TREE SEEDLING LIFTING MACHINE

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BACKGROUND

In 1958, in Georgia Dr. Rice and Sanford Darby produced the first seedling harvester that I am aware of in this country.

Some ten years later we are all enthusiastic about mechanical seedling harvesting. This speaks volumes about the foresight of these two gentlemen.

Bud Terrell from New York came down to Georgia and took lots of pictures of the Georgia harvester and with advice from Dr. Rice and Mr. Darby built a second generation harvester.

Neither of these machines functioned without problems at home. Bill King from Virginia borrowed the New York machine in the spring of 1968.

Through the urgency of inadequate labor to meet their shipping schedules and persistence by their personnel, Virginia was able to harvest about 20MM seedlings with this machine.

The machine was demonstrated at a workshop in Virginia in March 1968. The proposal for investigation and development of a seedling lifter is largely a result of that workshop and the response by State Foresters nationally to the Virginia State Foresters' call for support. The response was immediate and positive.

The objective of this project is to develop a tree seedling lifting machine or machines which will meet the requirements of state, federal and industrial forest tree nurseries nation-wide.

A cooperative venture to develop a suitable seedling harvester was initiated. Financing is from cooperative state and federal funds, and the national forest system. Responsibility for development was assigned to the Missoula Equipment Development Center, Missoula, Montana.

Performance and Other Features Required

These tentative requirements were formulated, investigated and are subject to change as necessary.

(a) General Nursery Conditions

Soil type: Sandy Loam

Slope: Not a factor

Moisture content: 12 - 18% at field capacity

(b) Nursery Layout

Beds are usually four feet in width with 16" to 24" paths for over-the-bed vehicle travel. Equipment with wheels centering 65" to 72" is used.

Seedlings are drill sown in bands, spacing between bands may be 6", 8" or some other uniform spacing. Six, seven or eight rows per bed may be encountered with eight being most common.

Seedling density in the band or drill row will vary from 10 - 25 per linear foot of row. Rows or bands may be from one half inch to two inches wide.

Density may be increased proportionately in beds with less rows.

(c) Tree Species

The lifting unit must be capable of lifting pine, spruce and fir species varying in size from 1/8 to 1/2 inch stem caliper at ground line. Height will vary from 3 inches to 15 inches from ground line to tip of terminal bud. Certain pine, spruce and fir species will have developing lateral branches along the main stem which the lifter must be able to accommodate; these branches will exceed three inches in length for some species.

(d) Operation

A lifting device should be able to undercut the seedlings at variable depths from 6 to 10 inches, extract the seedlings from the seedbed, remove 95% of the soil and

elevate them to a position where they may be further transported or processed, The lifter must be designed to accomplish this in over-the-bed operation and discharge of lifted seedlings at a point to allow above-the-bed consolidation for further transporation and/or processing.

A modular concept should be considered in the development. A successful lifting device will be used in nurseries of various size, from one million to fifty million annual capacity. The development of modules or single units with minimum cost, maintenance and operational features would meet the requirements of more nurseries than an expensive high capacity unit.

(e) Seedling Damage

Damage to roots, stems and buds cannot be tolerated. Retention of fibrous roots and mycorrhizal root associations should be a principle concern.

As a standard, seedlings should exhibit no more damage than occurs during conventional lifting methods when performed by trained nursery workmen.

(f) Operation Capacity

The basic lifter unit should be capable of sustained operation with output in a seven hour day of 400 to 500 thousand seedlings . This requires the lifting of 3,500 to 4,200 linear feet of bed per day or in terms of drill rows 28,000 to 33,600 feet of drill row.

(g) Mechanical Considerations

In order to keep the lifter unit cost at an acceptable level, an attachment suitable for category II, three point hitch should be considered. This is a standard hitch unit in use on most nursery equipment. The lifter unit should be developed from as many standard or readily available components as possible with particular emphasis in this regard on high maintenance parts

Status of the Project

A committee was selected to furnish the development center assistance and technical information concerning nursery operations.

Members are:

E. G. Terrell – New York

G. W. King – Virginia

D. F. Williams - National Forest System, Intermountain Region

Coordinator: S. H. Hanks – S&PF, Northeastern Area

Engineers from the Development Center have viewed the Georgia type harvester at the New Kent Nursery in Virginia.

Numerous contacts in person and by letter have been made with nurserymen, in various parts of North America.

Recently a visit was made to the Indianhead, Saskatchewan nursery to view two seedling lifters. One a two row model designed for harvesting 2 year old deciduous material. It is a self-propelled device, undercuts two rows at a time (32" row spacing) lifts the trees and places them, facing one direction, in a bin. The machine lifts empty bins placed ahead of it and drops full bins in the field behind. The machine has the capability of harvesting eight acres per day or from 800,000 to 1,000,000 seedlings. This machine has been in use for several seasons and is thoroughly operational.

The second machine is new having been used only one season. It was designed to harvest four year old conifer transplants, 5 rows at a time, with row spacing of 11".

A machine called the "Plantlift" developed in Holland was encountered in searching the literature. This machine is designed to lift a single row from a bed, remove the soil, elevate and tie in bundles. In operation it straddles a nursery bed and lifts from the adjoining bed.

This machine is now being sold in North America by TIMM Enterprises 1599 Winston Churchill Blvd., Oakville, Ontario, Canada. Advertisement for this "Plantlift" first appeared in the American Nurseryman, July 1, 1968 issue.

An asparagus harvester investigated by the engineering staff yielded some good ideas and a possible manufacturer of a seeding harvester.

I am optimistic that a suitable mechanical harvester can be developed. Tentative scheduling by the Missoula Equipment Development Center (MEDC) calls for trial under actual working conditions during the 1969 shipping season. We hope that a prototype can be field tested in the South, Northeast, Intermountain and Western areas of the country during 1969.

It is doubtful that a first generation harvester will meet all the requirements. However, it is expected that 2nd or 3rd generation harvesters will accomplish the seedling lifting job.

The Development Center functions in eight phases for the development of new equipment.

Phase I	Investigation, problem analysis, determination of requirements.
Phase II	Design studies.
Phase III	Design pilot model and prepare test plans.
Phase IV	Performance, reliability and functional tests .
Phase V	Trial use under working conditions.
Phase VI	Modification and retest as necessary.
Phase VII	Handbooks, training aids, project reports specifications and purchasing arrangements .
Phase VIII	Demonstration and training courses.

There has been a change in philosophy on the part of nurserymen since Dr. Rice and Mr. Darby developed this harvester, At that time, and to some extent even now, some nurserymen feel that a machine must lift from a bed as we commonly recognize it. Some are rigid in their feeling that a harvester must lift an entire bed at once.

It would seem that a lifter which will operate successfully offers such savings that we can afford wider spacing to accomplish mechanized lifting.

Nationwide, nursery programs are 30 to 60% smaller than during the peak period of 1958 - 1962. It would seem that space exists in most nurseries for wider spacing if that is necessary to accomplish mechanization. This has been confirmed by comments from several areas of the country.

It seems doubtful that production will again reach the peak levels of the 1958 - 1962 period. Instead of quantity our reforestation efforts have shifted to quality production with genetically improved seed. Even though the quality of our product has increased and the cost of all facet of nursery operations has increased we must do everything possible to hold nursery stock prices to a reasonable level.

The lifting and packaging operation in nursery practice contributes about 50% of the cost of producing seedlings It seems quite logical that opportunities for cost reduction are greater in this part of our operation than any single part of the nursery business.

I am optimistic that a suitable mechanized lifter will be the result of current cooperative efforts.