Reforestation Tech Tips

USDA United States Department of Agriculture
Forest Service
Technology & Development Program

September 2010
2400 1024–2322P–MTDC

# Top Pruner Developed for the Lucky Peak Nursery

*Keith Windell, Project Leader*

The U.S. Department of Agriculture, Forest Service, Lucky Peak Nursery in Boise, ID, includes a containerized seedling operation housed in a large greenhouse with three bays. Trees, such as western larch, grow tall in the greenhouse before they are ready to be planted. Top pruning (cutting the tops off plants) controls shoot height, ensures that all trees are about the same size, decreases shoot-to-root ratio (important because the tree has to have enough root to provide water for the leaves and stems), increases stem diameter, and makes it easier to handle seedlings during transplanting and outplanting, says Tom Landis, the Forest Service's former national nursery specialist (he retired in 2002). Lucky Peak has recognized the benefit of top pruning western larch as well as other tree species. The Missoula Technology and Development Center (MTDC) was asked to identify or develop a suitable top pruner (figures 1a and 1b) for the Lucky Peak greenhouse.

## Highlights...

- Tree seedlings sometimes grow so large in nurseries that it is best to prune off their tops before they are planted.
- The Forest Service Lucky Peak Nursery in Boise, ID, needed a way to top prune trees and shrubs that didn't require cutting them one at a time.
- The Missoula Technology and Development Center developed a prototype top pruner that uses industrial shears purchased from AgriNomix mounted on a rail system that can be rolled into different areas of the nursery's greenhouse.
- Nursery employees were pleased with the prototype after the first season of use.

Figure 1a—The prototype top pruner developed by MTDC for pruning seedlings.

**For additional information, contact:** *Keith Windell, project leader; USDA Forest Service, MTDC; 5785 Hwy. 10 West; Missoula, MT 59808–9361. Phone: 406–329–3956; fax: 406–329–3719; email: kwindell@fs.fed.us*

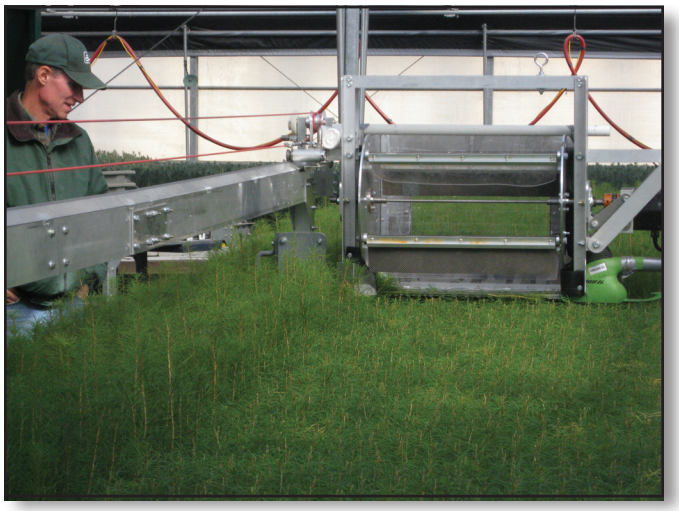

Figure 1b—The MTDC prototype top pruner in use at the Lucky Peak Nursery.

## Top Pruning in Outdoor Nursery Beds

Lucky Peak top prunes plants grown in outdoor nursery beds as well as containerized stock grown in a greenhouse. In open fields, many nurseries use tractor-powered sickle bars or rotary mowers for top pruning, equipment the nurseries already own. A possible disadvantage of this approach is that the cuttings fall back onto the plants, where they can spread diseases. The wind must be relied on to blow the cuttings away.

The EZ Cut Trimmer (figures 2a and 2b), imported by AgriNomix <http://www.agrinomix.com>, is a gasoline-powered top pruner for field settings. This trimmer cuts a 5-foot, 3-inch swath. Air forces the cut tops into a collection bag. The trimmer does require that the plants be on a hard, level surface. The EZ Cut Trimmer costs $10,200 (2010).

Figure 2a—The EZ Cut Trimmer with a 5-foot, 3-inch-long cutting blade—*photo courtesy of AgriNomix*.

Figure 2b—The EZ Cut Trimmer extended—*photo courtesy of AgriNomix*.

## Top Pruning in Greenhouses

Some enterprising nurseries have developed their own greenhouse top pruners. These machines typically use an electric lawnmower that is pushed or pulled down a custom-built rail system. If the blades are kept sharp, these systems can create an acceptable cut and the whole system is easy to maintain. Most of the cut tops are caught in the lawnmower's grass catching bag.

