TOOLS FOR HAND PLANTING

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Why Hand Tools?

Planting machines are great labor-saving devices where the terrain is favorable to their use. Men are usually more willing to work with machines--the work appears to be, and often is, lighter. However, there are planting sites where the terrain or surface obstructions make machine planting impractical. The s t e e p, rough, stoney lands--often burns and cutovers--are the very places that planting today seems justifiable. On these lands hand tools are usually a must.

Progress in Improvement of Hand Tools

By and large the same hand planting tools used in the United States 40 to 50 years ago are still being used (see figs. 1-3). The planting iron, or wedge-shaped bar, does well in sand and in planting pine, but it is an inadequate tool for planting spruce or for use on rocky ground. The grub-hoe, mattock, spade, and shovel have been used in hand planting, but were made for other purposes.

Weight of Hand Tool--a Disadvantage

One of the main objections to hand tools, and curiously little realized, is that they are too heavy. The average laborer, accustomed to using a heavy pick or a mattock, is prone to use the weight of the tool to drive it into the ground. Merely raising the tool expends considerable effort. The force usually bears little relation to that needed to plant a tree--at least in planting in the Northeast.

What is needed is a horizontal or nearly horizontal cutting blow to scalp the sod followed by a light blow to sink the blade 44 to 6 inches into the soil to open a hole. Where the sod is

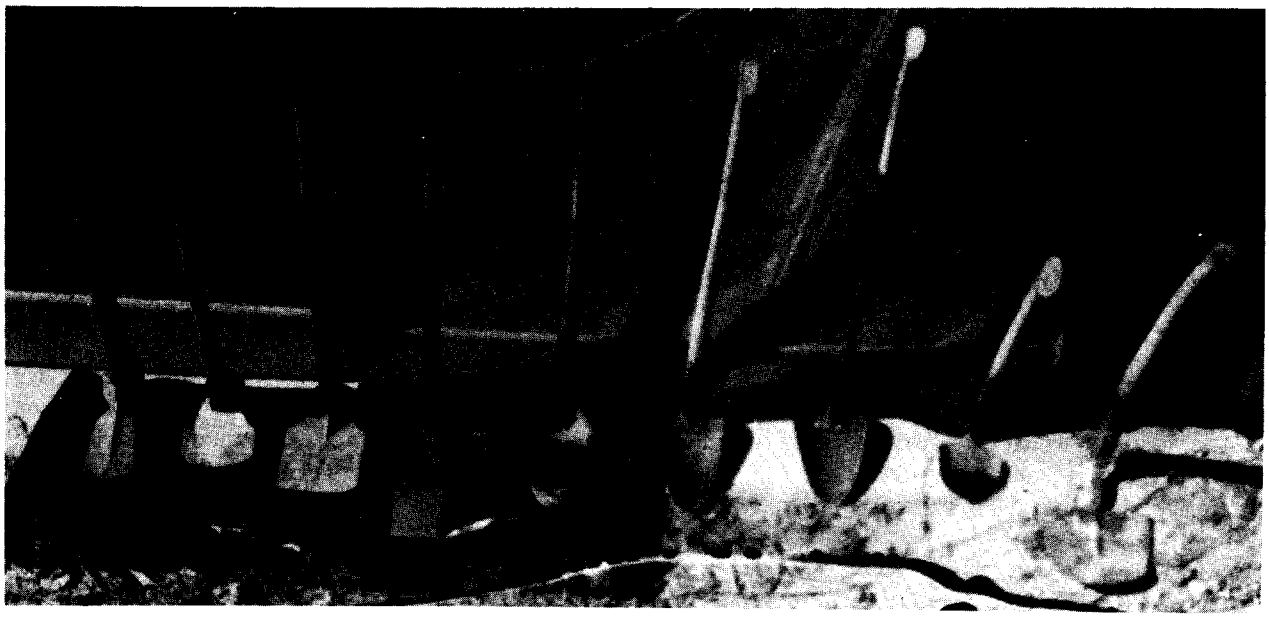

Figure 1.--Top View of Planting Tools. (Left to right) common grub-hoe; original Heiberg hoe; modified Heiberg hoe; western grub-hoe; SFI Swedish curved hoe, 1960; SFI Swedish curved hoe, 1964; "Swan-neck" 1965 model Swedish hoe; one-hand Swedish planting hoe; Swedish sod-scalper hoe.

