

- de 1,58 fois (de 34,8%), PA de pseudo-éosinophiles - 1,3 fois (14,8%).

Références

1. Ivanova, R. N. Morphologie, paramètres biochimiques du sang, productivité et sécurité des cailles lors de l'utilisation d'un additif probiotique pour nourrir "Bacell" / R. N. Ivanova, I. A. Alekseev // Revue russe "Problèmes d'assainissement, d'hygiène et d'écologie vétérinaires" / Zoohygiene. - M.: GNU VNIIVSGZ RAASKhN. - 2012. - № 7. - Pp. 92-94.
2. Khusid, S. B. Influence des probiotiques sur le corps des cailles / S. B. Khusid, V. V. Borisenko, V. I. Nikolaenko // Jeune scientifique. - 2015. - № 5.1. - Pp. 23-25.
3. Korchunova, L. G. Méthodes de modification génétique et de sélection des volailles agricoles / R.V. Karapetyan, V.I. Fisinin // Biologie agricole. - 2013. - № 6. - Pp. 3-15.
4. Kochaeva, O. V. Influence des probiotiques sur la sécurité, la croissance, le développement et la productivité des cailles / O. V. Koschaeva, G. V. Fisenko, S. S. Hatkhakumov // Jeune scientifique. - 2015. - № 8. - Pp. 394-397.
5. Petenko, A. I. Additifs alimentaires dans l'alimentation des cailles / A. I. Petenko, Yu. A. Lysenko // Volaille. - 2012. - № 9. - Pp. 36-38.
6. Tolpychev, E. V. Analyse microbiologique de la viande de caille après ajout d'extrait de sapropel / E. V. Tolpyshev, M. V. Zabolotnykh // Journal: Bulletin de l'Université agraire d'État d'Omsk. - 2016. - № 3 (23). - Pp. 56-60.

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MISTAKES IN BUILDING AND MANAGING VERTICAL FARMS IN RUSSIA

Sukhodolov Ilia Andreevich, Post-graduate student of the Department of Vegetable Growing of Federal State Budgetary Educational Institution of Higher Education "Russian Timiryazev State Agrarian University", gotem1996@mail.ru

Vasilchenko Tatyana Anatolyevna, Associate Professor of the Department of Foreign and Russian Languages of Federal State Budgetary Educational Institution of Higher Education "Russian Timiryazev State Agrarian University", t.vasilchenko@rgau-msha.ru

Abudujiaba Zunimaimaiti, Post-graduate student of the Department of Agriculture and Experimental Methods of Federal State Budgetary Educational Institution of Higher Education "Russian Timiryazev State Agrarian University", japparzunun@mail.ru

Abstract: Vertical farming is a global innovation trend in plant cultivation. Since this technology is fairly new, companies make a lot of mistakes from farm design to harvest. This article discusses a number of errors which have been identified in the existing vertical farms in Russia, and ways to correct them.

Key words: vertical farming, hydroponics, build vertical farms.

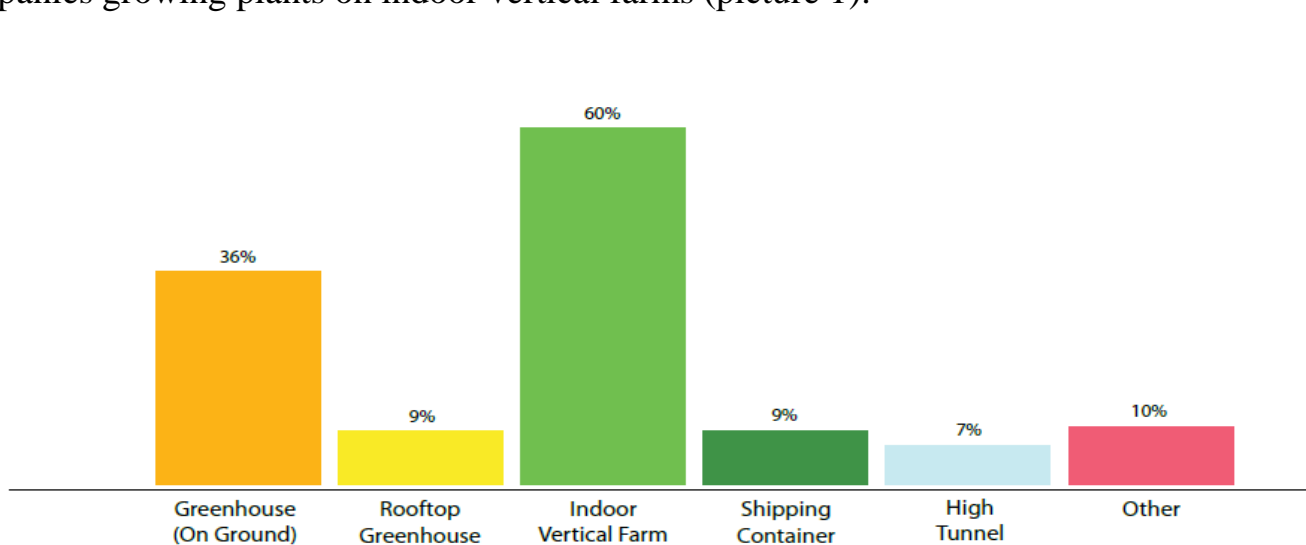
The population of our planet is growing, and the amount of available agricultural land is becoming scarce. More companies in the global agricultural sector have recently been involved in innovative crop production in closed spaces.

