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## PECULIARITIES OF AGRICULTURAL ENGINEERING CULTIVATION OF EUROPEAN WHITE BIRCH SEEDLINGS IN FOREST NURSERIES

Data of researches on application of various agricultural practices are resulted at cultivation seedlings of birch. Optimum terms of sowing seeds which allow to raise the yield of a standard planting material and its biometrics are established. Various variants of seeds closing are described, allowing to enrich quality of a planting material of a birch. Optimum doses of the basic fertilizers and additional fertilizing at cultivation of birch seedlings and also technology of its cultivation in the closed ground are resulted.

**Introduction.** A large variety of soil conditions of silvicultural Fund of the Republic of Belarus demand, for forest restoration, a wide variety of woody species among which deciduous ones occupy a significant part. Planting material of deciduous woods is in high demand as in the recent years they give preference to the cultivation of the highest yielding tolerant variety of mixed plantation. Seedlings of European white birch are widely used as planting material of deciduous specious during cultivation of forest plantations.

European white birch (*Betula pendula* Roth.) is widely spread forest forming species which forms planting with its predominance and also it is a part of mixed coniferous and deciduous plantation. The majority of birch forests aren't native but they appear at deforestations and burnt-out places in a forest, mainly, instead of coniferous forests. [1].

Pure forest plantations of European white birch are made on small areas, mainly on former agricultural areas and also on deforestation sites after clean sanitary cuttings in the centre of root fungus. Planting material is mainly used during creation of mixed forest plantations with the participation of birch. About 2 mln. seedlings of European white birch are cultivated annually in forest nurseries for providing silvicultural work with planting material.

European white birch is in blossom in April-May. Transformation into the reproductive phase is happening under free growth from 10 to 15 years, under plantation – 20–25 years. Annual fruiting is typical for this species. [1]. According to B. I. Kosnikov, rich harvests from European white birch can be expected once in 5–6 years, good harvests – in 3–4 years, medium – in 2–3 years [2].

Aglets of European white birch are procured after the physiological ripeness of the seeds. That is, at the end of July – at the beginning of August. Morphological sign of European white birch seeds ripeness is yellowing of aglets stem with further separation of seeds from them. [3].

B. I. Kosnikov has established that middle-aged plant (31–40 years), growing on soils containing humus in upper level equals to 3.0–3.9%, it's

possible to harvest about 4.5 kg, if humus equals to 1.5–2.2% – up to 4.0 kg of seeds [2].

Aglets, gathered after harvesting, are dried in well ventilated rooms for 2–3 days with layer not thicker than 5 cm or in special drying rooms at the temperature of +25...+35°C during 12 hours. Birch seeds are separated from its flakes either by hand on metal sieves with round 2 mm. holes or with the help of special seed-cleaning machines. Pure seeds yield from aglets of European white birch after processing is 30–40% [3].

It's possible to plant seeds of European white birch in any time of the year – in early spring, in summer, in autumn and in winter [4]. It should be mentioned, ripen seeds of European white birch are not needed in stratification, however, it is unreasonable to store them for a long time as sowing quality deteriorates. [5].

**Main part.** Research of the agricultural engineering cultivation of European white birch seeds took place in a number of forestry farms in the Republic. Research made in the forest nursery of Volkovysk forest estate land revealed that the most optima time of planting of European white birch seeds is exactly after their gathering, that is, at the end of July. In this case the highest field germination of seeds is observed, at the level of 40–50%. Soil is sandy loam with humus over 2%. The average height of seedling of July's planting was by 19.5%, and the average diameter at the root neck by 22% more in comparison with seedlings of September's planting (Table 1).

In addition to the above, some samples of yearlings of the birch, grown after sowing at the end of July reached the height of 45 cm, while after sowing at the end of August the largest samples were not more than 28 cm (Fig.).

The number of standard seedlings for 1 l.m. from sowing line, grown at seeds planting exactly after their gathering is 67 pcs., but at planting in September – 44 pcs.

It should also be mentioned that at planting ripe seeds of European white birch at the end of July, young seedlings appear in the current year, while at later planting - in spring next year.

In Drogichin forest estate land, technology of cultivation of European white birch is implemented, peculiarity of which is that seeding beds before planting seeds are covered with straw which is burnt. Planting of seeds is carried out broadcast in the first ten-day period of September over the surface of ash, received after burning of straw with further wood dust mulching. This technology allows getting good sprouts in spring.