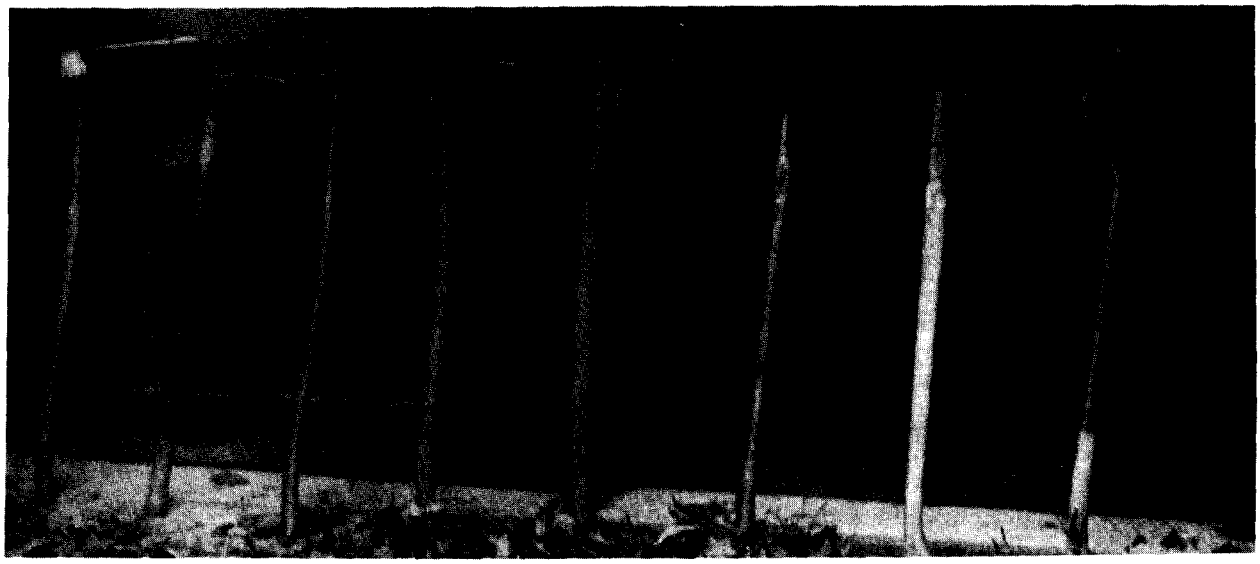

Figure 2.--Side View of Planting Tools. (Left to right) Western grub-hoe; common grub-hoe; original Heiberg hoe; modified Heiberg hoe; Swedish sod-scalper; SFI 1960 Swedish curved hoe; SFI 1964 Swedish curved hoe; "Swan-Neck" 1965 Swedish curved hoe.

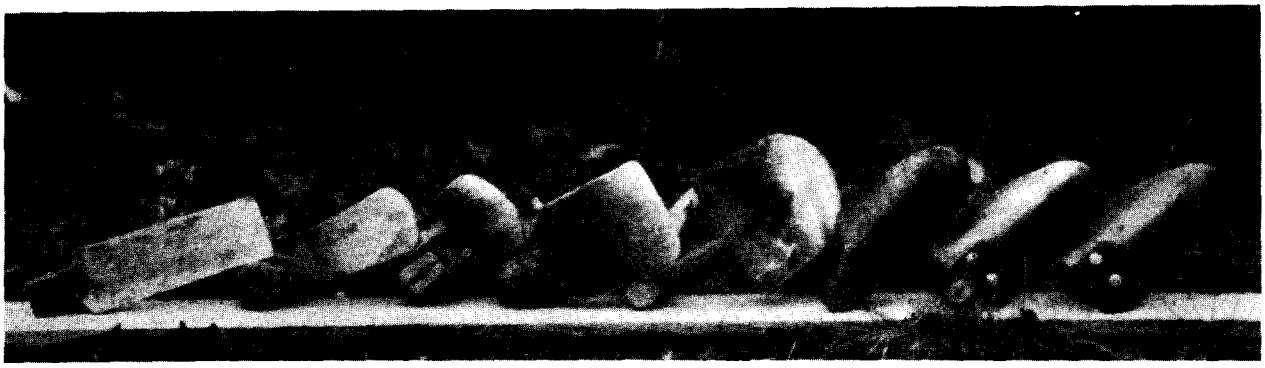

Figure 3.--End View of Blades. (Left to right) Western grub-hoe; common grub-hoe; original Heiberg hoe; modified Heiberg hoe; Swedish sod-scalper; Swedish "Swan-neck" curved hoe; Swedish SFI 1960 curved hoe; Swedish SFI 1964 curved hoe.

light or absent, the first motion can be omitted. All these motions are carried out better by a light tool that can be guided accurately and that will require a minimum expenditure of energy. While it is often difficult to retrain a worker used to heavy mattocks to use the lighter tools, it is possible to quickly train high school and college boys in their use.

