Problems of ornamental nurseries in Russia on the example of the north-west region

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Abstract: A great demand for ornamental plants is determined by the development of urban and suburban building construction. This requires organization of modern plant nurseries that would supply the market with a sufficient range of plants grown technologically correctly and using their own seeds and vegetative material. The article provides an analysis of the main approaches to the development of a projected range of plants grown by ornamental nurseries in the region, which will help to take first steps in the development of specialized ornamental nurseries and ensure the sustainable development of the industry.

1. Introduction

St. Petersburg is one of the world's northernmost megalopolises, which determines special requirements for the system of sustainable green spaces organization. Therefore, organization and development of plant nursery facilities must meet the growing demand for a variety of woody and shrub plants adapted to the conditions of the region. A strong prevalence of demand over supply creates a number of market flaws, which include low competition in the domestic market, extremely high prices, and frequent attempts by suppliers to sell low-quality products.

Despite a frequent appeal to this issue of the professional community, problems of the ornamental planting material production for use in Russia's cities, including St. Petersburg, still remain relevant and far from being solved. A number of reasons determine the current state of affairs in the industry. Among them, it is important to note the following:

- There are no full-cycle nurseries in North-West Russia that would ensure the supply of large quantities of woody and shrub plants in a wide range and with guaranteed quality.
- Ornamental nurseries organized in recent years and often quite successfully declared themselves on the market are focused on the production of a standard assortment of planting material, which essentially does not meet the needs of urban landscaping. Most often, they master cultivation of only those groups of plants in the production of which one can do without the use of technologically complex activities that require skills, knowledge and resource investment.

2. Methods and Materials

Domestic nurseries, the successors of the state owned ones, are in a state of decline, and the newly created ones are developing extremely slowly. The lack of the necessary equipment, backwardness of growing technologies, inaccessibility of investment resources, tough competition with imported
products, difficult environmental and climatic conditions and, unfortunately, lack of competent specialists to service high-tech production facilities are making themselves felt.

The assortment of domestic planting material on the St. Petersburg market is limited; as a rule, these are young plants grown in soil, multi-stemmed young trees, and trees that independently form a crown, often low-stemmed. Therefore, imported plants are mainly used for landscaping.

The market situation can only be judged by some indicators:

- the demand for seedlings is growing from year to year: according to experts, the seasonal capacity of the planting material market is about $ 5-7 million, and its growth rate exceeds 25% annually;
- about 70–80% of the planting material on the St. Petersburg market is currently imported;
- according to the estimates of intermediaries, about 1/6 of all imported planting material for open ground are trees for alley and row plantings of the fourth and fifth size groups.

Most of the companies operating on the market and importing trees and shrubs from abroad double their sales of ornamental trees and shrubs every year. However, planting material sold by them does not always match the environmental conditions of North-West Russia and is not resistant to the conditions of the urban environment [1]. The analysis of the ornamental plants assortment (table 1), produced by numerous nurseries over the past several years, allows us to draw some conclusions.

| Nursery          | Foliage | Conifers | Decorative shrubs | Fruit trees and shrubs | Climbers | Growing transplanted material/ Full cycle of growing plants in nurseries |
|------------------|---------|----------|-------------------|------------------------|----------|---------------------------------------------------------------|
| Kurortny District| 0–15    | 8–22     | 22–45             | 14–75                  | 3–4      | 64/36                                                         |
| Vsevolozhsky District | 27     | 23       | 22                | 23                     | 10       | 56/44                                                         |
| Priozersky District | 27     | 9–35     | 26–59             | 4                      | 8–9      | 74/26                                                         |
| Vyborsky District | 16–27  | 22–30    | 30–35             | 18                     | 1–3      | 58/42                                                         |
| Tikhvinsky District | 15–23  | 15–20    | 36–46             | 14–23                  | 3–5      | 83/17                                                         |
| Luzhsky District | 2–5    | 2–8      | 10–58             | 22–78                  | 6–7      | 70/30                                                         |
| Volkhovsky District | 25     | 19–20    | 15–28             | 2–7                    | 1–2      | 61/39                                                         |
| Gatchinsky District | 16–18  | 20–25    | 29–47             | 11–19                  | 2–11     | 54/46                                                         |
| Regional averages | 23     | 15.5     | 39                | 26                     | 5.3      | 65/35                                                         |