Such systems have potential safety problems. The high-speed rotating blades could cause serious lacerations if operators became careless. The problem would be more serious if the lawnmower's blade flew off. Some nurseries place the plants to be top pruned on the floor so the mower blade is below their knees. Other nurseries top prune their containerized stock on raised tables, placing the rotating mower blade at the height of the operator's chest. Sometimes operators are required to work behind a shield while they are top pruning.

AgriNomix also imports electrically powered top pruners that can be used in greenhouses. The high-volume top pruners require operators to place the plants on a conveyor belt. The Venti 003 Trimmer has a large vacuum collection system (figure 3a). The Venti 004 Trimmer is more compact and has a smaller vacuum collection system (figure 3b). Either trimmer can use one of two cutter heads: a series

of small electric motors with precision cutting blades called Gardena blades (figure 3c) or an industrial 230-volt trimmer with an 18-inch bar (figure 3d). Either of the Venti Trimmers costs $19,955 (2010) with the Gardena blades. Either of the Venti Trimmers costs $18,250 (2010) with the industrial shears.

Figure 3a—Venti 003 Trimmer—*photo courtesy of AgriNomix.*

Figure 3b—Venti 004 Trimmer—*photo courtesy of AgriNomix.*

Figure 3c—A precision cutting head with Gardena blades—*photo courtesy of AgriNomix.*

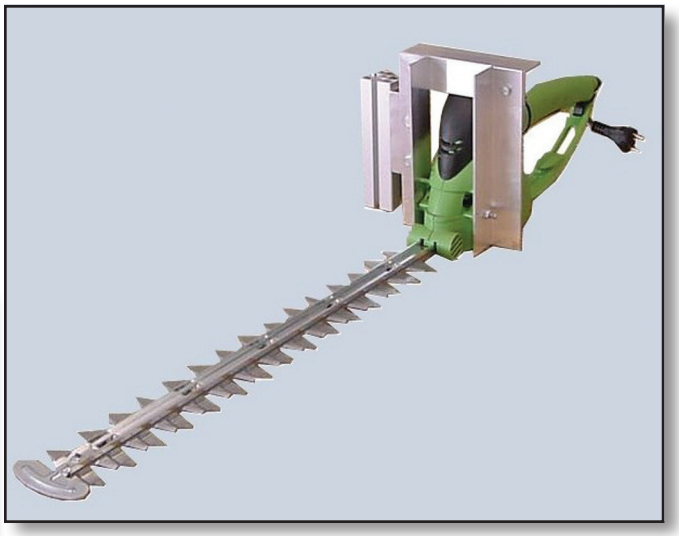

Figure 3d—A 230-volt industrial shear—*photo courtesy of AgriNomix.*

AgriNomix also helps nurseries develop custom top pruners for unique applications. In addition, the company sells lightweight conveyor systems to transport plants up to 150 feet to and from the top pruner. AgriNomix designed a custom system for a greenhouse operation where the plants were placed on the concrete greenhouse floor. The operator did not want to move the plants to and from a conveyor belt, so a rolling rail system was used with cutting and vacuum components (figure 4) provided by AgriNomix.

The author visited the Lucky Peak Nursery to determine whether any of the commercially available solutions would work there.

Figure 4—A custom top pruner built with AgriNomix components—*photo courtesy of AgriNomix.*

## Lucky Peak Nursery Greenhouse

Much of the floor surface in the Lucky Peak Nursery's greenhouse is landscape rock, which presents a challenge for making level cuts with equipment that rolls. The nursery has four greenhouses, 40 by 200 feet each. Some of the raised tables, which hold the Styrofoam seedling container blocks, were 18 inches apart. The rigging for the greenhouse's retractable sunshade hindered equipment movement along the sides of the bays. The support structure for the raised tables also created problems when equipment was being moved (figure 5). Heat is provided by inflatable plastic heating tubes under the tables. Equipment could be wheeled safely over the tubes when they were deflated.


Figure 5—Inside the Lucky Peak Nursery's greenhouse.

The Lucky Peak Nursery plans to top prune just a few rows of trees in widely scattered locations throughout the greenhouse. Employees wanted to take the top pruner to the plants instead of using conveyor belts to take the plants to the top pruner. The employees felt moving the container blocks by hand or by forklift to a conveyor belt would take too much labor or simply be impractical. The employees adamantly opposed using the electric lawnmower approach because of the safety concern posed by the rotary blades.

## MTDC Prototype Top Pruner

Because none of the commercially available top pruners met all of the nursery's needs, MTDC developed a new machine. MTDC's concept was to use relatively lightweight modular components that could be carried around the greenhouse and assembled where needed. Most structural members for the prototype pruner were made of aluminum.

