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# INFLUENCE OF SEEDING RATES SEEDS AT EXIT STANDARD SEEDLINGS PINE IN INDOOR GROWING

Investigations to determine the output of standard pine seedlings at different seeding rate of pine seeds in the greenhouse conditions. For the cultivation of seedlings it was used as a substrate of peat bogs transition milling work piece with a dose of application of mineral fertilizers, $N_{70}P_{150}K_{90}$. Pine seeds were sown in Egedal a scatter planter beds with a width of one meter seeding rates of 6.8; 11.0; 14.0 g/m$^2$. To estimate the output of seedlings that meet regulatory requirements, use trial-analysis based on a normal distribution. With the increase of pine seed sowing rate was observed decrease in the yield percent of standard seedlings and increase custom. It is not noted a significant change in percent yield seedlings height of 7 cm. With seeding rate is 6.8 g/m$^2$ output of standard seedlings was 94.5%, while and 14.0 g/m$^2$ – 88.4%. Significant changes were observed in the output of larger seedlings 12 cm. When seeding rate of 6.8 g/m$^2$ yield was 57.9%, with 11.0 g/m$^2$ – 46.0%, and at 14.0 g/m$^2$ – 27.2%. Therefore, the indoor planting pine material should be grown in a medium-density plantings with a seeding rate of 11–12 g per 1 m$^2$, which will be combined with economical consumption of seeds with an optimal output of standard planting material.

**Key words:** pine, seed, seed rate, indoor, seedling output.

**Introduction.** For normal growth and development seedlings require an adequate growing space where they can receive enough moisture and nutrients. If sowing is sparse and there are few plants per unit area, the yield of planting stock will be low, though each plant in this case usually has the biggest biometrical growth indicators. At thickened sowings an individual development of separate plants weakens, and growth processes gradually decrease. Thus, too thinned sowings lead to reduction of yield of the planting stock, and too thickened – to decrease in its quality. The best results can be received only at optimum density of seedlings standing which is closely connected to the seeds seeding rate.

**Main part.** Seeding rate is expressed by the number of germinable seeds or by the mass of seeds sowed per unit area. For wood species the seeds seeding rates are determined which are expressed by the mass of seeds in kg sowed per 1 hectare. However taking into account the actual conditions it is necessary to modify the quantity of sowed seeds per unit area. It is especially actual at seedlings growing in a hothouse as for covered ground conditions the seeds seeding rates should be different as compared to the open ground.

For determination of density influence of pine seedlings standing in the covered ground on the yield of the standard planting stock the experimental sowings were done with different seeds seeding rates in the conditions of hothouse enterprise GEDFI "Gluboksky experimental forestry". For seedlings growing peat was used as substrate of transient type of bogs of milling preparation with the application dose of mineral fertilizers $N_{70}P_{150}K_{90}$. Pine seeds were sowed randomly by seeder Egedal in 1 m beds with the seeding rates of 6.8; 11.0; 14.0 g/m$^2$. Seeds with technical germinating capacity of 95% and mass of 1,000 pieces – 7.5 g were used for sowing.

For the yield assessment of annotinous pine seedlings which correspond to standard requirements, the probit analysis method was used, based on the normal distribution law. Probit is the standardized feature deviate from the average value, increased on 5 units.

In the mathematical statistics the deviations vary from $-3\delta$ up to $+3\delta$, where $\delta$ – is the root mean square deviation. Therefore probits vary from 2 up to 8. To each probit there corresponds a certain probability of the feature occurrence which is found in tables of integral functions of normal distribution [1].

Construction of probit-graphs was carried out according to materials of statistical treatment of the measurements results. The average value and the values corresponding to quantities $x \pm \sigma$, $x \pm 2\sigma$, $x \pm 3\sigma$ are set on the abscissa axis. On the ordinate axis – probits from 2 to 8. As the equation of the normalized deviate is the first order function, so the probit-graph is expressed by a straight line. These graphs are given in Fig. 1–3 at different seeding rate of common pine seeds in the covered ground in a hothouse.

