. Gorbe E. & Calatayud A. Optimization of Nutrition in Soilless Systems: A Review // Advances in Botanical Research. 2010. Vol. 53. Pp. 193–245.

3. Мировой опыт использования аэро- и гидропонной технологии при возделывании овощных культур / Х.К. Фаравн, Т.А. Терешонкова, В.И. Леунов, А.И. Селянский, И.И. Дмитриевская // Картофель и овощи. 2019. №6. С. 10–13.

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ИЗУЧЕНИЕ ВЛИЯНИЯ ХОЛОДОВОЙ ОБРАБОТКИ НА ЭМБРИОИДЫ КАПУСТЫ КОЛЬРАБИ, ПОЛУЧЕННЫЕ В КУЛЬТУРЕ МИКРОСПОР

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