Measurement of Physical Effort and Efficiency

During the past decade, Prof. Sundberg, Georg Callin, their coworkers in Sweden, and others in western Europe have measured the motions used in planting and shown that by using the tools more efficiently these could be reduced in number. They also measured the weights lifted and the muscular force used. Physiologists have measured the physical effort required by different planting methods and that required by using different tools with the same method. The studies were used to develop new tools to provide the maximum effect with the least effort. Both tools and methods have been in practical use in Sweden for several years (Callin and Hansson 1959; Callin 1962).

New Swedish Tools

In Sweden[1] planting is done by contract which is awarded after competitive bidding. The planting agency (often the government) can usually lower costs by placing efficient tools in the hands of the contractor and instructing him in their use.

Weights of Planting Tools
(including handles)

Swedish one-hand hoe	1 lb. 11 oz.
Swedish 1965 swan-neck hoe	3 lbs. 4 oz.
Heiberg original model hoe	3 lbs. 4 oz.
Swedish 1964 model curved hoe.	3 lbs. 7 oz.
Swedish 1960 SFI curved hoe	3 lbs. 8 oz.
Heiberg modified model hoe	4 lbs. 3 oz.
Swedish sod-scalper (Jonstorp).	4 lbs. 8 oz.
Common spade	4 lbs. 12 oz.
Hazel hoe (forest fire tool)	5 lbs.
Western grub-hoe	5 lbs.
Common grub-hoe	5 lbs, 9 oz.
Swedish planting auger	6 lbs. 4 oz.
Common axe mattock	8 lbs.

For this reason the Swedish Forest Experiment Station has been conducting a planting methods study for several years. From the results of this study the SFI tool[2] and its various modifications were developed (figs. 4 and 5). Actual measurement showed a greater force was necessary to tear off a slab of sod than to cut it off. The SFI tool has sharp cutting edges on the sides so the sharpness is not dulled when digging with the point. A gouge or spoon-shaped tip replaces the flat or curved grub-hoe blade. It is claimed that a man can plant seven trees per minute in grass land with this tool after only a few minutes training.

The Station made a modified model with a hinged blade so that it can be used as a straight dibble or can be jammed vertically into a brush pile, and then with the head swung into a position at right angles to the shaft and locked, planting can be continued as with an

Figure 4.--Swedish "Swan-neck" 1965 model planting hoe.

[1] Examples in this article are drawn mainly from Swedish experience since the author is most familiar with them.

[2] Initials stand for Skogs Forsknings Institut, which is now combined with the Swedish Forest School.

Figure 5.--Swedish Planting iron (left) and one-hand planter (right).

ordinary hoe. In March 1965, a further modified model[3] was introduced. It has a gooseneck steel tube on the end of a light hickory handle to which the blade is attached. The advantages of the goose-neck is that in opening holes in stony and rooty ground, the handle does not strike the obstruction.

The procedure for planting with this tool is:

1. Place the plant container diagonally forward of the left foot, which is ahead of the right foot.
2. With the left hand, grasp the hoe handle near the blade (if the person is lefthanded, reverse all lefts and rights). Raise the hoe blade to the horizontal or slightly above and cut off a 1-inch slab of sod by striking the blade on its side against the turf. (This step can be omitted where ground cover is light or non-existent.)
3. Strike the blade vertically into the bare mineral soil, the handle coming almost parallel to the ground.
4. Bring the right foot up under the curve of the handle.
5. Grasp a seedling between the left thumb and forefinger by the root collar.
6. Push the handle up, forward, and to the right without removing the blade from the soil.
7. Transfer the weight of the body to the left foot, the right foot resting on the heel. Put the plant into the hole with a shipping motion, drawing the plant to the left edge of the hole.
8. Lift the blade of the hoe and scrape any adhering soil off against the toe of the right boot.
9. Firm the soil with the right foot, striking the heel sideways if necessary to pack the tree firmly.
10. Grasp the plant container with the left hand and take two paces forward. Repeat the process.

[3] Manufactured by Edsbyns Industri A/B, Edsbyn, Sweden. Cost: 15 sv, kr. ($ 3.00).

Costs and Results

The costs of planting with the light SFI tool differed insignificantly from the costs of machine planting on sites with smooth ground adapted to machine planting. Survival and initial growth of the hand-planted trees were greater than those that were machine planted. However, the greatest advantages of handplanting are that it can be used on any type of terrain, the tools are low in cost, the tools are always available, and they can be used for other purposes (e.g. fire line construction).

Conclusions

Manual planting will probably continue to be used in reforestation planting in the Northeast. Using high-cost selected or "improved" seed will necessitate growing the seedlings in

nurseries rather than direct seeding. In many such cases, even on smooth land, careful hand-planting will be preferred to machine planting. In repair planting (replacing dead trees) hand-planting is also used. The newer, specially designed hand-planting tools should reduce planting costs and lower the opposition to hand labor.

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