MECHANICAL SEEDLING LIFTER

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This paper will deal primarily with the construction and operation of the seedling lifter developed in Florida by the Division of Forestry. My first thoughts, when thinking about mechanical seedling lifters, actually revert to the mid-60's when the Georgia Forestry Commission first constructed a mechanical seedling harvester. This, of course, was a first step, and represented quite intensive and extensive work by that state. To my knowledge this was the first such trial machine for this operation.

I must also consider the efforts which were put forth by the Forestry Department of New York State when they built a similar machine based on the Georgia design.

There has been, as we all know, a considerable amount of work done toward solving the problem of lifting seedlings. Mr. King, in Virginia, following the efforts of New York State, continued and did not give up the idea, and I am sure now has in operation a very successful seedling lifter.

The progression of trial and error was necessary to the development of a seedling lifting machine, due to the limited marketing potential for a machine built solely for nursery seedling lifting. The machine built by the Florida Division of Forestry did not go through the progression as mentioned earlier, but I am sure capitalized upon many of the original ideas set forth for a seedling lifter.

Since most nurseries were limited as to the funds available for purchasing equipment of this type, any machine developed had to be inexpensive and cover a wide spectrum of soil and weather conditions. Competition for nursery labor and general inflation contributed a great deal to the progress which has been made toward mechanical seedling lifting.

In the late 60's, most nurserymen could see that some type of equipment would be needed in order to reduce costs and also to accomplish the most difficult job on their respective nurseries--lifting seedlings. In light of this, the U.S.F.S., in cooperation with many of the eastern states, built a prototype seedling lifter during the summer of 1969. This gave a sense of urgency to machine development and encouraged more thought and work toward principles which might be used in developing such a machine.

Aaron Jordan, with the Florida Division of Forestry, had an idea which he thought could be developed into a practical and inexpensive seedling lifter. After viewing the prototype machine built by the U.S.F.S., and visiting the Virginia Division of Forestry for the purpose of observing their machines in operation and discussing his ideas with Mr. King, he decided at that time, to proceed with the development of a machine along the lines of his original idea.

The Florida machine was begun in the late Fall of 1969; the basic principle was to lift a single drill from a seed bed, using opposing triple ribbed vee belts, backed with neoprene rubber, with power being supplied from the tractor PTO shaft.

It was envisioned that this machine would, if successful, be converted into a dual drill machine. This prototype was completed in mid-December and put in operation at the Herren Nursery in South Florida, and some minor deficiencies were corrected. For normal field operations, the machine was considered operational at that time.

The greatest problem at this time appeared to be the turning radius of the machine, and it was taken, late in the season, to the Lake City Central Shop. It was re-designed by locating the wheels at the midsection, rather than at the rear where they were first located.

Based on this initial design, two dual drill seedling lifting machines were constructed the following year. The new machines incorporated minor changes in the design of the root knockers, in addition to reducing the speed of the conveyer belt which moved the seedlings to the rear of the machine. A revolving type rack was designed which would hold 20 tubs on each machine for seedling storage while the machine was in operation. The 20 tubs allow the machine to make a complete pass over a six-hundred foot bed and are then loaded onto a trailer at the field turn-around point.

These two machines were fully operational during the 1970-71 lifting season. Basic problems encountered were primarily in the areas of chain and sprocket wear and PTO shaft whiplash at high speeds. Additional problems during this year were encountered with the neoprene backing which was used on the triple ribbed belts--no glue compound could be found which would satisfactorily bind the belts with the neoprene, and operations required a quick turn-around on belt resurfacing, in addition to a large stock of belts which were needed to keep the machine in operation.

Before entering the 1971-72 seedling lifting season, the Mathis Plow Company in Lake City, Florida, had built a dual drill machine on the Florida principle for the Hiwassee Land Company in Calhoun, Tennessee. This machine utilized hydraulic motors for power. The hydraulic motors were supplied with hydraulic fluid from the tractor's hydraulic system.

The division at this time was considering hydraulic power to replace the chain and gearbox system, and a trip was made to Tennessee for the purpose of observing the hydraulic machine. Upon seeing the problems encountered with the hydraulic system at Hiwassee Land Company, we determined that our best approach would be to use a system which separated the machine's hydraulic power from that of the tractor. We then contacted hydraulic manufacturers and purchased a pump to work on a tractor PTO shaft to supply the needed hydraulic fluid to power the seedling lifter motors.

A new machine was constructed before the 1971-72 lifting season, utilizing all hydraulic power and in addition, one of our older chain driven machines was converted to hydraulic power.

In the construction of the new hydraulic powered machine, the seedling pickup heads were re-designed to utilize a spring loaded principle. This, we found, highly reduced the amount of time needed to make field adjustments on pickup heads. Seedling root knockers were also properly shielded and mounted with sealed bearings. Each hydraulic motor contained a separate speed control valve, which allowed us more flexibility with the operation of the machine than we had previously.

As of this time, we do not envision any major changes or improvements on the machine. The belt problem has not been licked, but we feel that belts are now acceptable, as we are able to lift seven to ten million seedlings with each set.

COST

It would be difficult for me to give you an accurate machine cost, since the Florida Division of Forestry does not include the labor cost as a part of the seedling machine construction cost. The most recent machine constructed was built at a cost of $2,900.00 for materials.

PRODUCTION

Seedling lifting capacity and production figures vary somewhat as to seed bed densities and soil types. Our maximum production for a dual drill machine in an eight-hour-day is 800,000 seedlings. A more realistic figure to expect would be from 500,000 to 700,000 seedlings. This production is obtained with three people; two located on the machine itself and a tractor driver.

In summary, I would have to say that our machines have worked quite well, although they are not completely trouble free at this time.

There were eight in operation of this design last year, and I understand that three more are under construction. I understand that Rayonier contracted for the construction of a machine which utilized its own power source to operate the hydraulic system.

I believe that Union Camp Corporation has installed remote steering on their machine, which allows the operator to sit over the pickup heads and drive the tractor from that point.

With all these modifications and changes, I would anticipate that seedling lifting machine development will not stop here. This is by no means the final product, and I sincerely hope that each individual nurseryman will continue to strive for better ideas and more efficient machines to accomplish the lifting task.