As you can see, most of the plants produced by nurseries are ornamental shrubs, and significant part of the plants produced are fruit trees and shrubs. Production of deciduous trees, the most demanded for the organization of new and repair of existing urban green objects, does not exceed 27%. Most of the plants are grown using imported low-value planting material. Nurseries are engaged in reproduction using technologically low-cost methods and, in the overwhelming majority, in the production of fruit plants and ornamental shrubs.

At the same time, it should be noted that in recent years the market situation is gradually changing. The changes are connected with the formation, following the initiative of private plant nursery owners,
"Association of Planting Material Producers" (APPM) in 2008, which unites more than 130 Russian nurseries.

Basic principles and directions of activity of APPM:

- exchange of experience (seminars, conferences, training courses);
- information and analytical activities (production of catalogs, search engines);
- introduction of quality standards for planting material, bringing nursery products to uniform standards;
- legal support and protection of the interests of members of the APPM.

Nine nursery farms of the Leningrad region are members of the association [2]. In the majority of nurseries, judging by advertisements on their websites, seedlings of ornamental trees and shrubs, which are in the greatest demand on the planting material market, are grown. The range of cultivated plants is constantly being expanded. All trees and shrubs are adapted for northern weather conditions and have a good survival rate.

All these gratifying changes allow us to hope for the further development of nurseries in the country and region; however, without a consistent governmental investment policy, it is impossible to achieve long-term positive changes in the industry.

Currently, a significant amount of planting material for the needs of urban landscaping is brought from abroad. A sharp change in growing conditions significantly affects the survival rate and development of ornamental trees and shrubs. However, there is no exact information on the number of dead plants, since the imported planting material is sold through numerous retail outlets. A significant part of the planting material is purchased individually and planted in the private sector, and it is not possible to follow up and summarize the results and build a clear picture of the plants survival rate.

The purchased ornamental plants cost the city several times more than the price of the planting material itself. According to experts, on the trading floors of St. Petersburg the average cost of deciduous trees from Europe ranges from $ 200 to $ 1 000. For conifers, the price range is wider, from $ 400 to $ 7 thousand per plant. Domestic 0.2-1.4 m high shrub saplings can cost only $ 8-10, but up to 1 m high imported ones, in containers, cost $ 60, and up to 3 m high, $ 110-670. Prices vary depending on the manufacturer, demand and sales season [3].

In addition, plants imported from European nurseries are not sufficiently adapted to the climatic conditions of the taiga zone and very quickly show signs of decline. The use of European planting material often leads to a low survival rate, due primarily to the low winter hardiness of imported planting material.

Thus, the market situation will only be changed by an active development of domestic production of ornamental trees and shrubs. That is why it is so important to restore the structure of the nurseries and resume cultivation and use of local planting material of decorative trees and shrubs resistant to the climatic conditions of North-West Russia and difficult environmental conditions of modern cities.

Maintenance of existing green structures of St. Petersburg and organization of new ones has a number of specific features, primarily due to the climatic conditions of the region, as well as the influence of the urban environment. Urban vegetation, although artificially created, is the main natural component of the urban environment, compensating for the negative impact of aggressive technogenic factors. The level of comfort of the urban environment is largely determined by the presence of green spaces, which create favorable microclimate and define the aesthetic impact of the environment.

The data of the 2017 environmental assessment of the state of 1000 objects of the ZNOP revealed 114 species of trees [4]. According to the results of original scientific surveys of the urban area (including both public places, in particular, plantings of common use, and adjacent areas) obtained in the fall of 2018, the list of ornamental woody plants comprised 467 species (39% of the total) [5]. At the same time, the studies indicate the relative uniformity of the assortment of urban plantings.