The Controlled Environment Agriculture (CEA) industry is still refining its own identity.

For the purposes of this article, we are using the following definitions:

- CEA is the growing of crops while controlling certain aspects of the environment including lighting, temperature, humidity, irrigation, fertigation and other factors that influence plant physiological responses.
- GREENHOUSE refers to a climate-regulated structure with walls and roof made out of a transparent material in which crops are grown.
- ROOFTOP GREENHOUSE refers to greenhouse located on top of another building.
- SHIPPING CONTAINER refers to a climate-regulated shipping container using only supplemental lighting (no sunlight) for crop production.
- HIGH TUNNEL refers to crops covered with a canopy for protection against the elements and sometimes referred to as hoop houses or tunnel houses (not small backyard hobby tunnels).
- INDOOR FARM refers to crop production that utilizes artificial lighting instead of sunlight. This can include rooms, warehouses, factories and other converted indoor spaces.
- VERTICAL FARMING is crop production that uses the vertical space. Plants can be stacked horizontally or in tall towers.

In the Russian Federation as well as all over the world all the options of cultivation facilities available are used, and in the last two years there has been significant [1] growth of companies growing plants on indoor vertical farms (picture 1).



Picture 1. Type of facility for cultivation (2020 Global CEA Census Report)

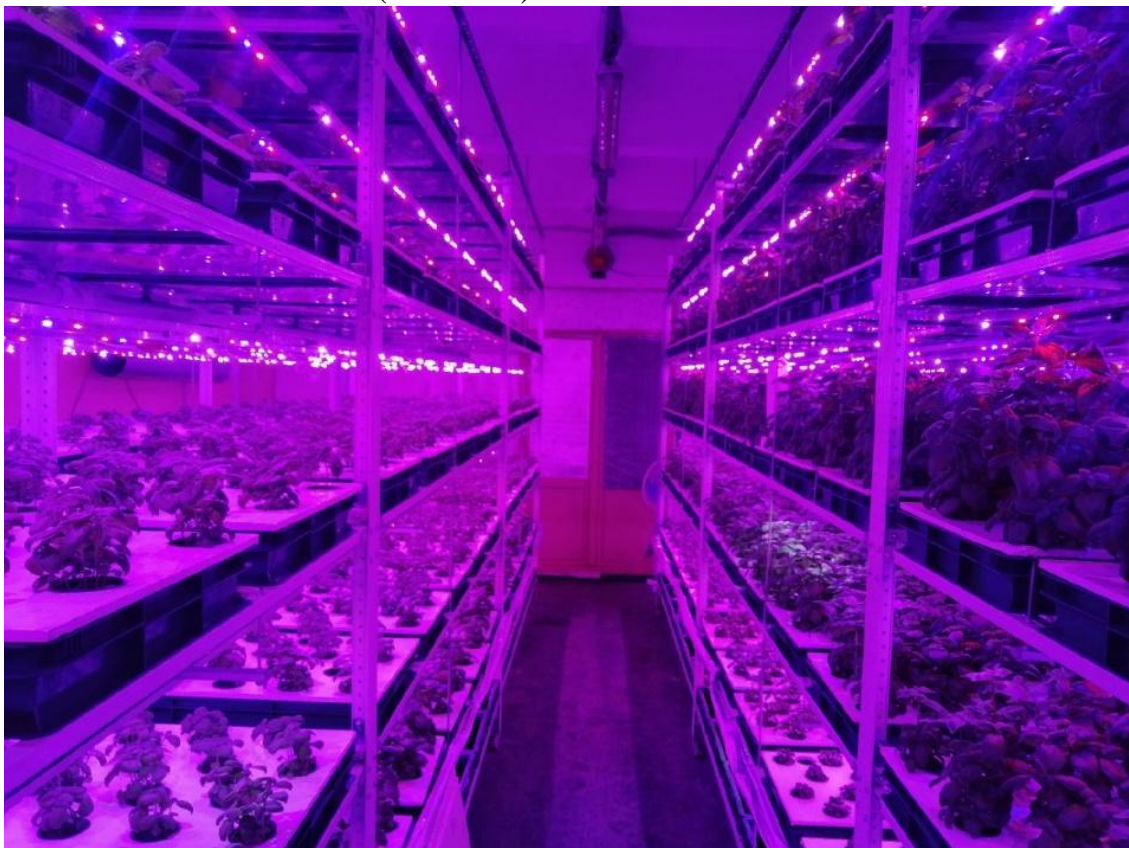
The applied part of this article was to visit and analyze operating vertical farms located in the Russian Federation. The objects of research were 11 vertical farms was carried out in such cities as Moscow, Bryansk, Voronezh, Petropavlovsk-Kamchatsky, Yekaterinburg, Rostov-on-Don. As a result, a number of mistakes were found in the design of the farms, the choice of microclimate equipment, the choice of artificial lighting sources, growing plants technology, plant protection and phytosanitary control, labor protection. Because of these errors, the farm wastes extra resources, the yield of plants decreases, and as a result, the vertical farm becomes unprofitable.

