

VERTICAL GARDENING CONSTRUCTIONS

ALESYA KHRYSCHANOVICH, YANA IKSANAVA, RAISA PLATONOVA
Polotsk State University, Belarus

In this article the analysis of conceptual and realized domestic and foreign projects on vertical gardening are executed, the most effective designs of gardening of building facades for Republic of Belarus are offered.

Introduction. In conditions of high population density, lack of oxygen and lack of free space, vertical gardening has become one of the most relevant methods to solve the problem of comfortable well-being and human activity in an aggressive urban environment.

The research part. Our ancestors knew about vertical gardening in 600 BC, when hanging gardens of Babylon – one of the seven wonders of the world were erected in ancient Babylon. The founder who patented and introduced a new way of gardening was Peter Blank. He proposed to move the green cover from the horizontal plane to the vertical one – a technology known as "Vertical gardens" (Vertical Garden System), which will allow to green large areas of facades, and later "green walls" include directly in the interior of buildings. The most ambitious project of vertical landscaping by Peter Blanca today is the design of the Museum walls of modern art Quai Branly in Paris (Fig. 1). On the wall with a total area of 800 m² there are more than 170 species and 15,000 plants [4].



Figure 1. – Museum of modern art Quai Branly in Paris

Initially, for planting vertical gardens mountain plants in Thailand and Malaysia were selected. More than two thousand species of tropical plants are able to take root on rocky slopes in conditions of insufficient lighting, a small amount of minerals and lack of moisture. Peperomy, alocasia, asparagus, Pilia, Anthurium, spatifilum - these and many other plants are found in nature on rocky slopes and in the beds of waterfalls. All that is needed for the growth of such plants to have the ability to fix the roots, sunlight and plenty of water.

The main components of the green walls are: plants, substrate, supporting elements around which plants grow, and the system of tubes and pumps that deliver water and fertilizers. These plants are found in nature on the rocks and in places inconvenient for growth with a minimum of soil. At the bottom of the vertical garden shade- and water-loving plants are planted, and at the top – the able ones to withstand the bright sun and wind. The choice of plants depends on the climate and the location of the wall relative to the cardinal points.

The main systems of vertical gardening are: frame system, "Living wall" system, and tiered terraces [3].

Frame system, an adjacent to the surface of the facade – a frame of steel, wood, or plastic nets, which are attached to the enclosing structure, and they grow climbing plants. Frames can be flat, consisting of cables of ropes and nets, and three-dimensional, formed of rigid frame and cellular structures. This type of support structures is differentiated by the types of the following systems:

- the system of wire mesh is intertwined mesh of aluminum or light steel cables attached to the facade with brackets. Plants usually grow from special modules located along the entire height of the wall;
- the system of cables and ropes consists of flexible vertically stretched elements;
- Rigid system is a trellis design. It can be both flat and three-dimensional.

Due to its spatial rigidity, it can be held not only by mounting on walls or columns, but also without any vertical support elements.

The "Living wall" system is a system where plants do not curl around a supporting grid attached to the wall – they are integrated into its structure together with the substrate (earth or perlite). The main difference between the living wall is that its device uses herbaceous plants. To protect the enclosing structures from moisture, they are covered with a moisture-proof membrane. The irrigation system can be equipped with rain sensors. There are two types of living walls:

- Suspension system with felt pockets. The roots of the plants are located in these pockets, filled with nutritious composition.
- Modular system of non-plastic rectangular, mostly plastic, containers, filled with nutritious composition. Such a system is either attached to a vertical wall, or stands freely, relying only on the surface of the earth. The system of containers is made of light metal or plastic. It can be boxes or wire cages. In some cases, the containers are divided into smaller cells at an angle to the back of the container. Plants are grown directly in these modules, filled with soil, inorganic nutrient composition or natural fiber. An example of using such a system is one PNC Plaza in Pittsburgh (Fig. 2).



Figure 2. – Modular system of containers. One PNC Plaza in Pittsburgh

Tiered terraces usually consist of concrete stepped ceilings, in which plants are planted. The life cycle of such plants can be both seasonal – plants are installed in mobile containers and tubs, and they are perennial. This type of landscaping system allows you to diversify the types of vegetation, not limited to vertical climbing plant species. Among the most famous buildings of this type are the ACROS building in Fukuoka city in Japan; Solaris and Parkroyal in Singapore. The use of this type of landscaping on the Keppel Bay building in Singapore showed that the longline terrace gardening can be used at high altitudes.

Conclusion. Thus, with the help of landscaping systems, you can decorate the facades of buildings, mask unsightly buildings and create a favorable microclimate in the building. Given the climate of Belarus is established that currently, for this purpose you can use the following green spaces: hops, edible and decorative

grapes, honeysuckle, vine, lianas, hydrangea creeping ivy, black beans, climbing rose, curly header, Actinidia, perfoliate, kirkazon, Highlander, English and clematis [1], [2].

REFERENCES

1. Climbing plants (plants for vertical gardening) [Electronic resource] / Svetlana Lutsenko // Minsk. Mode of access: http://ozelenenie.by/16_liany.htm. – Date of access: 08.01.2019.
2. Zhdanov, V. 7 ideas of vertical gardening in the country in 2019 [Electronic resource] / V. Zhdanov. – Mode of access: <http://superda4nik.ru/vertikalnoe-ozelenenie-sten/>. – Date of access: 08.01.2019.
3. Гераймович, А. Озеленение как инструмент экологических решений [Электронный ресурс] / А. Гераймович, Н. Шилкин. – Режим доступа : http://zvt.abok.ru/articles/351/Ozelenenie_kak_instrument_ekologicheskikh_reshenii. – Дата доступа : 06.01.2019.
4. Khosrovyan, A. History of vertical gardening [Electronic resource] / A. Khosrovyan. – Mode of access: <http://www.bloomgrace.ru/single-post/2017/04/24/История-вертикального-озеленения>. – Date of access: 08.01.2019.