The prototype's three-section rail system spans almost 20 feet and has an arch to account for deflection when the fully loaded cutting head and collection system are in the middle of the span. The height of pruned trees should not vary more than 1 inch.

The cutting head is the 18-inch-long industrial trimmer supplied by AgriNomix. A power converter was used to allow the greenhouse's 115-volt power to run the 230-volt industrial trimmer. A rotating paddle sweeps the cut tops into a collection bin (figure 6). The speeds of the industrial trimmer and the rotating paddle are adjustable (figure 7).

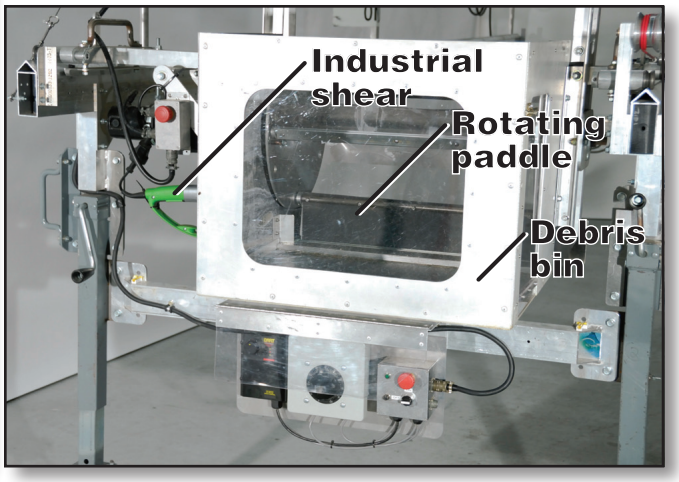


Figure 6—The MTDC prototype top pruner, which includes an industrial shear, rotating paddle, and debris collection bin.

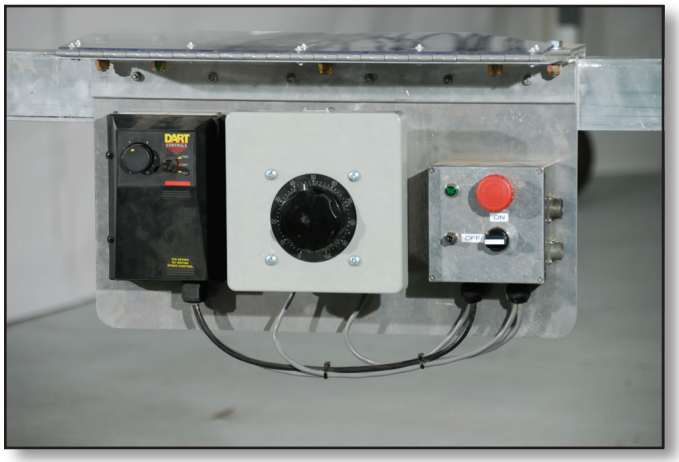

Figure 7—The variable speed control for the cutter and paddle assembly.

A trolley system was developed to move the cutting head and collection bin across the rails either with a manual crank (figure 8) or a cordless drill. Once the collection bin is full, it can be emptied into a plastic garbage bag for disposal. The rail system can be pushed down the greenhouse to cut another swath. A leveling jack and bubble level on each of the machine's four legs allow employees to compensate for the uneven floor (figure 9).

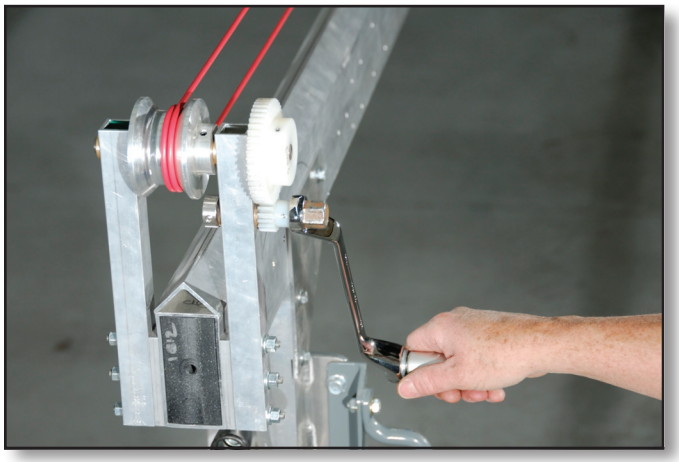

Figure 8—A handcrank moves the cutter assembly along the rail system.