Unlike industrial greenhouses of the 4th or 5th generation, there is no standard (reference design) for vertical farms [2]. Almost every company uses its own patented technologies, which

complicates the mechanization process, and makes it practically impossible to robotize, since it would be extremely unprofitable to create a robot for each new farm. Thus, there is an extra waste of the budget for extra human labor.

The founders of the companies without agronomic education pay little attention to microclimatic processes on the farm. Each design engineer sees in his own way where to locate the farm and what kind of air circulation system there should be [3]. Therefore, on some farms there is air circulation from top to bottom, while on others only lateral air circulation is used. To select the necessary circulation system one needs to know the dimensions the pallets with plants, the height of the ceiling and the number of plants per square meter, since a large number of plants will inevitably create increased humidity in an enclosed space, which will affect the growth, development and resistance of plants to diseases.

By 2021 there has already been a number of scientific-based evidence published in authoritative journals that red-blue LEDs compared to full-spectrum white LEDs have less positive effect on plants and a very large negative effect on human health. It has been scientifically confirmed that prolonged work in such rooms (even using protective glasses) leads to defective eyesight, disorientation in space and endocrine diseases. However, many farms still use red-blue LED bulbs (Picture 2).

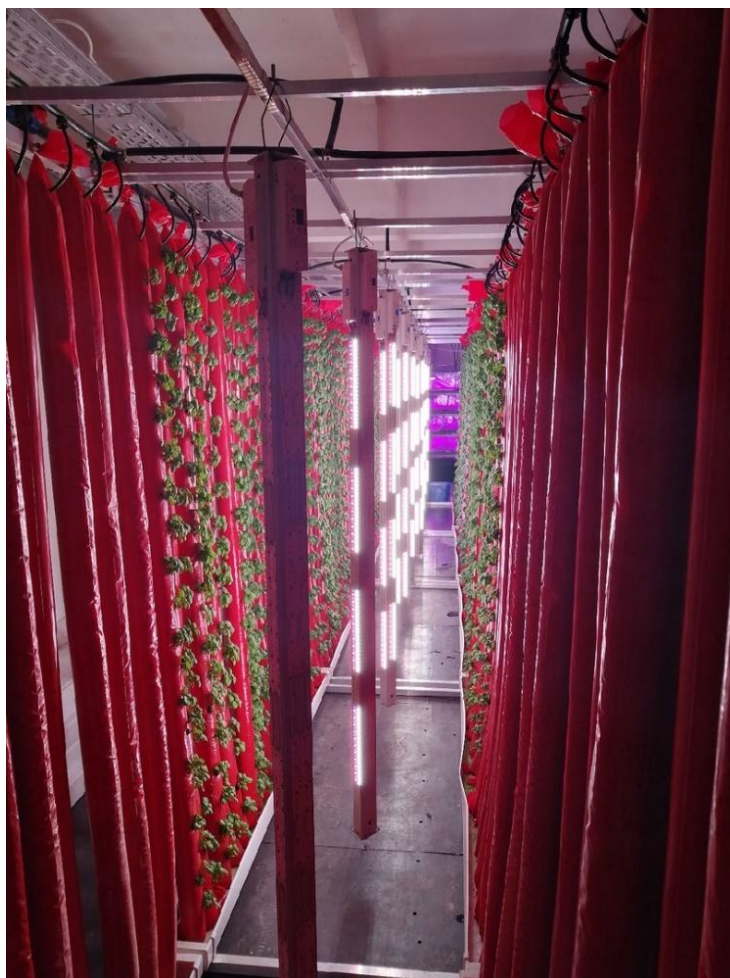


Picture 2. Red-blue LED on a vertical farm

There are also numerous mistakes considering the technology of growing green and vegetable plants. Lacking knowledge of plant physiology, plant growers on vertical farms, by their decisions, do not allow the normal growth of the plant root system, thereby preventing the plant from showing its yield potential. There is also a wrong choice of substrate and packaging where this substrate should be located (Picture 3). As a rule, it is advisable to use such substrates as rock wool or coconut substrates. Peat or vermiculite are not suitable substrates

since peat will put a heavy load on the filters when recirculating the solution, and vermiculite will inhibit root puffing and normal water absorption. The packaging for the substratum should be white on the outside so that the artificial light reflects as much as possible on the plants, and black on the inside to reduce the spread of diseases.