The analysis of the species and varietal composition of deciduous trees in the common use areas of St. Petersburg shows that representatives of the family Malvaceae dominate: Tilia cordata Mill., (27%) and Tilia platyphyllos Scop. (2%), the family Sapindaceae is also widely represented: Acer platanoides L. (19%), Acer negundo L. (3%), Acer ginnala Maxim., Acer rubrum L., Acer
The family Oleaceae is represented by Fraxinus excelsior L. (6%). Representatives of the family Ulmaceae are Ulmus glabra Huds. (8%) and Ulmus laevis Pall. (2%).

The families Betulaceae: Betula pendula Roth (9%) and Betula pubescens Ehrh. (2%), and Salicaceae: Populus balsamifera L., Populus alba L., Populus laurifolia × P. pyramidalis, P. alba × P. Bolleana Lauche (6–16 %), Salix alba L. (5%), Salix × fragilis L. (4%), Salix schwerinii E.L.Wolf, Salix caprea L. (1%) are also present.

Of 124 shrub species, the most common are: Syringa vulgaris L. and Syringa josikaea J.Jacq. ex Rchb.f., Cotoneaster lucidus Schlecht., Rosa rugosa Thunb. and Philadelphus coronaries L.

This state of affairs is due to several reasons, but, among other things, mostly due gradual aging of existing green structures and a significant shortage of the range of ornamental plants that are in demand in the city's green areas.

The traditions of decorative nursery farms in Russia have a long history. The first Russian nursery for ornamental trees and shrubs was founded in St. Petersburg in 1717, according to the project of A.A. Leblon. Alongside with the development of the city, gardens and parks were created, which required planting material; the latter was brought from abroad. However, already under Peter I, ornamental trees and shrubs began to be grown directly in St. Petersburg.

During the Soviet period, there was a whole network of nurseries in Leningrad, which supplied the city with local planting material in the required amount. In the 1970s, that is, more than 40 years ago, in the vicinity of Leningrad (St. Petersburg), there were 15 nurseries in which ornamental trees and shrubs were grown [1]. Over the years, Vyborgsky, Volkhovsky, Lomonosovsky and other nurseries ceased to exist.

Table 2 provides information on the nurseries of the Department of Gardening and Green Building on the territory of the Leningrad Region as of 1985 [6].

| Title                      | Nursery area, ha | Trees, thousand pieces | Shrubs, thousand pieces |
|----------------------------|------------------|------------------------|-------------------------|
| Vsevolozhsky               | 39               | 5.0                    | 100.0                   |
| Glukhovsky                 | 162.6            | 27.0                   | 400.0                   |
| Christmas tree plantation  | 132.0            | 114.0                  | -                       |
| Christmas tree plantation  | 210.0            | 120.0                  | -                       |
| Kurortniy                  | 78.0             | 14.0                   | 205.0                   |
| Moscow                     | 44.0             | 5.0                    | 80.0                    |
| Pulkovsky                  | 193.0            | 20.4                   | 350.0                   |
| Sestoretsky                | 101.3            | 10.0                   | 195.0                   |
| Strelninsky                | 93.0             | 13.0                   | 410.0                   |
| Lawn grasses seed production, t | 460.0      | 80.0                   | -                       |
| Total                      | 1512.9           | 328.4                  | 1740.0                  |

During the period of "perestroika", the emergence of market relations, change in the economic situation in the country and land ownership rights, and growth of areas allocated for private construction led to the fact that the land closest to the city, both occupied by nurseries and used in agricultural production, turned out to be unavailable. Financing of state nurseries ceased, and most nurseries of St. Petersburg and the Leningrad region ceased to exist.

Currently, Zelenogorsky and Glukhovsky nurseries of the Kurortny Forest Park, where decorative species of trees and shrubs are grown, are subordinate to the Committee for Improvement. However, St. Petersburg and the Leningrad Region currently do not have large nurseries, despite the fact that local planting material has a number of advantages:

- higher resistance to climatic conditions;
higher resistance to anthropogenic factors;
lower cost compared with that of imported plants.

Restoration of ornamental nurseries is a long and complicated process, since the modern market requires large-sized planting material of standard categories; this is associated with long periods of plant cultivation (3–7 years for shrubs, and 7–25 years for woody plants) [7]. In addition, the modern planting material market demands a wide range of plants that meet the requirements of urban landscaping.

