

**Introduction into the Subject of scientific research.
On the basis of the reports presented at the scientific conference**

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TREE PLANTER DESIGN IMPROVEMENT

M. V. Shavkov, N. I. Bazarskaya

FSBEI HPE «Voronezh State Academy of Forestry and Technologies»

mikhvit737@mail.ru

Woods constitute an important part of Russian economy, being the main source of material for various industries and agriculture. In some regions the money received from woods – growing as well as wood processing make major item of their budget.

Nowdays despite large national wood reserves exploitable forests in the vicinity of wood – processing centers are exhausted.

Evergrowing demand of wood is mainly satisfied at the expense of inclusion into the turnover of new forest plots situated on a distance from the centers of wood – processing. It causes extra expenses associated both with roads construction and wood transportation and manufacturing, making the development of such plots unprofitable. The price of the raw wood increases alongside with the extra turnover of woody areas. Consequently, not only the cost of raw wood increases, but more and more new wood plots get involved into a commercial turnover.

In the Russian southern regions poor of woods, the forest areas are treated first and foremost from the point of view of creating comfortable conditions for life and work of the citizens. Protective afforestation, typical for these regions creates a natural barrier preventing areas deterioration and promoting the renewal and fertility improvement of soil.

Because of abnormal hot weather of 2010, big forest territories were destroyed by

fires, which increased the volumes of subsequent forest planting works.

Forest is a renewed resource, therefore silviculture and protective afforestation should be in the focus of foresters' attention.

Forest restoration as well as replenishment of forest stocks will remain the state priority for the next years. To provide high quality wood planting in a short period of time if is necessary to apply highly technological equipment and machines.

To establish seedlings and saplings of wood species the forestry implements tree planters. Modern tree planters consist of three main units, each of them fulfilling its own function: a trencher making a trench; a planting mechanism submitting a seedling to a trench and covering rollers sealing up the soil and consolidating it around the plant roots. Thus the quality of planting directly depends on the mutata coordination of work of the above mentioned units.

Proper operation of a tree planter presupposes fulfillment of the following requirements: a) zero speed of a seedling relatively the earth surface in the process of it's covering; b) good soil consolidation around the root system; c) and vertical position of a planted seedling.

However, present day tree planters do not answer these criteria: in the process of planting the seedlings are inclined more than

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30 degrees, the root system is deformed and sealed up by the covering rollers inadequately.

The modern tree planter implement a rotary – radial planting mechanism submitting a seedling into a seedling pocket and having a circular trajectory of movement. This mechanism guarantees zero speed of a seedling only in a position of vertical diameter. However, in reality a seedling together with the seedling pocket is moving along the circumference arch getting in this process an angular acceleration. Thus the seedling in the moment of release from the seedling pocket is being slightly dragged which brings about plants deformation and consequently deterioration of their striking.

The solving of above mentioned problems is associated with the technology of tree planting as well as the functions of tree planter main units.

In particular, a trencher, being one of three main blocks, carries out the function of trench formation. This function is realized in the following way: the upper layer of soil collapses into the bottom of a trench during the passage of a trencher, the soil collapse being insignificant and covering the root system only partially.

Then comes the turn of covering rollers, which in their turn fulfill two functions, while forming the soil wave: the first one of sealing up the trench, and the second one of consolidating soil around the plants roots.

In the result the trencher is sealed up by two soil streams directed towards each other, both from the covering rollers and a collapse of the top soil layer. The main task here is to find such a distance between the rare trencher side and covering rollers that the soil wave

from the covering rollers could not prevent after trencher soil collapse. This distance depends on the unit speed, increasing on the damp and consolidated soil.

However, rotary – radial planting mechanism guarantees a seedling still and vertical position only in one point. Hence, it should be positioned in such a way, that the seedling pocket could forward the seedling to the part of the trencher, where the particles of the upper layer collapse alongside with the movement of soil wave from the covering rollers. It is of special importance, because otherwise the plant can be forwarded into the trencher until top soil layer collapses, being unfixed in vertical position, it will be covered by soil wave.

On the other hand, the forwarding of plant into the trench after the upper dried soil layer has collapsed will not guarantee the set depth of root neck sealing, provoking its deformation. Thus, the application of existing tree planters on different types of soils and at various high-speed modes demands additional adjustment for mutual units work coordination.

It is important to note that the top soil layer is usually dried and getting into the trench bottom, it creates air cavities negatively affecting the plants striking. In its turn, the soil wave from the covering rollers influences on the seedling mechanically, inclining it in the direction of planter's movement.

To solve the above mentioned problems, it is recommended to make some improvements in the construction of existing machine, which concern both planting technology and function of individual units.

Firstly, a trencher should be provided

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with additional functions. Our experiments make us believe that a trencher alongside with making a trench should also seal up the root system. This additional function can be realized with the help of earth – sealing ports in the trencher's walls, their purpose being to

forward the soil from the bottom and middle layers into the trench (Fig. 1). In this case we shall exclude the falling of upper dried soil layer responsible for air cavities, into the trench bottom [1].

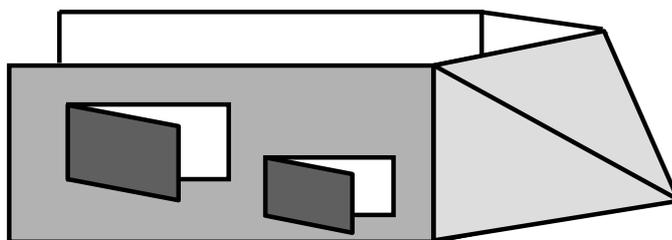


Fig. 1. Model the combined trencher with earth – sealing ports

The second improvement concerns the construction of planting mechanism. As it was pointed out earlier, the main problems here is in pertaining of a zero speed by the seedling from the moment its forwarding into a seedling pocket up to the complete sealing of its root system. This problem can be successfully solved with the help of chain joint planting mechanism having a horizontal part of seedling pocket movement (Fig. 2). This construction of a planting mechanism provides the seedling with a permanent zero speed throughout planting process.

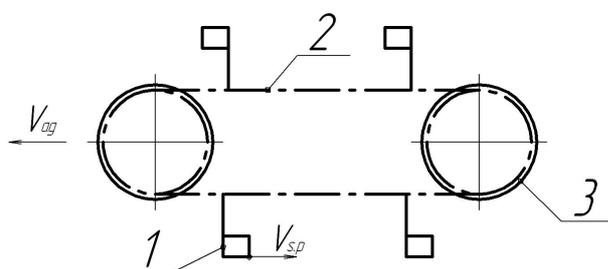


Fig. 2. The scheme of chain planting mechanism: 1 – seedling pocket; 2 – chain; 3 – turnstile

Finally, the covering rollers have to carry out only one function; that of soil consolidation around the roots.

Thus the application of combined trencher with earth – sealing ports provides:

- covering up of the root system inside the trencher, eliminating the formation of the soil wave negatively affecting the seedlings;
- distance reduction between a rare trencher side and covering rollers, diminishing the machine steel intensity;
- stable work of a tree planter on various types of soils and at various high-speed modes.

However, all these strong points of a tree planter can be realized only after precise calculations and parameters optimization of earth – sealing ports. We plan to make these calculations a goal of the next stage of our explorations.

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