What's New with Nurseries and Reforestation Projects at the Missoula Technology and Development Center?

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Abstract: The USDA Forest Service Missoula Technology and Development Center (MTDC) offers technical expertise, technology transfer, and new equipment development to federal, state, and private forest nurseries. Current and recently completed projects at MTDC include a front and mid-mount tractor evaluation, ATV-pulled mechanical tree planter, greenhouse snow remover, freeze chamber, brush cleaner improvements, greenhouse crop mower, non-chemical vegetation control, pine seed screening, evaluation of single seed planters, wireless soil moisture monitors, herbicide shield for spraying irrigation pipelines, and rotary lasers.

Keywords: nursery equipment, freeze chamber, seed screening, moisture monitoring, herbicide

Introduction

USDA Forest Service Missoula and San Dimas Technology and Development Centers (MTDC and SDTDC) help solve problems identified by field employees of the USDA Forest Service (USFS). For 60 years, both centers have been evaluating existing technology and equipment, developing equipment prototypes, and conducting technology transfer through their reports, Web sites, videos, and DVDs. The reforestation and nurseries program is located at MTDC in Missoula, MT. The principle focus of the nurseries program is to develop new equipment or technology to improve nursery operations and processes. The program is sponsored and funded by the USFS Forest Management staff group at the Washington Office (Washington, DC) and through State and Private Forestry. Our focus is applied technology and technology transfer. We do not conduct research, but sometimes we apply research findings to help solve on-the-ground problems. Projects typically last from 2 to 4 years depending on their complexity. Equipment-based projects are field tested and fabrication drawings are made so the equipment can be duplicated by other nurseries. We document our projects through printed reports or journal articles that are available from MTDC. You can find our drawings and reports on our website (URL: http://www.fs.fed.us/eng/t-d.php).

Following are some current nursery projects that may be of interest to you.

Front and Mid-Mount Tractor Evaluation

Project leader Gary Kees is evaluating a Saukville diesel tractor for replacement of the old Allis-Chalmers Model G tractor. It has been fitted with a belly mower and S-tine cultivator. A basket weeder and sprayer are being adapted to the tractor. Field testing is ongoing in 2010 and 2011.

Figure 1. Saukville diesel tractor.

ATV-Pulled Mechanical Tree Planter

Project leader Gary Kees tested ATVs to pull a mechanical tree planter at USFS Lucky Peak Nursery (Boise, ID). He found that a UTV was needed to pull the transplanter. Modifications to a Holland hand transplanter (Holland, MI) is in the design-and-build phase. Field testing is planned for fall 2010.

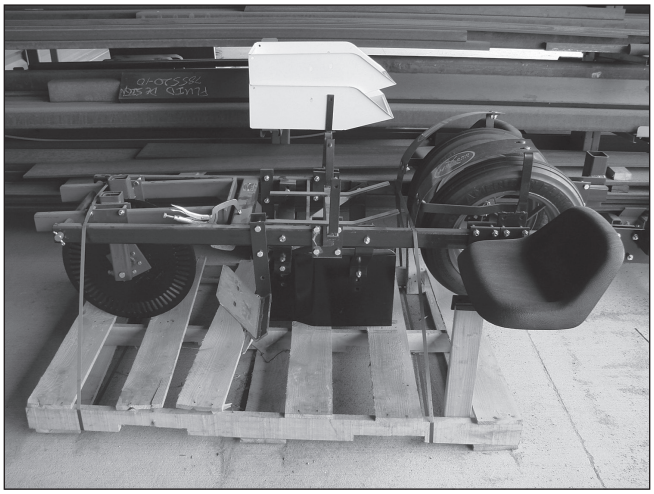

Figure 2. ATV-pulled mechanical tree planter.

Greenhouse Snow Remover

USFS JW Toumey Nursery (Watersmeet, MI) currently uses a long-handled broom with a styrofoam block to pull the snow off of their greenhouses. MTDC project leader Mary Ann Davies is investigating alternatives. IceClear®, a bio-based propylene glycol, was sprayed onto the greenhouse plastic, but the results were not satisfactory. The use of mechanical vibrators was examined but it was decided this would be too expensive and could damage the greenhouse structure. In winter 2010, a heating cable attached to the top of the greenhouse that heats the air space between the two layers of plastic will be tested.

Figure 3. USDA Forest Service, JW Toumey Nursery greenhouse in winter.

Freeze Chamber

Project leader Mary Ann Davies has partnered with Oregon State University College of Forestry (Corvallis, OR) to design and build an on-site freeze chamber to simulate freeze events on bareroot seedlings. The data generated will provide a better understanding of expected damage and recovery potential, and aid in determining optimum lifting windows for harvest and outplanting.

Figure 4. An *in situ* freeze chamber developed to simulate freeze events on bareroot seedlings.

Brush Cleaner Improvements

Project leader Keith Windell developed an improved brush-cleaning comb for the USFS Bend Seed Extractory (Bend, OR). The improved combs keep awns from clogging the rotating brushes in their Westrup seed cleaning machine (Huntsman, Incorporated, Twin Falls, ID) (Barner and Windell 2010).

Figure 5. Brush-cleaning combs keep awns from clogging rotating brushes in a Westrup HA-400 (Huntsman, Incorporated, Twin Falls, ID).

Greenhouse Crop Mower

Project leader Keith Windell designed a top pruner for trimming greenhouse container seedlings. Successful field tests at USFS Lucky Peak Nursery trimmed uniform tops while collecting the trimmings. Engineering drawings, an operator guide, and Tech Tip will be published.