According to standards one-year-old pine seedlings should have height of seedling tree equal to 7 cm, and thickness of root collar equal to 1.5 mm, and two-year-old seedlings of pine and spruce – height of 12 cm and thickness of root collar of 2 mm [2].

In Fig. 1 pine seedlings height of 7 cm corresponds to the probit equal to 3.4, and it corresponds according to the table of normalized normal distribution to occurrence probability equal to 0.055, or 5.5% [3]. Thus, the seedlings quantity, not corresponding to standard requirements, is equal to 5.5%,

and standard ones is accordingly 94.5%. The yield of standard seedlings with height of 12 cm is equal to probit 4.8, and it corresponds to 57.9%.

At the seeding rate of 11.0 g on 1 $m^2$ the seedlings height of 7 cm corresponds to probit 3.5, and it is equal to yield probability of standard seedlings 93.3%, and non-standard – 6.7%. The height of standard seedlings equal to 12 cm corresponds to probit 5.1, and it is equal to the yield of 46.0% (Fig. 2).

The yield of standard pine seedlings at the seeding rate of 14.0 g on 1 $m^2$ was determined according to the probit equal to 3.8 (Fig. 3). It corresponds to yield probability of standard seed lings equal to 88.4%, and of non-standard ones – 11.6%. The yield of standard seedlings with height of 12 cm is equal to probit 5,6, and it corresponds to 27.2% (Fig. 3).

Thus, when we increase the seeding rate of pine seeds there is a tendency of yield decrease of standard seedlings and of yield increase of non-standard ones. However there is no significant change of seedlings yield percent with height of 7 cm at the seeding rate increase from 6.8 to 14.0 g on 1 $m^2$. So, at the seeding rate of 6.8 g on 1 $m^2$ the standard seedlings yield makes 94.5%, and at 14.0 g on 1 $m^2$ – 88.4%. Essential changes are observed in yield of larger seedlings with height of 12 cm. At the seeding rate of 6.8 g on 1 $m^2$ the yield makes 57.9%, at 11.0 g on 1 $m^2$ – 46.0%, and at 14.0 g on 1 $m^2$ – 27.2%.

The standard seedlings yield in quantitative expression with 1 $m^2$ of sowings in a hothouse is given in the Table.

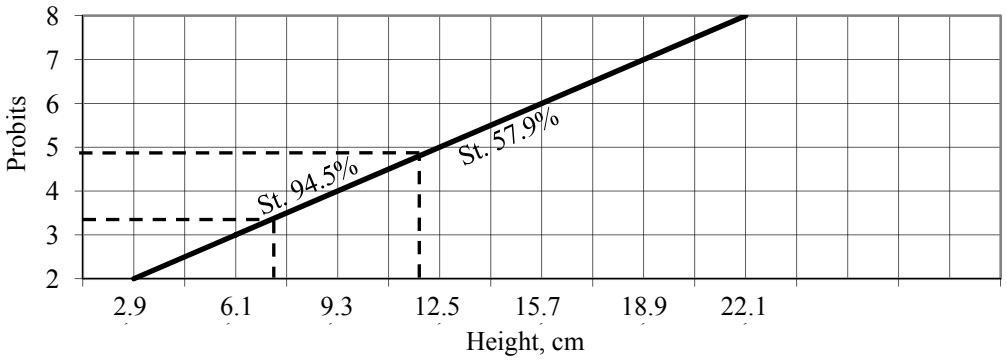


Fig. 1. Yield percentage of standard pine seedlings at the seeding rate of 6.8 g on 1 $m^2$

