

УДК 630\*164.8

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### **INVESTIGATION OF PROGENY AND METHOD EFFECTIVENESS IN THE PROCESS OF PREPARING LINDEN SEEDS FOR DROPPING**

The article considers information about phytocoenotic role and popularity of linden stands on the territory of the Republic of Belarus. There have investigated progeny of small-leaved linden and large-leaved linden by means of unit sample analysis in correspondence with existing standards. There has been determined viability, mass of 1,000 pieces of seeds, laboratory germination. It has been determined that viability of small-leaved linden and large-leaved linden seeds being analyzed is quite high comprising 70–74%. The highest viability (74%) is specific for large-leaved linden earthed during 6 months since spring till autumn. Mass of 1,000 pieces of seeds comprised from 31.8 till 142.5 g. The results of linden seeds by various methods have been shown. Along with traditional ways of preseed treatment (seed-soaking treatment, seed-soaking treatment in potassium permanganate) there have been tested more complex methods of preseed treatment by means of affecting them by positive and negative temperatures as well as by variable temperature modes. Determining laboratory germination, there have been noticed separate seedlings when small-leaved linden seeds being earthed for 2 months at +18°C, then for 2 months at 0°C, then again for 2 months at +18°C in tight dishware. There have been investigated the effect of depth of seed placement on their germinability. The highest germinability (23.0%) is specific for seeds placed 3.5–4.0 cm in depth.

**Key words:** viability, germination, stratification, soaking, seedlings.

**Introduction.** Lime (*Tilia*) is a valuable forest-forming species which has a positive effect on all components of forest communities. It is widely known as a medicinal and honey plant. Lime (*Tilia*) is resistant to air pollution. Lime leaf litter markedly improves soil and increases its fertility. This creates favorable conditions for the emergence of regrowth of woody plants. Lime wood is well processed and is highly valued in carpentry.

Currently, lime planting in Belarus occupies a small area of about 1,350 ha in age from 5 to 142 years, with 242,000 m<sup>3</sup> of stem wood total reserve a lime areas decrease from north to south is observed in terms of geobotanical subzones (1,033 ha of plantations in the subzone of broad-leaved spruce forests, 280 ha in spruce and hornbeam oak forests and 44 ha in hornbeam oak forests). The average age of trees is 41 year old [1].

The widespread introduction of lime in forest plantations is constrained by lack of planting material. Therefore, at the present stage the first priority is to develop and study effective agro technological processes of growing of planting material to lindens permanent forest nurseries using the latest scientific developments.

To activate the process of introduction of a lime tree in the culture of the Republic of Belarus Ministry of Forestry in 2012 obliged the heads of forestry institutions to provide all permanent forest nurseries annual seeding limes on an area of not less than 0.01 ha, followed by the use of planting material in the production of silviculture.

Growing seedlings is difficult stage in the production of lime forest crops. First of all, preparing seeds for sowing causes great difficulty,

as lime refers to a group of species that have seeds with a long period of germination. Because of it mass shoots with sowing seeds without pretreatment appear only on the 2<sup>nd</sup>–3<sup>rd</sup> year of cultivation.

Knowing the causes of seed dormancy allows you to develop and apply different methods to overcome it through a special pretreatment. Therefore, the seeds of trees and shrubs, in a deep and sometimes in forced rest, before planting should be specially treated to facilitate their accelerated germination. First of all, it is their stratification, snow retention, soaking, scarification, microelements and growth substances treatment, disinfection and pest control, etc.

**Main part.** Basic information about the quality of the collected lime seeds can be obtained as a result of determining the viability and weight of 1,000 seeds.

Determination of lime Seed viability was carried out in accordance with GOST 13056.7-93 “Seeds of trees and shrubs. Methods for determination of viability” with 0.05% indigo carmine solution, and the weight of 1,000 pieces of seeds – in accordance with GOST 13056.4-67 “Seeds of trees and shrubs. Methods for determination of mass 1,000 pieces of seeds”.

Indicators of viability and mass 1,000 pieces of seeds were determined for freshly picked from the tree in November and seeds linden macrophylla, as well as seeds linden macrophylla, collected from the ground in the spring in the first half of April and stratified in boxes with sand from April to September in the open area. The results are shown in the Table.

**The results of the sowing qualities of small-leaved linden seeds and large-leaved linden seeds**

Species	Weight thousand pieces seed, g	Determination of viability, %				
		vital	nonviable, including			
			empty	germless seeds	rotten	damaged by pests and disease
Small-leaved linden (freshly harvested seeds, November)	31.8	70.0	16.7	10.0	3.3	–
Large-leaved linden (freshly harvested seeds, November)	107.5	72.0	14.7	13.3	–	–
Large-leaved linden (seeds stratified in the sand from spring to autumn)	142.5	74.0	10.0	8.0	8.0	–

Analyzing the Table, it can be concluded that the viability of the seeds is high and ranges from 70 to 74%. The highest seed viability of different limes macrophylla, past stratification in the sand for 6 months from spring to autumn. The number of non-viable seed for most seed freshly linden and is 30%, of which a large part is occupied by empty seeds.

Weight of 1,000 freshly harvested small-leaved linden seeds is 31.8 g, and the weight of 1,000 freshly harvested large-leaved linden seeds is 107.5 g. The obtained data meet and even exceed the figures given in the reference books.

Also, an attempt to identify the germination of lime seeds was made by us, although GOST 13056.6-97 does not provide the definition of germination and vigor for this species [2].

