New Style Acorn Seeder

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A simple mechanical acorn seeder developed by the USDA Forest Service Toumey Nursery is described. A Wind River Seeder Frame was modified by inserting holes in a rotating drum to allow acorns to pass through the drum. The seeder sows 8 acorns per foot of nursery bed, and its use can produce substantial savings in time and money. Drawings are available upon request from the senior author. Tree Planters' Notes 42(3):16-17; 1991.

The James W. Tourney Nursery is a USDA Forest Service tree nursery located in the western upper peninsula of Michigan. Established at Watersmeet, Michigan, in 1935, the nursery currently produces approximately 4 million seedlings annually for the national forests in the Lake States.

Over the last few years regeneration of oak stands has received increasing emphasis. This has resulted in increased orders for quality oak planting stock. Research into nursery cultural regimes and their effects on field survival of oak has shown that seedbed density is a critical factor in seedling growth and survival. Currently Tourney Nursery is growing oak at a target density of 6 seedlings per square foot. At this low density, in-row spacing is critical. Too-wide spacing or missed spots will increase the per seedling cost of bed treatments. Too many seedlings per linear foot can reduce seedling growth and survival.

For lack of a better method to achieve consistent acorn spacing during sowing, Tourney Nursery was sowing acorns by hand. We had tried mechanical acorn planters but had not found any that produced the desired precision in spacing.

Roy Kangas, of the Forestry Sciences Laboratory in Houghton, Michigan, through a cooperative agreement with Jud Isebrands and the USDA Forestry Sciences Laboratory in Rhinelander, Wisconsin, had identified the need for a mechanical acorn planter. Roy came up with the idea of a rotating drum and spent part of the winter working on the concept. When Roy presented his concept to the personnel at Tourney Nursery last summer, they were intrigued and jumped at the chance to help him with his project.

The first step in making an acorn planter was to find a way to get acorns out of a container one at a time. First Roy tried moving an outer plate around a horizontal drum with holes in the bottom. The acorns would bridge or come through several at a time. Then he left the outer plate stationary and started turning the drum. With the hole on the bottom, this still did not give consistent results. Roy then moved the outer plate hole to the 9 o'clock position and added a sheet metal pickup on the inside of the drum to carry a single acorn above the mass of acorns. The angled pickup, combined with centrifugal force, allowed the acorn to exit when the outer plate ended. This method produced consistent, satisfactory results; thus the rotating drum concept was adopted.

The prototype for Tourney Nursery was built on an old Wind River seeder frame with the adjustable cone gearbox (figure 1). The drum that was selected is a 26-inch-diameter fiberglass drum. It was cut to 50 inches wide, with five rows of holes; thus five rows can be planted at one time. The $1^{1}/_{8}$-inch holes

Figure 1—*Ground-driven seeder sowing 5 rows of acorns.*

were placed 3.1 inches apart around the drum, resulting in 26 holes around the circumference for each row. Therefore, a five-row unit plants 130 acorns with one revolution of the drum. Drum speed of 27 revolutions per minute equaled 1 mile per hour, sowing 8 nuts per foot in each of 5 rows. The drum was driven from a bed roller on the front of the drill. The speed of the drum and thus the number of acorns planted per row foot could be adjusted through the adjustable cone gear box. This gear box was later abandoned in favor of a more direct drive type of system where the drum speed could be adjusted by changing gears.

The adjustable outer plate was adjusted so the acorns would exit into the tubes at the 9:30 o'clock position. Formed sheet metal strips were used for the pickup apparatus rather than individual pickups for each hole. Three-inch flexible tubes guide the acorns to the floating furrow openers. The furrow openers are suspended from cables so they can move up if obstacles are encountered. By adjusting the length of the cable, the depth is adjusted.

The machine was first used the fall of last year to sow northern red oak acorns at Tourney Nursery. The machine performed excellently. Acorn density and placement was comparable to hand sown beds. Acorns spacing was very consistent, and numbers per row foot usually varied by less than one acorn. The nursery planted approximately 100 bushels of acorns in the first afternoon.

Substantial cost savings were realized in the sowing operationals. Hand sowing requires approximately 3 person-hours per bushel, and machine planting reduced this to less than .4 person-hours per bushel. Further savings may be realized, since consistent spacing results in more uniform and higher quality seedlings thus reducing the cull rate at shipping time.

Future refinements are expected to include a hopper system to feed the drum so that more acorns can be carried on the machine, a dirt screen on the bottom of the outer plate to remove dirt, and a different type of furrow closer. This acorn planter could easily be adapted to plant ten rows in a 4-foot-wide bed or plant other large seeded species such as plum, cherry, or walnut. The machine also has the potential to tumble pregerminated acorns to clip the radicles before planting, thus increasing the number of large lateral roots on seedlings (Ponder 1990).

References

Ponder, F. 1990. Clipping roots of oak seedlings: a "radicle" approach to better roots. North Central Research News. 1990 August. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station: 3.