Figure 6. A top pruner designed for trimming container seedlings.

Non-Chemical Vegetation Control

Some greenhouse managers would like to reduce their reliance on synthetic herbicides for controlling weeds. Project leader Keith Windell helped USFS Dorena Genetic Resource Center (Cottage Grove, OR) test a prototype propane weeder cart and a wet steamer. Neither system was as effective as hand or mechanical weeding.

Figure 7. Testing a wet steamer to control weed growth.

Pine Seed Screening

Project leader Keith Windell partnered with the USFS Region 8 Resistance Screening Center (Asheville, NC) to increase seed testing rates. A one-time-use factory sterilized dish was found to replace the use of ethanol for sterilization germination trays. This eliminated a cleaning step and the use of hazardous chemicals. Seed crushing was improved with an upgrade from a 25-seed capacity to 53-seed capacity that can be autoclave sterilized. The seed crusher was also improved with a mechanical arbor press. Testing will be performed during summer 2010.

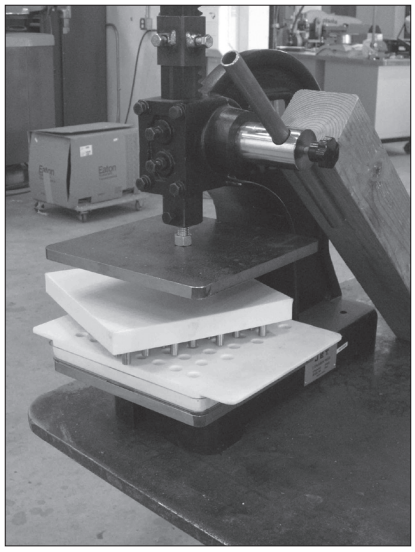

Figure 8. An arbor press and plates for pine seed screening.

Evaluation of Single-Seed Planters

Project leader Gary Kees evaluated four commercially available single-seed planters. Each planter was tested in its ability to plant whitebark pine (*Pinus albicaulis*), lodgepole pine (*P. contorta*), and Douglas-fir (*Pseudotsuga menziesii*) seed. The planters were tested in previously prepared seedbeds at the USFS Coeur d'Alene Nursery (Coeur d'Alene, ID) and in a field setting at MTDC. They all proved acceptable, but durability was questioned (Kees and Campbell 2010).

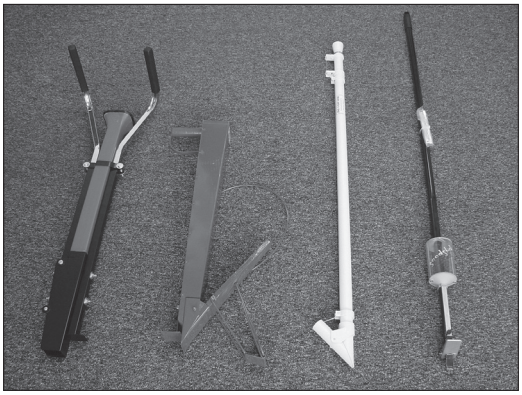

Figure 9. Single-seed planters (from left to right, Hatfield Transplanter, Almaco Hand Jab, Stand 'n Plant, and Seed Stick).

Wireless Soil Moisture Monitors

Project leaders Mary Ann Davies and Ted Etter worked with the Coeur d'Alene Nursery to test the HOBO Micro Station weather logger (Onset®, Bourne, MA) and its ability to monitor soil moisture and soil temperature remotely. Data was communicated wirelessly from the field to a base station allowing the monitoring of soil moisture at four plots as far as 0.8 km (0.5 mi) from the nursery headquarters. Remote monitoring saved staff time by eliminating frequent trips to the field to manually check irrigation needs. After one growing season, with watering based on the wireless monitors, seedlings looked healthier than seedlings grown the previous year. Additionally, weeds were not as common as they had been in previous years when plots were more likely to be overwatered. Evaluation is ongoing. Stations cost about US$ 1200 (Davis and Etter 2009).

Figure 10. This wireless soil moisture monitoring station used a gel cell battery charged by a solar panel.

Herbicide Shield for Spraying Irrigation Pipelines

USFS nurseries find it difficult to spray weeds growing along irrigation pipelines because the spray kills seedlings in nearby beds. Project leader Gary Kees developed a tractor-operated system that uses adjustable shields, two spray nozzles, and a 12-volt battery-powered pump to spray weeds along irrigation pipelines (Kees 2008).

Figure 11. A sprayer shield assembly is shown mounted to a three-point hitch sprayer designed specifically for spraying around irrigation pipelines.

Rotary Lasers

Project leader Gary Kees developed a system where self-leveling lasers were used to help lay out irrigation pipe and nursery beds in a straight line. Kees (2008) describes the use of the Spectra Precision HV401 laser and Spectra CR600 and AGL MR360R receivers by the Coeur d'Alene Nursery.

Figure 12. A rotary laser, used vertically, projects a beam of light to help field personnel lay out irrigation pipelines and nursery beds in a straight line.

Additional Information

A complete listing of the nursery projects completed over the years is available electronically to USDA Forest Service and USDI Bureau of Land Management employees at the MTDC intranet site (URL: http://fsweb.mtdc.wo.fs.fed.us/programs/ref/). Drawings and reports are also available to the public in electronic format (URL: http://www.fs.fed.us/t-d/).

Paper copies of MTDC reports and drawings are available from:

USDA Forest Service, MTDC
Attn: Publications
5785 Highway 10 West
Missoula, MT 59808
Phone: 406.329.3978
Fax: 406.329.3719

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