

SHORT RECOMMENDATIONS FOR PLANTING, MAINTENANCE AND GROWING OF PLANTATION FORESTS BEFORE FIRST SELECTIVE CUTTINGS

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Girionys

Site selection

Forest plantations are mostly grown on agricultural land. Spruce stands grow fastest and reach the highest productivity in Nc, Nd, Nf and Lc habitat plots. The size of the plot located outside of the wood should be at least 2-3 ha. European larch plantations can be planted in Nc, Nd and Nf, habitat plots. Larch plantations should not be grown on steep (10° and steeper) northern slopes and deep enclosed ravines. Hybrid (*Larix decidua* x *Larix leptolepis*) larch is better to plant in the coastal lowlands and on the western slopes of the Samogitian Highlands. Birch plantations should be planted in Nc, Nd, Nf and Ld habitat plots. The most productive black alder stands grow in Lf, Ld, and Uf habitat plots.

Species composition of plantations

Plantations are best planted as pure stands; however, black alder is planted in lowlands where the soil for spruce, larch or birch is too moist. This increases biodiversity and the resilience of plantations to adverse environmental factors.

Planting of forest plantations on the outskirts of the forest, conservation and enhancement of biological diversity

Ornithochorous (hawthorns, Siberian crab and Zibold apple trees, rowans, and alder buckthorns), those providing food and shelter for small fauna (brooms, willows, thorns) and melliferous (goat willows, hazels, sea buckthorns, honey suckles, barberries, and privets) shrubs could be planted at the edges of plantations bordering another owner's land. Shorter shrubs are planted at the edge of the shrub strip, and further away from this edge – taller shrubs. In order to preserve biodiversity, several small (up to 1 are) groups of shrubs should be planted on 1 hectare.

Initial density of plantations and location of planting sites

Initial density of spruce and larch plantations – 2000–2500 trees ha⁻¹, that of birch and black alder – 3000 trees ha⁻¹. Planting sites are best arranged in a rectangle. The width between the rows should be about 4.0 m.

Planting time

The growing season can be divided into four periods according to the suitability for tree planting:

Early spring. It continues until the onset of bud burst. Suitable for planting trees with closed and open root systems. Larch is best transplanted only during this period. The optimal planting time in spring is when the soil temperature reaches 5 – 7° C at a depth of about 10 cm. Usually soil reaches a temperature of 5 – 7° C two weeks before the buds start to burst.

Late spring. It lasts until the end of May or the beginning of June. Not suitable for planting trees with an open root system and moderately suitable for seedlings with a closed root system.

Summer. It lasts until the beginning or mid-August. Suitable for planting trees with a closed root system and unsuitable for those with open roots.

Plantations with seedlings with a closed root system can be planted in summer immediately after soil preparation, but it would be better to wait for abundant rain before planting. Planting in summer should be completed in July or mid-August.

Autumn. Suitable for planting deciduous trees and shrubs when the leaves fall or have fallen. Conifers planted in late autumn establish and grow a little worse than those planted in spring. They should not be planted in heavy or peaty soils as they can become damaged by frost heave.

Soil preparation

Eluviated, brown, gleyic, etc. soils (Nc, Nd, Nf, Lc, Ld, and Lf habitats) where there is no “plough sole”, are prepared by ploughing continuously to a depth of 25–27 cm or by ploughing slices. In heavy soils (loams, clays), 10–15 cm thick, and in light soils (sand, sandy loams) – 10–15 cm or 25–30 cm thick slices are ploughed. The minimum width of the slice is 50 cm. In soils with temporary excess moisture, drainage furrows are ploughed in the direction of slopes after continuous ploughing. It is advisable to destroy herbaceous plants and shrubs with herbicides before preparing the soil.

Soils with a formed plough sole are ploughed continuously to such a depth that the compacted subsoil layer is turned to the surface (a depth of at least 40 cm should be reached while ploughing). On slopes, if the gradient allows, the soil is also ploughed completely. In unprepared soil, plantations are planted only with containerized seedlings.