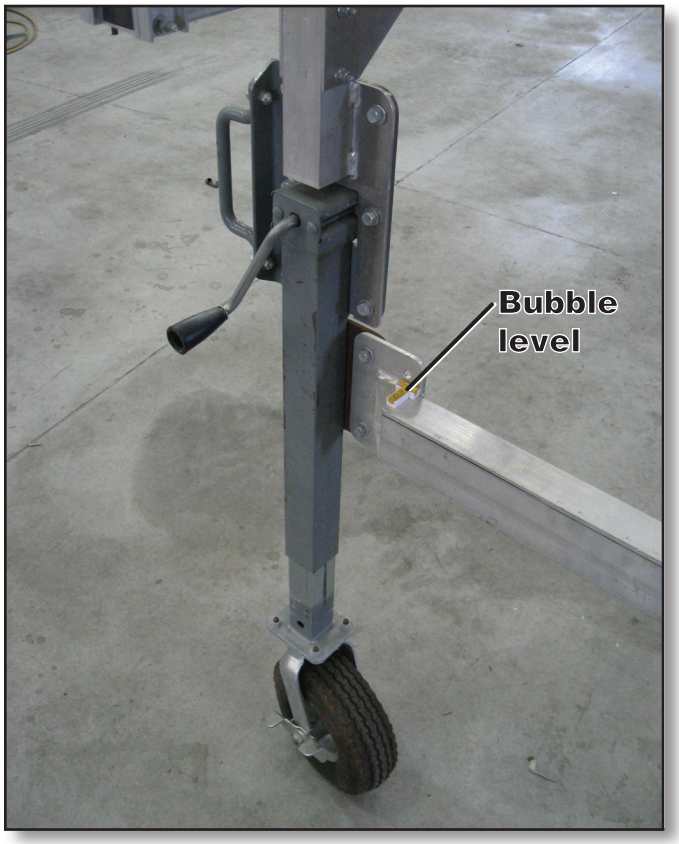


Figure 9—The manual leveling system used in the MTDC prototype top pruner.

## Conclusions

The Lucky Peak staff used the prototype top pruner to prune larch seedlings. The employees were satisfied with the quality of the cut, the speed of operation, and the collection of cut tops. They also plan to use the machine to top prune native shrubs, such as sagebrush. By reorienting the nursery's raised tables, Lucky Peak employees have been able to keep the top pruner assembled so it can simply be rolled into position when it's needed.

For further information on how the machine is working, contact Clark Fleege (cfleege@fs.fed.us, 208–343–1977) or John Sloan (jpsloan@fs.fed.us, 208–343–1977) at the Lucky Peak Nursery. MTDC is preparing engineering drawings for the top pruner. Contact Deb Mucci (dmucci@fs.fed.us, 406–329–3999) at MTDC for the status of those drawings. An operator's manual "Lucky Peak Greenhouse Top Pruner: User's Guide" (1024–2823P–MTDC) is available from MTDC.

## About the Author

**Keith Windell** is a project leader for reforestation and nurseries, fire, residues, forest health protection, recreation, engineering, health and safety, range, and watershed, soil, and air projects. He has a bachelor's degree in mechanical engineering from Montana State University. He has worked for the California Department of Forestry; U.S. Department of the Interior, Bureau of Land Management; and the Forest Service.

## Library Card

Windell, Keith. 2010. Top pruner developed for the Lucky Peak Nursery. Tech Tip 1024–2322P–MTDC. Missoula, MT: U.S. Department of Agriculture, Forest Service, Missoula Technology and Development Center. 6 p.

Tree seedlings sometimes grow so large in nurseries that it is best to prune off their tops before they are planted. The Forest Service's Lucky Peak Nursery in Boise, ID, needed a way to top prune trees and shrubs that didn't require cutting them one at a time. The Missoula Technology and Development Center investigated commercially available top pruners, but could not find one suited to the needs of the Lucky Peak Nursery. The prototype top pruner that the center developed uses industrial shears purchased from AgriNomix mounted on a rail system that can be rolled into different areas of the nursery's greenhouse when needed. The rail system spans 20 feet. Nursery employees were pleased with the prototype after the first season of use. For assembly, operating, and maintenance instructions, see the "Lucky Peak Greenhouse Top Pruner: User's Guide" (1024–2823P–MTDC).

**Keywords**: AgriNomix, equipment development, greenhouses, nurseries, pruning, shears

**For additional information about top pruners, contact Keith Windell at MTDC:**

USDA Forest Service, Missoula Technology and Development Center
5785 Hwy. 10 West
Missoula, MT 59808–9361
Phone: 406–329–3956
Fax: 406–329–3719
Email: kwindell@fs.fed.us

**Electronic copies of MTDC's documents are available on the Internet at:**

http://www.fs.fed.us/eng/pubs

**Forest Service and Bureau of Land Management employees can search a more complete collection of MTDC's documents, CDs, DVDs, and videos on their internal computer networks at:**

http://fsweb.mtdc.wo.fs.fed.us/search/