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**REFORESTATION IN REPUBLIC  
OF BELARUS SUBJECT TO FOREIGN EXPERIENCE**

Reforestation can be done by various methods: artificial, natural and combined. In the various countries the share of participation of each method is various. The analysis of carrying out of reforestation of some developed and neighboring countries has shown that in many of them the basic method is artificial. In Sweden the method of forest cultures is used on 75%, in Finland – 84%, in Czech Republic – 78%, in Poland – 85%, in Ukraine – 79%. In Germany a share of natural restoration of woods is more than 50%, in Lithuania – 25%, however 31% from total amount is mixed forest cultures. In Russia the method of natural renewal is used on 78% of sites, but growth of volumes of use of a containerized planting material and mixed forest cultures is observed.

In Belarus on a share of creation of forest cultures is 55%, natural growing over – 32%, assistance to natural renewal – 13%, including by creation of mixed forest cultures is about 2% from total amount of renewal of woods. Application of natural renewal does not allow to raise capability of forest and quality of forest considerably. For achievement of this purpose with simultaneous preservation of a genetic variety of forest it is necessary to introduce more widely mixed forest cultures with usage of a selection planting material.

Important question is creation of forest seed plantations of the second order. However here it is necessary to direct efforts to increase in quantity of elite trees and quality check of creation and carrying out of actions of already existing plantations.

Introduction of new methods of treatment of soil, working out of a design of the planting machine, perfection of technology of carrying of forest cultures is important too.

**Key words:** reforestation, forest cultures, natural renewal, mixed forest cultures, forest seed plantations, mechanized planting, carrying of forest.

**Introduction.** Reforestation is one of the most important activities of forestry arrangements. The future composition of plantations and its productivity depends largely on the success of this arrangement.

The main objective of reforestation is the shortest time reproduction of forests by the most effective methods, improving of productivity, quality and sustainability of forests, biodiversity conservation, improving the environment.

**Main part.** Traditionally reforestation can be carried out by the following methods: natural regeneration without the assistance measures, combined regeneration when taking steps to promote natural regeneration, including the created partial forest plantations and artificial reforestation [1].

Its share in the total volume of reforestation and the significance of each method is not the same in different countries.

The method of sowing and planting in Sweden is 82% of new forests, the share of natural regeneration of 18%, which has been twice decreased in the last decade [2]. Volumes of planting and sowing in the last decade has been steadily increased, while the volumes of final felling remain approximately at the same level. It means that there is a replacement of natural regeneration on sowing and planting.

A similar model is observed in Finland. The issue of reforestation in the country is referred to as

one of the key ones, ensuring the increased productivity and quality of Finnish forests.

In this regard, they also give the priority to artificial reforestation [3]. About 84% of the forests are regenerated by sowing and planting. Sowing and natural regeneration are mainly used for Scots pine, many parts of which are located in the poor, stony ground or in protected areas. Spruce and birch are recovered almost fully by planting. Volumes planting and natural regeneration is gradually reduced. So, over the past 20 years the number of natural recovery of forests decreased by three times.

In Lithuania, in state forests the share of natural regeneration is about 25% [4]. The planting and sowing are used on the remaining area. However, 40% of forests are created by partial forest cultures, which are connected by planting or seeding with natural regeneration.

In Poland forest plantations occupy more than 85% of the new forests [5]. However, in the last few years there is some increase in natural forest recovery areas.

In the Czech Republic forest plantations was established on 76% of the land [6].

In Ukraine artificial recovery also prevails, which accounts for about 80%.

In Russia, artificial renewal accounts for only 22%. This is not surprising, because the volume of reforestation reaches almost 850,000 hectares.

The share of partial forest plantations is about 4%. However, the state program of forestry development for 2013–2020 years of the Russian Federation supposes gradual increase in the proportion of artificially restored plantations to increase the percentage of use of the selection of planting material, as well as the broader application of the combined method using partial recovery of forest plantations.

In Belarus, parity afforestation and natural regeneration are both used. According to the Ministry of Forestry of the Republic of Belarus in 2014 the establishment of forest plantations was carried out on an area of 24,073 hectares, the helping natural regeneration processes on the area of 5,431 hectares. This number includes an area of 803 hectares of partial forest plantations. 14,000 hectares were left under natural regeneration.

One of the key moments in the selection method of regeneration is the ability to provide the industry with high-quality raw materials. The experience of Finland should be taken into account. It has a highly developed wood processing industry, which provides around 20% of the total exports of the country's products.

One of the main reasons that have led to a significant reduction of the role of natural recovery in Finland, were the results of the inventory of qualitative parameters of forests. It was established that as a result of intensive logging has deteriorated forest quality in wartime and post-war period and, accordingly, natural regeneration is not be able to increase their productivity and quality characteristics. Therefore, emphasis was placed on the planting material breeding, and it led to increasing the forest productivity by 10–15%, and it is expected to increase with the further implementation of this direction by another 20–25%.

