

# FOREST REGENERATION AND FOREST GROWING

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## TECHNOLOGICAL ADVANCEMENT OF SAPLINGS GROWTH IN A FOREST NURSERY

Seedlings planting techniques using the manual planting method into the preprepared slits by trenchers of the tree planting machine and mechanical planting using the machine for seedlings planting S 237 are considered here. It is found out that better growth conditions due to the uniformity of planting in a line and quality of closing up of plants root systems are created using the seedlings machine planting in a school department of a forest nursery.

**Introduction.** The development and implementation strategy of modern intensive agrotechnologies of planting stock growth using the newest mechanization means is determined in the Government program of forestry development of the Republic of Belarus for 2011-2015.

Work is conducted to improve quality and amount of the planting stock being grown, including saplings, in the permanent forest nursery of Negoreloe every year.

Different mechanized techniques can be used while cultivating saplings of wood species and shrubs in school departments of forest nurseries.

To obtain spruce seedlings the seeds are sown in the sowing departments by the sowing machine Egedal model 83 with the seeding norm of 33-58 kg/hectare.

The thinned sowing of seeds is used to grow bigger spruce seedlings, as a result of sowing of 50-60 seeds on running meter of the sowing line and the subsequent cultivation during three years. Such technique permits to diminish expenditures of labour and material resources.

According to the current Reforestation Manual of the Republic of Belarus, it is recommended to use the standard forest planting stock, also including the breeding material with the improved hereditary basis while creating the man-made forests. At initiation of culture of spruce, preference should be given to saplings (2 + 2 or 2 + 3).

Therefore traditionally saplings of wood species and shrubs are grown in the school departments of forest nurseries by relocation of one-, two-year seedlings or of rooted cuttings.

**Research purpose.** The research purpose is the comparative examination of saplings cultivation techniques in the forest nursery of Negoreloe forestry using new sowing machines.

**Main part.** To grow coniferous saplings they put packed schools with band placing, and to grow

ornamental wood species and shrubs they put packed schools with combined placing (combined schools).

In the packed schools the area is used more rationally and planting stock cultivation expenditures decrease. The planting layout (fig. 1) in the packed schools is a band one, normally consisting of two-five lines. Band three-line layout (50×50 - 50 cm) or five-line layout (25×25×25×25 - 50 cm) with the planting space of 10-20 cm are the most widely-spread.

Planting density of spruce seedlings in the school department on sod-podzol loam soils makes 200-400 thousand piece / hectare.

At denser plants placing in the school with the cultivation term of two years and more even with application of root additional fertilizing the output of standard saplings diminishes.

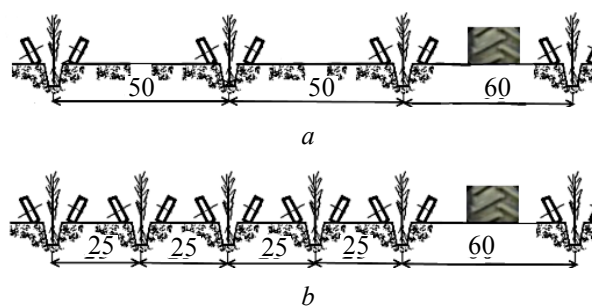


Fig.1. Planting layout in the packed school by the school planting machine EMI-5M:  
*a* - planting according to the three-line layout;  
*b* - planting in the packed school according to the five-line layout

If using the tree planting machine EMI-5M in the five-line variant (Fig.1) the band width on the extreme lines makes 1 m. The band width in that case should be not less than 1,6 m, and that depends on the tractor track, not to damage the grow-

ing plants by wheels while conducting agrotechnical nursing. Such width increase diminishes the producing field area.

Besides, the drive of the planting apparatus is carried out from the power take-off shaft (PTOSH) of a tractor on under speeds, therefore, the tractor should be equipped by a reduction gear to provide the required driving mode to implement the planting space and to exclude gaps at planting.

The combined cultivation in the combined school permits to receive a bigger amount of the better quality planting stock with smaller expenditures. At first deciduous wood species with wide row-spacing are planted, then in the received row-spacings the planting of coniferous wood species or shade-requiring shrubs (fig. 2) is done.

The given in fig.2 layouts are implemented with usage of one-line tree planting machines MT-5, MLU-1, etc., and school tree planting machines SSHP-5/3, ЭМИ-5М, Л-218, and also seedling planters PRM-4, MR-2/4, etc.