3. Results and Discussion
Implementation of the urban program for the development of green spaces requires a significant expansion of the range of planting material and improvement of its quality [8].

The assortment of ornamental trees and shrubs for urban landscaping should be structured:
• by assortment groups, target designation and resistance to man-made factors, which makes it possible to create green objects of various functional purposes, including those for difficult ecological conditions of a megalopolis;
• by the ratio of woody and shrubby plants, which ensures creation of plantations in accordance with the approved standards;
• by groups of decorativeness – the use of decorative deciduous, flowering, fruit, architectural forms of deciduous, as well as various cultivars of coniferous plants, which provides a stable seasonal decorativeness of green areas.

The inclusion of modern promising species, forms and varieties of plants in the range of regional nurseries can provide unlimited possibilities for their use, depending on specific design tasks:
• traditional natural landscapes;
• compositions that are associated with the landscape, culture and traditions of other countries and peoples;
• multicolor compositions for the seasons of the year;
• mono gardens of the same species using different varieties and architectural forms;
• production of planting material for use in container gardening becomes relevant [9].

To restore and confidently develop ornamental nursery in the region, long-term investment is necessary, which is possible only with the support of both the governments of St. Petersburg and the Leningrad region. That is, restoration of nurseries under the Department of Gardens and Parks of St Petersburg and private investors including farms and landscaping firms of the Leningrad Region.

Restoration of ornamental tree and shrub nurseries in the Leningrad Region will allow:
1. To obtain local planting material for St. Petersburg and cities of the Leningrad region which will be more adapted to the climatic conditions of North-West Russia; this will increase the survival rate of planting material, which, ultimately, will reduce the city budget allocations for landscaping.
2. To solve the problem of partial employment of the urban and rural population of the Leningrad region.

A precondition for organizing a nursery should be a thorough and comprehensive socio-economic analysis in order to select the locations of nurseries. When choosing a site for a nursery, the following factors should be taken into account:
1. The presence of employable and at the same time currently unemployed population in a particular area.
2. Organization of a nursery should not cause an outflow of the population from agricultural production, that is, it is preferable to organize a nursery in a forest rather than in an agricultural area.
3. The ability to choose an optimal site, taking into account topography, soil quality, availability of water sources (stream, river, pond), which provides the possibility of watering plants during their cultivation.
4. Economic analysis of the organization of the nursery, along with other factors, taking into account the distance of transportation of planting material.
It should be noted that cultivation of large-sized planting material will require at first annual investments in sowing, watering, transplanting garden trees without making a profit from sales. The shortage of funds can be partially reduced by producing fast-growing ornamental shrubs, which can be sold 3-4 years after sowing, as well as by growing annual and perennial flower plants.

The preliminary economic calculations for the organization of local nurseries for the cultivation of ornamental trees and shrubs indicate the feasibility of their organization. This fact is also evidenced by the presence of a sufficient amount of land that was taken out of cultivation and which is currently overgrown with *Heracleum sosnowskyi* Manden., herbaceous, shrub and woody vegetation.

4. Conclusion

Green spaces are important and effective means of environmental protection, capable of protecting and improving the quality of the urban environment; vegetation shapes architectural and artistic appearance of the metropolis, provides it with individuality and originality [10].

Development of a system of durable, functionally and aesthetically justified green objects is impossible without creating a sustainable source of planting material. Taking into account the predominance of imported from abroad planting material on the market, primarily in the category of large-sized deciduous and coniferous trees, as well as the expansion of the supply of new varieties and hybrids, the role of ornamental nurseries becomes important as a basis for introducing new species and varieties of ornamental plants into the assortment.

Economic efficiency of landscape architecture objects, both newly organized and subject to restoration and reconstruction, fully depends on the origin and quality of planting material. Only zoned planting material can best adapt to difficult conditions of the urban environment. Organization and development of a system of modern nursery farms as a source of high-quality, locally adapted planting material is of great importance for the entire north-west region.

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