The territory of Belarus was affected by the two world wars with their predatory looting of resources and the large post-war construction. Therefore, the way the prevalence of artificial regeneration of forests observed today in our country is the right and proper implementation. The task is not only to restore the forest, but also to increase its productivity. It requires a greater degree of partial implement forest plantations with selection of plants for planting, even in places with successful natural regeneration.

Breeding plants for planting create about 40% of forest crops in our country. They are grown from seeds harvested almost 1,200 hectares of plantations of the first generation and almost 650 hectares of the second generation. Unfortunately, many plantations were not conducted with appropriate care, resulting in lower productivity of these plantations, the difficulty in harvesting the cones and, as a consequence, failure to perform such work. In addition, the inventory revealed

some violations in the technology expressed in the presence of non-grafted plants or grafting with no plus trees. The mentioned consequences make a few questionable our successes in the field of practical implementation of forest selection problems.

Many years ago 3,000 hectares of forest seed plantations of the first generation were planted in Finland for the implementation of the program to improve the productivity of forests laid, providing them with timely, complete care. Currently, there is an active creation of plantations of the second generation. By 2025, the plan is to establish 648 hectares of pine, and by 2021 – 256 hectares of spruce plantations. Thus, the program will create the second-generation plantations, which according to Finnish researchers will increase forest productivity by 20–25%, stretched to 30–35 years in time.

Such plantations, both in Finland and in our country, are based on progeny testing with selected elite trees. Belarus has allocated a little more than 100 of elite pine trees and less than 10 of fir trees. This is clearly not enough to maintain genetic diversity in plantations. According to the plantation rules it must be administered at least 50 clones. Therefore, special attention of scientists at this stage should be paid to identify new elite trees.

Forestry seed production should be developed in two directions: plantation and population with approximately equal shares in the reforestation process. If the seed plantation in our country develops, the population one has not paid much attention. The basis of the seeds population are the best natural stands – a plus stands, reserves, permanent forest seed plots, commercial seed stands. Undoubtedly, the best object is the plus stands representing the local population, the most adapted to local growing conditions and having the highest performance. However, because of the need to collect seeds in lifting the crown from such plants is very complex. The best option is to create a population-clonal seed orchards, which are able to combine the best natural genetic diversity of crops with ease of preparation and early seed production of conventional seed orchards.

The experience of seed orchards creation in greenhouses also seems promising. In Finland almost all birch seeds are harvested on such plantations. The same technology is used in the UK and Lithuania.

Contemporary, an important area of forest plantation production is the introduction of planting material with closed root system. In the United States about 30% of such seed material are produced, 87% are produced in Sweden, but Finland almost completely abandoned the idea of planting material with an open root system. Planting material with closed root system is actively implemented by Russia. It released 37 million seedlings in

2013 and thereby increased their production by 5 times in two years.

Despite the fact that the production of planting material with closed root system in Belarus is engaged in a long time, there is a number of problems. It is necessary to define the scope of such planting material, which will justify its growing volumes, to optimize the substrate, growing technology. An important issue is to determine the dimensional characteristics of planting material. Using year-old seedlings of Norway spruce, as is customary in Finland, could be a step backward for us, because direction to large-sized plant material is taken when creating fir plantations. The seedlings with closed root system biennial age by its parameters may be well competed with other seedlings.

One of the most difficult issues in our reforestation is the problem of treatments for forest plantations. The country has accumulated successful experience of creating forest plantations with an open and a closed root systems, but lack of timeliness or lack of care often nullifies all previous efforts.

Technical care means, e.g. in Finland, are no different from those that are used here, but the timeliness of the pro-reference of drifts allows them to plant about 2 thousand seedlings per hectare, and to keep these two thousand plants planted

before the first commercial logging. Consequently, it is very important to improve the technology and technical care means, e.g. machinery and devices.

There should also be a revision of tillage methods for forest plantations and the introduction of our forestry discrete processing, which are moving abroad, including Russia. This method is considered to be one of the best methods of cultivation, as it allows not only to remove the layer of unwanted vegetation, but also double layer of fruit and native land planted plant.

Another important direction of development of mechanization of afforestation is the use of tree-planting machines. Despite the fact that the volume of mechanized landing in foreign countries is not great (in Finland do not exceed 5%), the development of new machines and mechanized planting technologies is actively underway.

Since the refusing of the use of planting material with open root system in our country is not appropriate, the best for us is to develop machines that can work on felling and planting of both types of planting material.

**Conclusion.** The main objective of reforestation is to increase the productivity of forest breeding methods, while maintaining genetic diversity and sustainability of plantations, as well as the further development of technologies and means of reforestation.

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