

THEORETICAL SUBSTANTIATION OF MECHANIZED PINE SOWING

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INTRODUCTION

Forest seeding is the oldest form of 'anthropogenic' forest regeneration. Soil preparation is necessary after clear-cutting, which is one of the prerequisites that must be met in order for the trees planted or seeded in the Boreal forests to survive and grow better. To grow high quality forest stand need to choose seed material that collected from seeds plantation and seeds correspond to the category *improved* and *superior*. The mechanized sowing of pines is ecologically and economically justified by regenerating pine stands in oligotrophic forest types. The seeds are close to each other when sowing manually, which then makes difficult to agrotechnical cleaning. Therefore, it is better to choose mechanized sowing (Fig.1). There is always the question of whether the forest stand trees are sowing 'anthropogenic' or grown naturally. **The aim of research** was to determine proportion of natural and sown pine five years after mechanized sowing and estimate differences of tree growth parameters.



Fig.1. Sowing manually and mechanized (2008-2021)

METHODS

Experimental stands had been established during evaluation of success of mechanized sowing in the East Vidzeme on May, 2014 (Fig.2).

To determine the distribution of pines by genetic origin in the sowed stands of East Vidzeme, pine genotyping was carried out both in the Salaca plantation and in four forest stands.

Mapping of the Salaca pine plantation was carried out for **112 clones**. DNA was isolated by the cetyltrimethylammonium bromide (CTAB) method and the samples were genotyped with 16 microsatellite markers.

Sowing pines was measured after five years growing, on 2019 (Fig.3). At the same time was collected samples for genetic analysis. DNA was isolated by the CTAB method and the samples were genotyped with 13 microsatellite markers. A total were analyzed **192 samples**.

Sown pine seeds:

- collection location – Salaca pine seed plantation;
- seeds collection time - 2002–2012 annual collection;
- germination – 72 %;
- sowing rate - ~ 300 g per 1 ha.