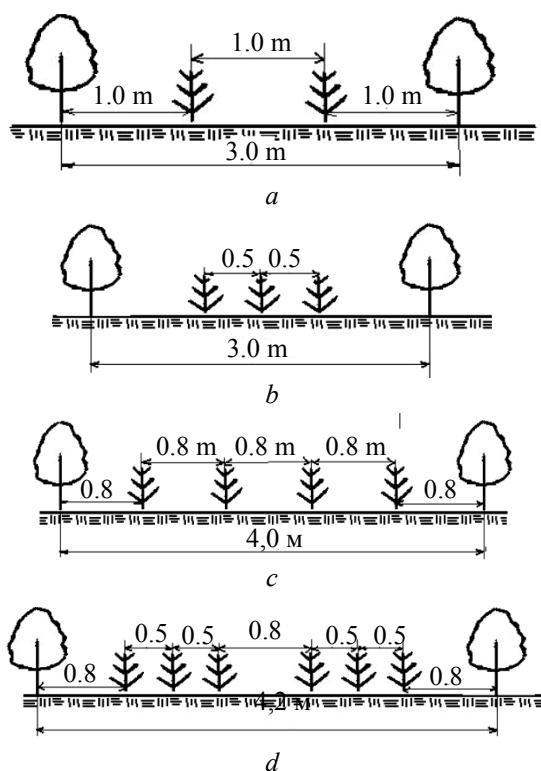


Fig.2. Combined school:

*a* – four-line; *b* – five-line; *c* – six-line; *d* – eight-line

Now also the method of creating of the packed school is used when they make beforehand the planting slots using special disk devices (Fig. 3, *a*) or school tree planting machine with the removed covering mechanism (Fig. 3, *b*). The subsequent planting is accompanied by manual seedlings placing with free planting space.

Recently they began to use seedling planters PRM-4, MR-2/4 in forest nurseries.

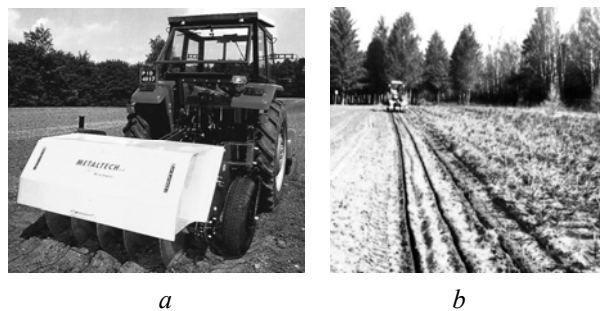


Fig.3. Making slots for planting:  
*a* – by a disk slot-maker; *b* – by a school planting machine EMI-5 (three-row modification)

Machine S 237 (Fig. 4) has two planting sections, fastened to the frame by a hinge. Sections on a frame can be moved, thus, adjusting row-spacing by the required planting layout. The drive of disk planting apparatuses is carried out from the right running roller with the help of the tooth gear. The regulation width of row-spacings is 51-109 cm. The planting space is 20-120 cm. The trencher depth stroke is 25 cm. The travel speed is 1 km/h.



Fig.4. Seedling planter S 237

For saplings planting of wood species and shrubs, including the ornamental ones, there is production of domestic one- and two-row planting machines - PM-1C, MPS-2M, tree planting machine MT-5, and also seedling planter S 237 (two-row packaging) and S 237/1 (four-row modification) AGROMAX (Poland). However it is still not enough experience of their application as compared with school planting machines.

For development of seedlings planting technique while growing planting stock in the packed school and for adaptation of the given type of machines to the application conditions in the forest nursery, researches were conducted and the seedlings planting technique was developed while creating the packed school. Seedlings planting layout is given in fig.5.

Unlike the layouts applied earlier (see Fig.1) while using the experimental pilot machine S 237 it is possible to do planting in two- or four-row variants (Fig.5, *a*, *b*). And it is possible to receive

the four-row layout using the two-section machine with the appropriate adjustment of sections.