Seedlings

Plantations are planted only with seedlings grown from seeds collected in seed collection stands, with the highest selection value and locally adapted. Spruce is planted with four-year (E2+2) seedlings, black alder with biennial (J1+1) seedlings, larch with biennial seedlings (M1+1) or saplings (M2+0), and birch – with containerized seedlings. Only with containerized seedlings, plantations are also planted on steep slopes, where due to their steepness soil cannot be prepared by technical means.

Wind resistance

At the very edge, trees are planted less densely, and as you move away from the edge, the distances between the trees are gradually reduced to the established ones for a particular tree species. The width of the outer wood strip should be about 30–50 m wide. The widest windbreaks are formed at the seaside, and their width may decrease as they move away from the sea. Black alder would be the most suitable for the formation of spruce plantations, which is cultivated in the plots of temporarily wet soils, and larch would be the most suitable for the plots with normal humidity soils.

Fertilization of plantations

In principle, only the initial fertilization of larch and spruce plantations works. Fertilization is carried out only during the first and second year, and if planted in summer with seedlings with a closed root system – only during the second year after planting. It is recommended to use NPK 20-8-9 fertilizer for initial fertilization. In the same year after planting, it is recommended to fertilize in late May–early June, and in the following year after planting – in April-May (depending on weather conditions), when tree vegetation period begins. A sufficient rate of fertilizer per tree is 2.5 g of active ingredient, spreading the fertilizer in a radius of 10–15 cm around the tree. Plantations can be fertilized with wood ash in accordance with the "Special requirements for the use of ash in forestry". Raw ash fertilization can be carried out on Nc and Nd habitats with an acidity index (pHKCl) ≤ 3.5 . The amount of ash when fertilizing the area evenly must not exceed 3.5 t/ha.

Maintenance of plantations

In the first year of plantation growth, especially in dry summers, weeds growing next to the trees planted should be removed. Grasses are more dangerous compared to other herbaceous plants. In the second and subsequent years of growing, maintenance must be carried out on fully suppressed spruce and alder trees (competing plants equal to or taller than those cultivated), and on birches and larches fully suppressed and 3/4 crown-shaded. In the first year of plantation growth, it is best to maintain it using a hoe or scythe, in the second and subsequent years – using a scythe or trimmer (brush cutter). If the rows of trees are straight enough, the spaces between rows can be trimmed with special disc cultivators, however, the plants near the trees will need to be removed with hand tools or brush cutters.

Protection of plantations

The protection of forests, including forest plantations, from animals, diseases, pests and fires is set out in the Forest Protection Manual („Miško apsaugos vadovas“, Žiogas et al., 2000), the Forest Grower's Guide („Miško želdintojo žinynas“, Žiogas, 2017) and the Forest Phytopathology („Miško fitopatologija“, Dabkevičius et al., 2006); diagnostics of tree diseases – in “Atlas of Tree Diseases and Pests” (Hartmann et al., 2005); the protection from damage by *Heterobasidion annosum* – in the Recommendations to Limit the Spread of *Heterobasidion annosum* in Coniferous Stands and

Afforestation in Agricultural Lands („Rekomendacijos šakninės pirties plitimui apriboti spygliuočių medynuose ir miško įveisimui žemės ūkio naudmenose“, Vasiliauskas, 2008).

Selective cuttings

Timely removal of trees of other tree species and shrubs before the first selective cuttings, during which the number of planted trees is reduced, may make other cuttings not necessary, especially in larch, birch and black alder plantations. If other species of trees or shrubs begin to suppress spruce plantations, they should be cut down immediately.

Selective cuttings are carried out in accordance with the rules of deforestation, except for the time of the first selective cuttings in spruce plantations. Since the stumps remaining after felling are the source of the primary infection of *Heterobasidion annosum*, it is advisable to postpone the time of the first selective cuttings as late as possible. After planting the plantations at the recommended densities and arranging the planting spots in a rectangle with spaces between rows about 4 m wide, the first selective cuttings in spruce plantations are carried out when they reach 25–30 years of age.

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