In Hantsevichi forest estate land bed-grown seeds are also implemented and seeds of European white birch are planted just after gathering at the end of July – beginning of August. Then sowing strips are covered with molded fabric “spandbond” and repeating watering is carried out to keep soil surface wet. This provides good sprouts in the year of planting and exceeds by height autumn planting on average by 15%, by diameter by 16%.

In Luninets forest estate land cultivation of European white birch seedlings is carried out according to the following technology. Three-row strip planting in the first ten-day period of Octo-

ber or in the last days of September is used. Seeds are planted into wide rows 15–20 cm wide, embed at a depth of 0.5 cm and smoothed down by a roller. In spring after young seedlings appear NPK-compound (nitrophoska) are applied in two stages in an amount of 150–200 kg for 1 ha. At the end of vegetation yield of standard seedling is not less than 90%.

In Ostrovets forest estate land seedlings are cultivated in beds which are made with the help of cultivator bed-maker. Planting is carried out with the help of freshly harvested seeds in the first half of August. Birch seeds are planted broadcast by sowing machine “Egedal” with seeding rate of 100 kg/ha. After that seedling are mulched with wood dust by the cutter MCH-0.75. Soil is sandy loam with humus over 3%. Young seedlings appear in 2–3 weeks. At the end of May next year, root additional fertilizing with complete fertilizer “Azophoska” is carried out and in June-July – outside root application with 1% urea solution.

Table 1

**Growth performance of seedlings of European white birch depending on seed time**

Seed time	Average value				Number of standard seedling for 1 l.m., pcs.
	aboveground part height, cm	$t_{0.95}$	Stipe thickness at root neck, mm	$t_{0.95}$	
End of July (just after gathering)	22.1 ± 0.44	6.3	2.2 ± 0.04	8.0	67
Beginning of September	18.5 ± 0.36		1.8 ± 0.03		44



a



b

a – at planting at the beginning of September; b – at planting at the end of July (just after gathering)  
Yearlings of European white birch in seedling section of Volkovysk forest estate land

In Glubokoe experimental forest estate land birch seedling are cultivated in accordance with intensive technology. Four-rowed belt planting with seed drill 5–6 cm wide is used. Planting is carried out at the end of October with seed rate of 2.5 g for 1 l. m. At this sowing rows are marked by sowing machine "Egedal" but planting is carried out by hand with further mulching with 1 cm wood dust layer. Constant watering of seedling by sprinkler system is carried out to avoid drying of the surface soil layer before arrival temperature below 0°C. In spring after arrival of positive temperature watering is recommenced. At this agrotechnics young seedlings appear at the second half of May. To increase growing process of seedlings 3 times for vegetation period outside root additional fertilizing with complete fertilizer and crystalon at the rate of 3 kg/ha and with the consumption rate of 300 l/ha of working liquid is carried out. Using this technology number of standard seedling received from 1 ha is 700–800 thousand pcs.

In Luban forest estate land birch seedlings grow under cover. In growing houses for seedlings cultivation substrate consisting of the mixture of preliminary neutralized and enriched with necessary nutritive elements of bog peat (50%) and sand (50%) is used. Percentage of sphagnum moss in peat is 90%, degree of decomposition – 15%, peat acidity after neutralization by dolomitic meal 5.0–5.5 pH. As basic fertilizer nitrogen phosphorus potassium compound fertilizer (nitrophoska) containing of nutritive elements: nitrogen – 16–20%, phosphorus – 16–20%, potassium – 16–20% with rate application of 3 kg for 1 m<sup>3</sup> of peat is used. The optimal time of planting is the first half of April when substrate temperature in growing house is 6–8°C. Planting is carried out broadcast without covering of seeds. After planting seeds are slightly covered with wood dust and smoothed down by covering roller. Seeding quantity is 8–10 g for 1 m<sup>2</sup>. It is necessary that top of the substrate is wet for good seed sprouting. That is 2–3 times in 24 hours mist watering of seeds is used.

To provide optimal nutrition of plants it is necessary to take into consideration number of

birch seeds for the specific area. When birch sprouts are thick thinning is made to leave not more than 20–25 pcs. for 100 cm<sup>2</sup> of the sowing bed. It is necessary to make tinning after good watering. At this weak, ill and damaged plants should be taken away first.

Sprouts grow rather slowly for the first weeks of their life. Height of monthly birch sprouts are only 2–3 cm and only in the second half of the summer the period of rather fast growth starts and by the end of the vegetation they are rather large considerably larger than standard ones (Table 2).

According to table 2 by autumn seedlings may reach 95 cm in height and have average stripe thickness of 6.6 mm with root length of 35 cm. By their biometrics they 3–4 times exceed standard demands for open ground seedlings.