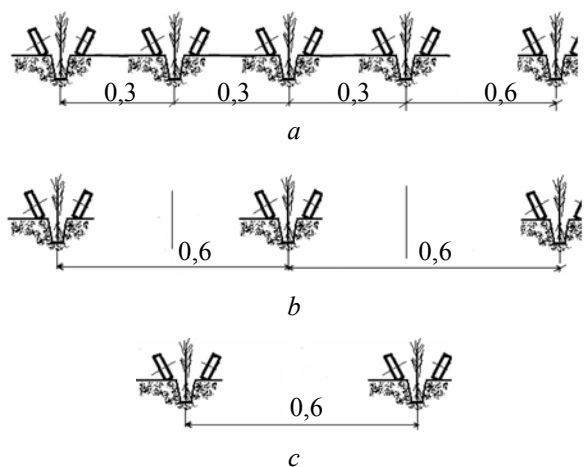


Fig. 5. Seedlings mechanized planting layout in the forest nursery by machine S 237

For its realization it is necessary to do adjustment according to Fig. 6. The machine should in both directions on one band to receive four rows on a band.

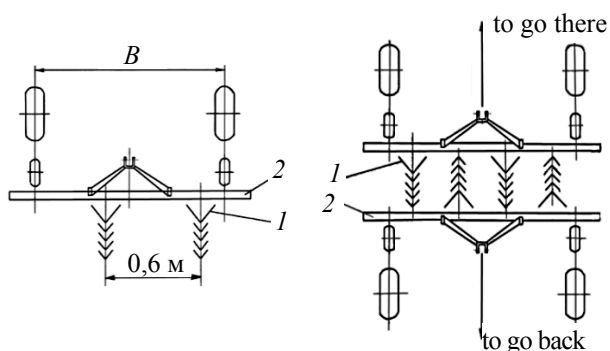


Fig. 6. The machine adjustment layout with two planting sections on the four-row planting band

For comparative research of the saplings cultivation technique in the forest nursery of Negoreloe forestry enterprise in the equal growth conditions on one field with the area of 0.4 hectare there was done planting of sorted beforehand seedlings of spruce having two, three years, which were received using the thinned seeds planting in the sowing department.

The field is divided into two areas, where in the first case there was used manual planting technique into the made beforehand slots with the three-row layout (Fig. 7, a). Such technique ensured usage of seedlings having the asymmetrical crone, bending of little trunks and the size which is not suitable for mechanized planting, i.e. seedlings, remained after sorting, for their planting on the second area using the machine S 237 (Fig. 7, b). The planting space in both cases was 20 cm.



a



b

Fig. 7. Planting of the packed school: a - manually in the prepared slots; b - by machine S 237

Preliminary research of growth progress (Fig. 8 and Table) showed that during the vegetation period from April till October the spruce saplings increase on both variants was about 9,7 - 9,9 cm. Diameter of the root collar was 7-8 mm and average saplings height was 28.5 cm.



a



b

Fig. 8. Experimental areas of the packed school: a - after manual planting into the made slots; b - after planting by the machine S 237

**The main biometric indexes of the planting stock**

Species	Age, years	Little trunk height, cm				Diameter of the root collar, cm			
		$M + m$	$\sigma$	$V\%$	$P\%$	$M + m$	$\sigma$	$V\%$	$P\%$
Common spruce	1	$3.1 \pm 0.03$	0.4	12.9	1.3	$0.6 \pm 0.01$	0.1	14.3	1.4
Common spruce	2	$11.2 \pm 0.14$	1.2	13.2	1.4	$1.4 \pm 0.02$	0.2	13.3	1.3
Common spruce	4	$28.5 \pm 0.8$	6.0	21.8	2.33	$7.1 \pm 0.12$	1.2	28.6	2.9

**Conclusion.** With usage of machine S 237 the transition to the planting layout of four-row bands (Fig. 8, *b*) increases the planting stock output by 33 % in comparison with the existing technique of three-row planting and with the manual handling of planting stock (Fig. 8, *a*) and diminishes production expenditures in comparison with the considered techniques.

It is also necessary to say that in equal growth conditions, and also with usage of machine planting the sorted planting stock of a smaller size was used which was different in height; as a result in

both areas there is saplings sizes leveling on height during this period of vegetation. Hence, at machine planting of seedlings at school there are better growth conditions, because of the uniformity of planting and qualitative closing up of the plants root systems.

Application of both techniques at saplings cultivation permits to use all planting stock grown in the sowing department as the seedlings sizes have essential differences and influence quality of the machine planting.

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