Phytosanitary control standards are not met on almost all vertical farms in Russia. When entering the "clean zone" on a vertical farm the worker must wear a dressing gown, special shoes, a hat, and gloves. Moreover, when entering the "Clean Zone" from the "Dirty Zone", one must thoroughly disinfect one's hands with an antibacterial agent and clean one's shoes on a special antibacterial mat.

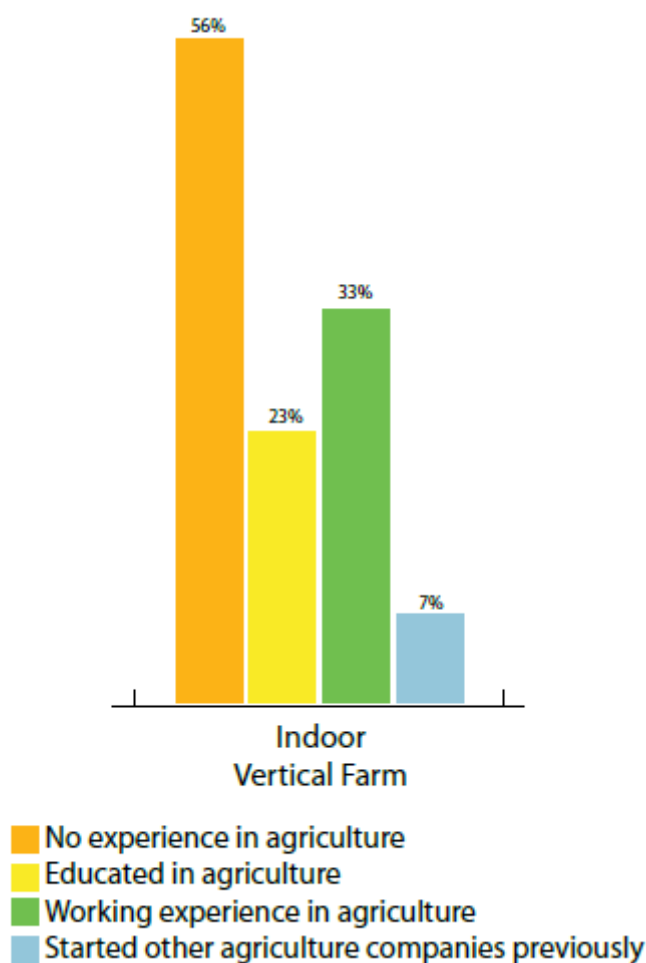


Picture 3. Incorrectly selected substrate and its packaging on a vertical farm

Failure to comply with phytosanitary control standards raises a big problem for a vertical farm - the appearance of pests and diseases, which should not be there a priori, thereby negating one of the main advantages of vertical farms - cleaner production.

Entomophages as a biological method of pest control are often misused as most plant producers on vertical farms do not have adequate information about predatory insects needed, and how to use them.

In conclusion, it becomes clear that most of the problems on vertical farms arise due to the lack of proper qualifications (Picture 4) in the field of growing green and vegetable crops which leads to large losses, the inability of the company to be profitable and even to its bankruptcy.



Picture 4. The founder's experience in agriculture before starting the company (2020 Global CEA Census Report)

References

- 1 2020 Global CEA Census Report. URL: <https://www.agritecture.com/census>
2. Ramiro Blanch. Business Plan for a vertical farming Startup: Market research, business model, economic model, and more Paperback - March 19, 2019.
3. Toyoki Kozai. Plant factory an indoor vertical farming system for efficient quality food production. - 2016.

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DEVELOPPEMENT DES ELEMENTS DE TECHNOLOGIE DE LA MICROPROPAGATION ET LE GREFFAGE IN VITRO DE LA VIGNE EN FONCTION DE L'ORIGINE DE SON ESPECE

Ter-Petrosiants Georg Eduardovich, le boursier de thèse de la première année, l'institut d'horticulture et d'architecture de paysage, l'Université agricole d'État de Russie - AATM, georgep.as117@yandex.ru

Guide de travail: Zaitsev Alexei Anatolyevich, docteur ès lettres, maître de conférences

Résumé: La recherche est consacrée à l'étude des modernes méthodes de multiplication des plants de raisin. Nous entreprenons notre recherche pour améliorer la technologie de