Fertilization was carried out with four types of water-soluble complete fertilizing with well-balanced ratio of macro- and microelements on chelated base chloride-free.

In the first half of vegetation for fertilization fertilizing Crystalon Light-blue (N 19% + P<sub>2</sub>O<sub>5</sub> 6% + K<sub>2</sub>O 20% + MgO 3%) with increased concentration of nitrogen and Crystalon Yellow (N 13% + P<sub>2</sub>O<sub>5</sub> 40% + K<sub>2</sub>O 13% + + MgO 1%) were used. In the second half of vegetation fertilization was carried out with fertilizing Crystalon Special (N 18% + P<sub>2</sub>O<sub>5</sub> 18% + K<sub>2</sub>O 18% + MgO 3%) and Crystalon Brown with increased concentration of potassium (N 3% + P<sub>2</sub>O<sub>5</sub> 11% + K<sub>2</sub>O 38% + MgO 4%). To reveal the influence of fertilization on seedlings growth research was carried out in which number and rate of application was modified. Number of fertilization varied from 4 to 7 for the season. Apply fertilizer rate Crystalon in research variations was 10, 20 and 30 g/m<sup>2</sup> of seeding. The most vivid results were received in variants in which 7 fertilizations with four types of Crystalon with fertilizer consumption of 20 and 30 g/m<sup>2</sup> of seeding correspondently were used. Maximum effect was observed in variants with triple usage of fertilizer Crystalon Special in June-July and double application of Crystalon Brown in July-August. Usage of these fertilizers resulted in considerable increase of seedlings height and thickness of stipitate.

Table 2

#### Birch seedlings biometrics grown in hothouse facility of Luban forest estate land

Name of sowing material	Average value		
	Top length, cm	Stripe thickness at root neck, mm	Length of roots, cm
Seedlings, grown in hothouse	95.0 ± 1.36	6.6 ± 0.07	35.0 ± 0.72
Seedlings defined in the standard GOST 3317–90	20.0	2.0	15.0

**Conclusion.** The most optimal is the sowing of European white birch seeds just after their gathering that is at the end of July – beginning of August. Young seedlings appear in the current year while after later sowing – only in spring the following year. In this case higher field germination of seeds is observed (at the level of 40–50%). According to the research data the average height of seedlings of July's sowing 15–20% more and the average diameter at the root neck – 16–22% more in comparison with seedlings of September's sowing.

Covering of sowing rows after sowing with molded fabric “spandbond” with the followed watering to keep the soil surface wet gives good results.

It is interesting that application of plant ash onto the sowing rows provide good sprouts. Carrying out of fertilization with water-soluble complete fertilizing with well-balanced ratio of macro- and microelements preferably chloride-free considerably increase growth index of seedlings. While growing seedlings under coverage good results are achieved after application of substrate consisting of the mixture of sand and bog peat preliminary neutralized to pH 5.0–5.5 and enriched with complete mineral fertilizing (nitrophoska) on the basis of 3 kg for 1 m<sup>3</sup> of peat. According to the research results in Luban forest estate land application of fertilization system with four types of water-soluble complete fertilizing with well-balanced ratio of macro- and microele-

ments on chelated basis chloride-free provides considerable increase of seedlings height and thickness of stipitate. Cultivation of seedlings under cover permits to receive planting material of the birch which is by its biometrics 3–4 times larger than the standard for open-ground seedlings.

## References

1. Википедия – свободная энциклопедия [Электронный ресурс]. – 2012. – Режим доступа: [http://ru.wikipedia.org/wiki/Берёза\\_повислая](http://ru.wikipedia.org/wiki/Берёза_повислая). – Дата доступа: 07.08.2012.
2. Косников, Б. И. Влияние природно-климатических факторов на плодоношение и посевные качества семян березы повислой / Б. И. Косников // Лесное хозяйство. – 1987. – № 6. – С. 51–53.
3. Новосельцева, А. И. Справочник по лесосеменному делу / А. И. Новосельцева. – М.: Лесная пром-ть, 1978. – 335 с.
4. Лесные культуры и защитное лесоразведение: учеб. пособие для студентов высших учебных заведений, обучающихся по специальности 26.04.00 «Лесное хозяйство и лесопарковое хозяйство» / Г. И. Редько [и др.]. – СПб.: Издат.-полиграф. отдел С.-Петерб. гос. лесотехн. акад., 1999. – 419 с.
5. Репина, Н. И. Об изменении качества семян березы бородавчатой при хранении / Н. И. Репина // Лесной журнал. – 1974. – № 3. – С. 150–151.

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