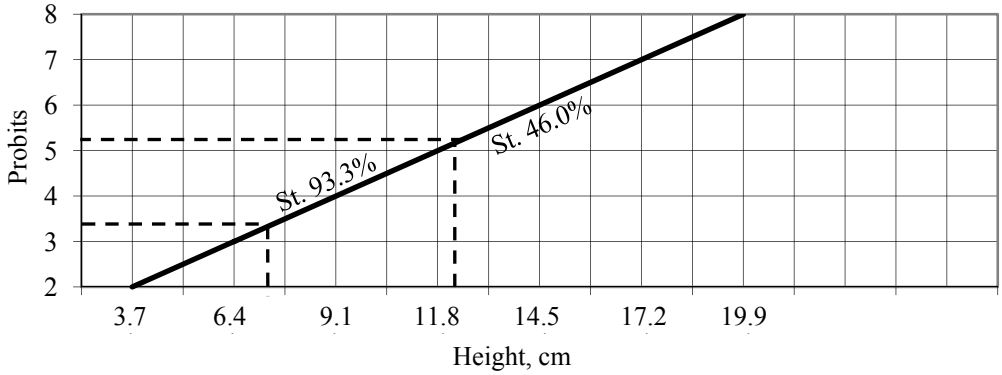


Fig. 2. Yield percentage of standard pine seedlings at the seeding rate of 11.0 g on 1 $m^2$

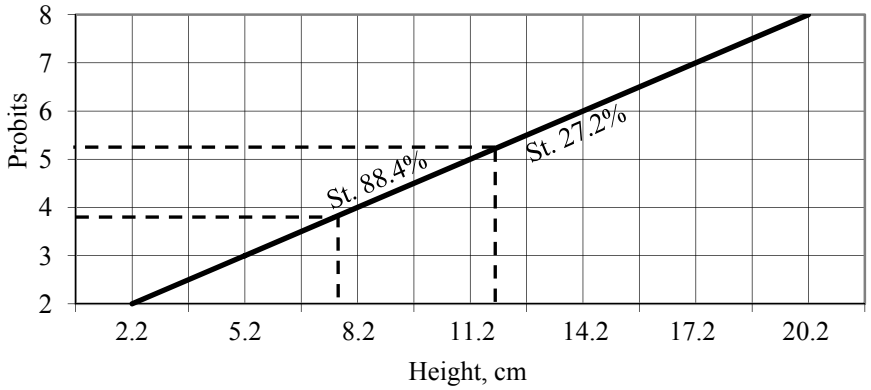


Fig. 3. Yield percentage of standard pine seedlings at the seeding rate of 14.0 g on 1 $m^2$

**Yield of the standard pine seedlings at different seeds seeding rates in a hothouse**

| Seeding rate on g on 1 $m^2$ | Seedlings stand thickness on 1 $m^2$, pieces | Standard seedlings yield with height of 7 cm from 1 $m^2$, pieces | Standard seedlings yield with height of 12 cm from 1 $m^2$, pieces |
|---|---|---|---|
| 6.8 | 760 | 718 | 440 |
| 11.0 | 830 | 774 | 382 |
| 14.0 | 980 | 866 | 267 |

As it is clear from the given data, the standard seedlings yield with height of 7 cm increased at augmentation of the seeds seeding rate. However at growth of the seeding rate by 60% (from 6.8 to 11.0 g on 1 $m^2$) the standard seedlings yield increased only by 7.8%. At the seeding rate increase by 105% (from 6.8 to 14.0 g on 1 $m^2$) the Scotch pine seedlings yield with height of 7 cm grew only by 20.6%.

As to the seedlings yield with height of 12 cm, sothere is its gradual decrease here at increase of the seeds seeding rate. At the seeding rate of 6.8 g on 1 $m^2$ the yield makes 440 pieces from 1 $m^2$ of the sowing area, at 11.0 g on 1 $m^2$ – 382 pieces, and at 14.0 g on 1 $m^2$ – 267 pieces.

**Conclusion.** In the conditions of the covered ground from the point of view of seeds economy the sparse sowings are more favorable, but at the same time the standard seedlings yield decreases.

At augmentation of seeding rate from 6.8 to 14.0 g on 1 $m^2$, the seedlings yield with height of 7 cm increases slightly, but the seedlings yield with height of 12 cm decreases essentially. That's why it is better to grow the pine planting stock in density-average sowings with the seeds seeding rate of 11–12 g on 1 $m^2$, at which the economical seeds consumption will be combined with the optimum yield of standard seedlings.

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