Four sample pieces of 50 seeds each were chosen to make an analysis. Before you put the seeds on germination, their seedbed preparation was realised in various ways. Some of them were relatively simple and include soaking the seeds in water, potassium permanganate solution. Other methods were based on the effects of various temperature regimes on the seeds. The list of all the ways can be seen below:

1. The seeds water soak of freshly harvested seeds of small-leaved linden in November for 42 hours.

2. The seeds potassium permanganate solution soak of freshly harvested seeds of small-leaved and large-leaved linden in November for 42 hours.

3. Stratification of large-leaved linden seeds in the pitch box on the open area from April to September.

4. Stratification of small-leaved and large-leaved linden seeds in the sand in a sealed container at a temperature of +18°C for 6 months.

5. Stratification of small-leaved and large-leaved linden seeds in the sand in a sealed container at a temperature of +18°C for 2 months, after that at 0°C for 2 months, and finally at +18°C for 2 months.

6. Stratification of small-leaved and large-leaved linden seeds in the sand in a sealed container at a temperature of +18°C for 1 month, then

1 month at a temperature of –15°C (with 6 months alternation).

7. Stratification of small-leaved seed in the sand in a sealed container at a temperature of +18°C for 6 months and 30 min sulfuric acid treatment before sowing.

8. Stratification of small-leaved seed in the sand in a sealed container at a temperature of +18°C for 2 months, then at 0°C for 2 months, then again at +18°C for 2 months and 30 min sulfuric acid treatment before sowing.

9. Stratification of small-leaved linden seeds in the sand in a sealed container at a temperature of +18°C for 1 month, then 1 month at a temperature of –15°C (with 6 months alternation) and 30 min sulfuric acid treatment before sowing.

10. The seeds water soak for 24 hours and 30 min sulfuric acid treatment before sowing.

Wet coarse deselected from fine silty particles and thoroughly washed sand was used for the seeds stratification of. 3 sand parts were taken for one seeds part. The sand was carefully mixed and wetted.

Determination of germination allowed determining that the germination of certain seeds was observed only during the stratification of linden seeds under variable temperature conditions (option 8). The lack of positive results of the experiences should be explained with a deep seed dormancy of seeds and probably with insufficient period of stratification time.

The greater importance for practical use has the definition of soil germination, as it allows a sufficiently higher degree of probability to determine seeding rate depending on specific conditions.

In order to determine this parameter, we laid the experimental linden crops in permanent forest nursery Negorelsky-experimental forestry.

Cultures were carried out on the prepared soil in the seed furrow. The soil in the area of forest nursery sod-podzol weakly podzolic, growing on sandy loam connected, the underlying light sandy loam, and at a depth of 150 cm on stained loam. Power arable layer is 27–35 cm. Ground water level lies below 3 m (July). Preparation of the soil was

realized by its plowing with a turnover and subsequent loosening to a depth of 25–30 cm.

For sowing linden seeds in the sand in a sealed container from April to November in the open area were used. They were sown in the amount of 140 pieces at 1 p. m of planting rows. The width of the planting rows was 12 cm (sowing belt, three-line, with a fair distribution of the lines under the scheme 40–40–70). Seeding depth has three options: to a depth of 3.5–4.0 cm, 2.0 cm, and on the soil surface.

The process of seeds sowing was realised manually in the nursery department in the beginning of November, 2013. Pre-sowing grooves were moistened.

The results of determination showed that the highest rates soil germination were observed when the seeds were sowed to a depth of 3.5–4.0 cm (dirt germination was 22.9%). Other variants of the experiment showed the significantly lower value. The dirt germination was 19.0% with the sowing depth of 2 cm. When sowed the seeds on the soil surface it was 13.3%.

**Conclusion.** Determination of the sown seeds quality of small-leaved and large-leaved linden showed that analyzed seeds viability is high and amounts to 70–74%. The large-leaved linden seeds gathered from the ground in the spring in the first half of April and stratified in boxes with sand from April to September in the open area are characterized by the greatest vitality.

Weight of 1,000 of freshly harvested small-leaved linden seeds was 31.8 g, and of large-leaved linden seeds 107.5 g. Weight of 1,000 large-leaved linden seeds stratified in sand from spring to autumn was 142.5 g. The obtained results meet or exceed the average index given in reference books.

Carrying out pretreatment of seeds of different temperature regimes with subsequent determination

of laboratory germination showed that the small-leaved linden seeds are not able to germinate at this stage of development, which should be explained by the late harvest of seeds and their entry into a phase of profound combination of seed dormancy.

Determination of soil germination of large-leaved linden seeds stratified in boxes of sand in an open area and sown in early November to different depths revealed that the highest rates of soil germination are the seeds sown at a depth of 3.5–4.0 cm.

Analysis of agricultural technologies of cultivation of linden planting material took place in seven permanent nurseries forestry enterprises of the republic (Ostrovets, Stolbtsy experienced, Molodechnenskij, gnocchi, Slonim, Negorelsky experienced and Osipovichsky experienced). It revealed that the most effective way to prepare seeds for sowing is sowing freshly harvested linden seeds (collection at the stage of physiological maturity when browning shell nuts) in late August – early September. At the same time the seeds still do not have time to enter into a deep seminal rest, and the passage of the warm phase of stratification in the soil early in the fall provides a massive germination (65–70%) in the spring of next year. This method is simple and cheap, because there are no costs of stratification. In the current “Instructions for growing planting material of trees and bushes in the forest nurseries of Belarus” (Minsk, 1986), this method is not given.

Enough effective is a process of long seed stratification (from April to September) in boxes of sand in an open area. Sowing the seeds produced in the beginning of November, mass germination (60–70%) appear in the spring of next year.

The both methods of preparation of linden seeds for sowing given above are recommended for wide use in the permanent forest nurseries of the country.

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Received 13.02.2015