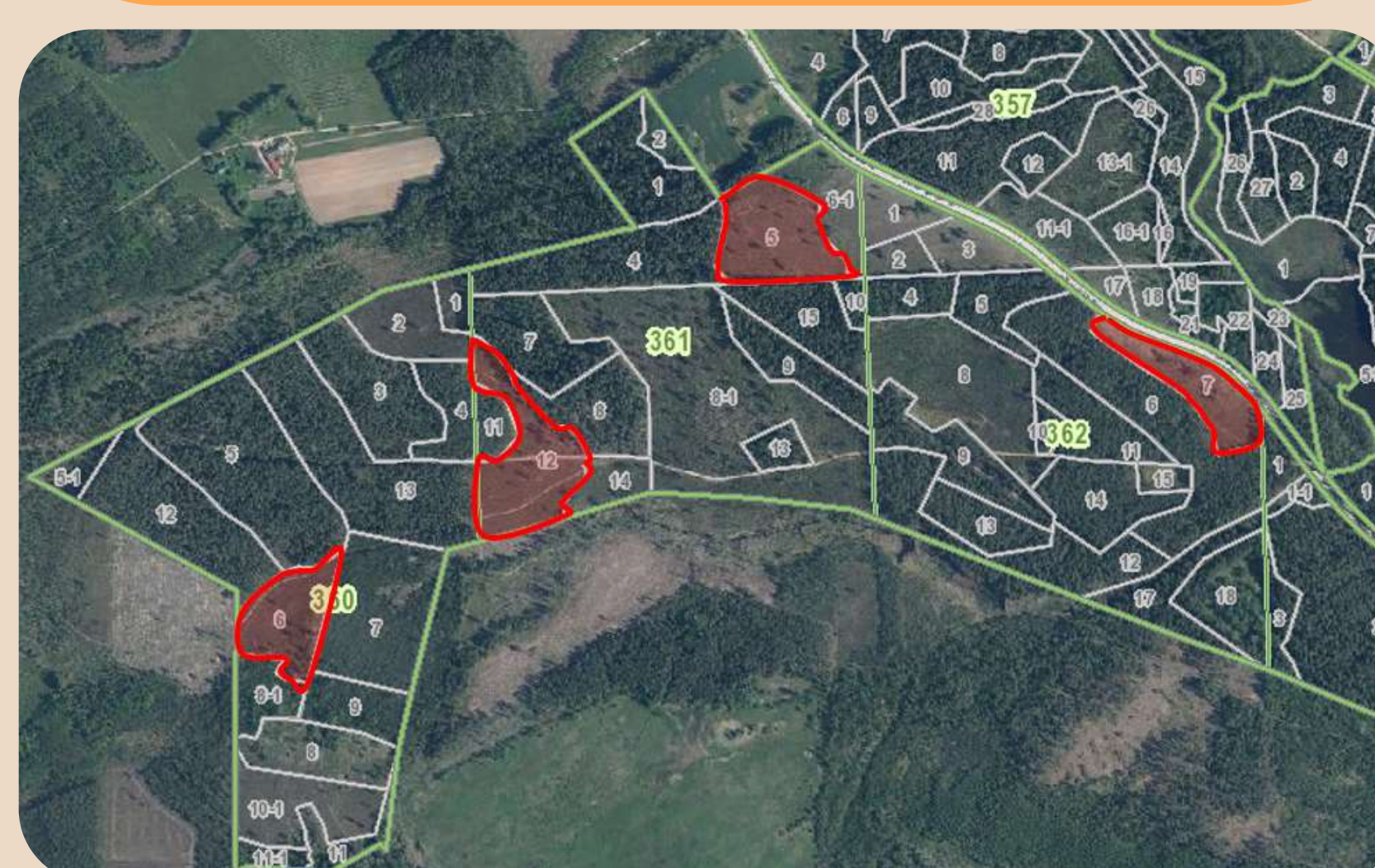


Fig.2. The location of sowing stands in East Vidzeme, Ergeme region



Fig.3. Establishment of plot in sowing stands and taking biometric measurements of tree

RESULTS AND DISCUSSION

Table 1. DNA identification of sowing pines

Stand	Some DNA fragments match	Salaca clone identified	Local
101-369-6	13 %	72 %	14 %
101-361-12	11 %	75 %	14 %
101-361-5	16 %	73 %	11 %
101-362-7	12 %	72 %	16 %
Average	13 %	73 %	14 %

Results showed that in all four districts, the origin of 72-75 % of the trees has been identified up to the clone level (Table1). DNA fragments characteristic of the Salaca seed plantation were not found in only 14-16 % of the listed trees.

87 clones of the Salaca pine plantation were identified of the analyzed samples from sown stands (Fig.4.).

Majority of the pines with the origin of the Salaca plantation dominated and grow faster than pines from the surrounding trees seeds. There is a cumulative tendency for sown pines to grow better and differences in tree height to increase over time.

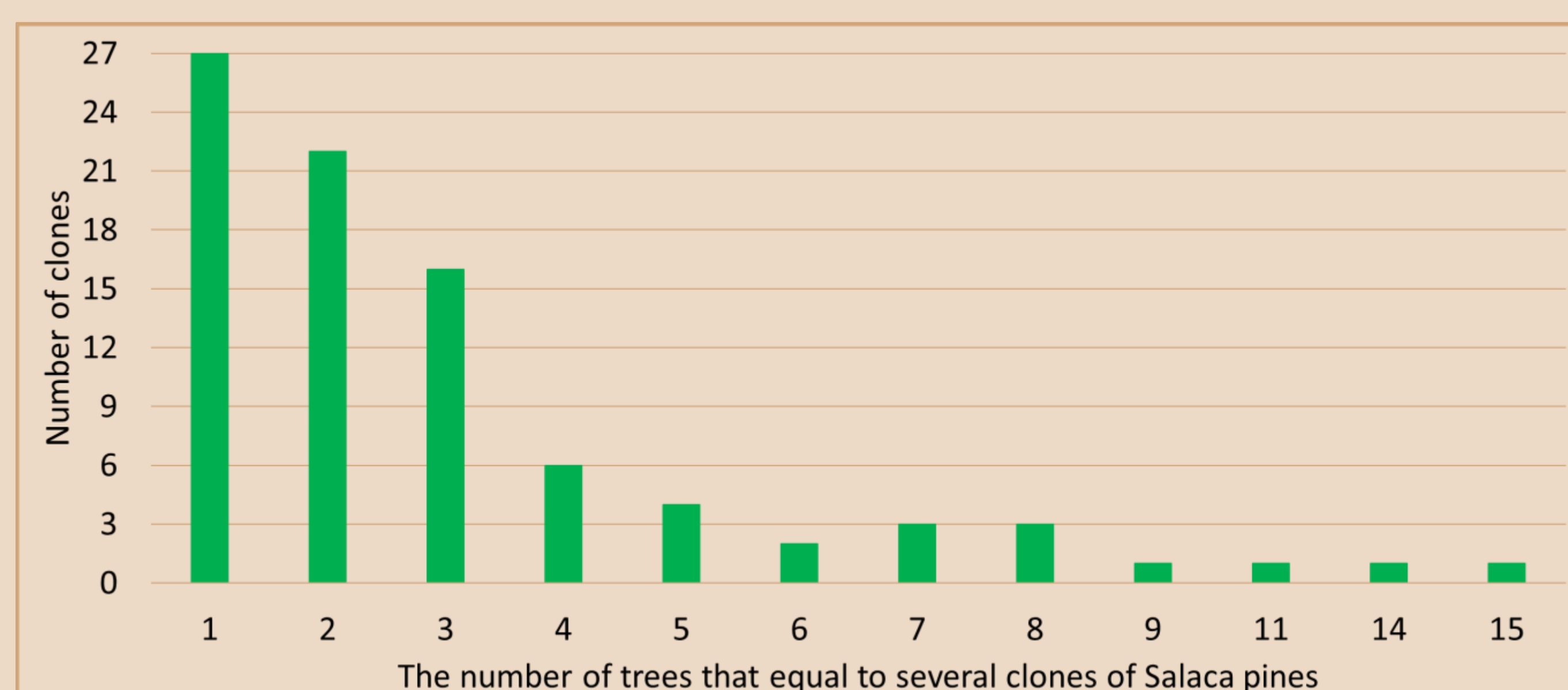


Fig.4. Genetic diversity of Salaca clone identified in sowing stands

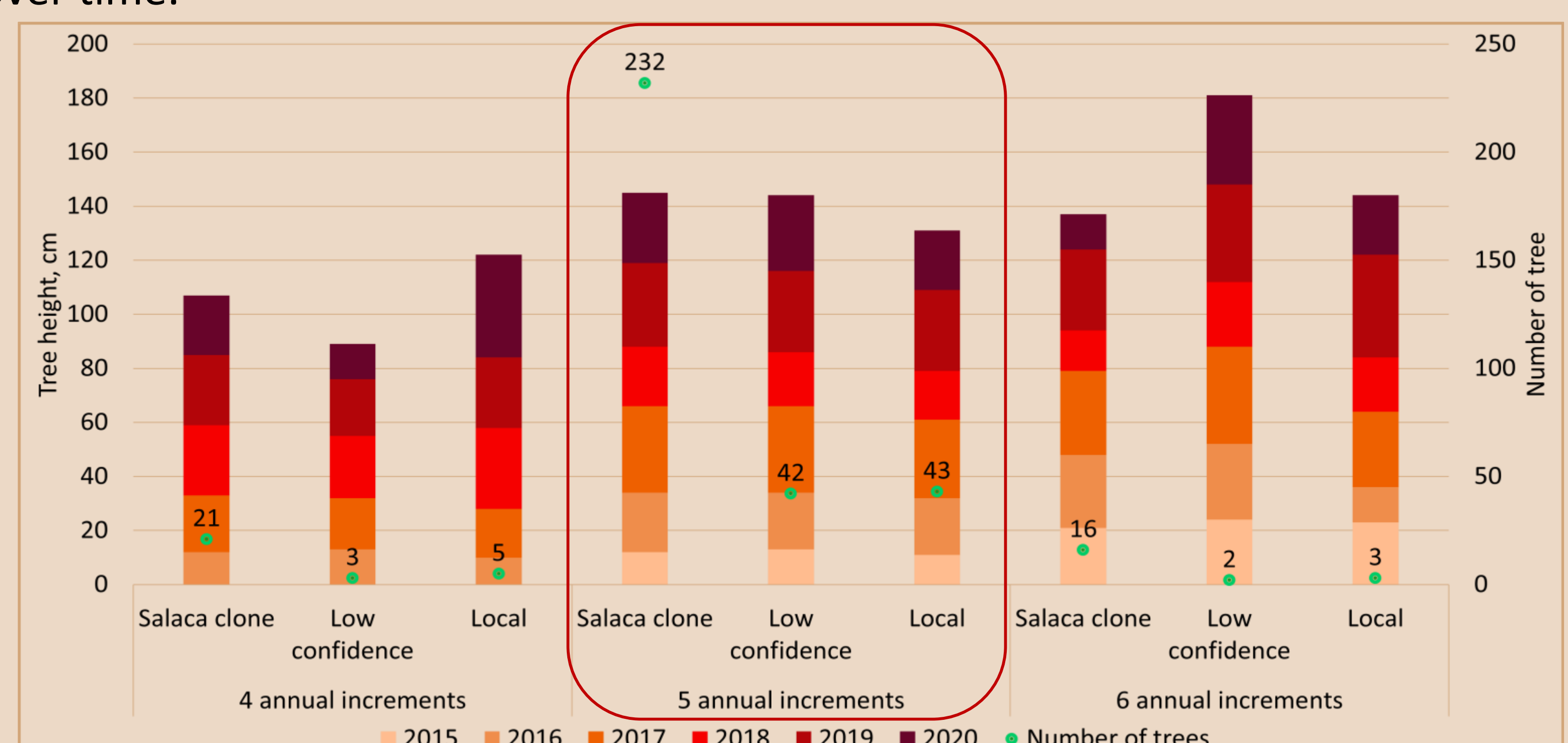


Fig.5. Heights of pines of different origin in distribution by years of growth depending on the number of annual increments and the number of trees analyzed in each group

The height growth of pines is evaluated by measuring the last five years meters (Fig.5). The first measurable stage of growth is 2015, the growth that took place in 2016. Depending on how active the seeds germinated and seedlings development in 2014 were, 5-6 whorls can be identified. On the other hand, one year later, 4 whorls can be seen on the seeds that have germinated. In the stand, there are mainly pines, for which 5 whorls are counted.

CONCLUSIONS

1. At least 70% of the pine trees preserved after agrotechnical care belong to the Salaca plantation. Sown pines show better morphological indicators.
2. Seeds suitable for sowing with excellent genetic characteristics, but lower germination (they are not suitable for large-scale production of framework plants) can be used for mechanized sowing of pine stands in oligotrophic forest types.

FUTURE RESEARCH QUESTIONS

Next research activity just started to carried out is covering of seeds aiming to improve germination and make seeds more visible in forest as well protect them from 'predators' – make less attractive to birds and small rodents. And to carried out how sowing depth effect to seeds germination.

