**"The spades are set so I can drive up to the gated pipe, drop them down, and drag the furrows straight back to meet the ones in the field," says Krush.**

# Front-Mount Toolbar Marks End Rows Fast

End rows are a pain when digging furrows in a field for gated pipe irrigation. Rear-mount toolbars with spades for furrows are fine for the rest of the field. However, doing end rows with one requires constant over-the-shoulder backing up and matching the toolbar to the pipe openings. Greg Krush had a better idea.

"I got the idea from a friend to mount a toolbar on the front of a tractor," says Krush. "The spades are set so I can drive up to the gated pipe, drop them down and drag the furrows straight back to meet the ones in the field."

Krush's toolbar mounts to the tractor with 3 by 4-in. angle irons bolted mid-frame. At the front of the tractor, the angle irons float on an angle iron crossbar bolted to the front end plate.

"The crossbar allows the angle irons to pivot if the toolbar rides up," says Krush. "It has two vertical arms made from square tubing to help guide the angle irons as they ride up and down."

A short length of angle iron welded to the ends of the angle irons connects them and serves as a base for a hydraulic cylinder that activates the toolbar.

The toolbar has five spring-tooth shafts with spade ends mounted to a 2 by 2-in. square steel bar. The bar rides inside two short lengths of 3-in. dia. pipe. The pipes, in turn, are mounted in 6 by 12-in., 3/8-in. steel plates that hang down from the long angle irons. A second length of angle iron is welded to the two plates to stabilize and brace them.

"The hydraulic cylinder ram is pinned to a piece of steel welded to the toolbar," explains Krush. "When it's extended, the toolbar rotates, lifting the spades out of the ground. When it retracts, the spades float at ground level. When I back up, they dig in as they're dragged backward. The weight of the toolbar and the angle of the spades are all that's needed to create furrows."

The Oliver 88 is one of more than a dozen older Olivers that Krush owns. He doesn't just collect them. He uses them.

The 88 is his gated pipe marker tractor. In addition to the front-mounted toolbar, he has a Mormon creaser on the back 3-pt. It's simply a length of gated pipe with spades attached at the gates.

"I have implements mounted on different tractors," says Krush. "Almost every one has a 3-pt. implement of some kind ready to be used when I need it."

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**Water wagon and paddock ready to be grazed.**

# Sheep Help Cut Costs Grazing Trees

Elise and Jeff Koning planted half an acre of Christmas trees two years in a row at Sylvanmore, their Indiana farm. They quickly found that keeping the grass mowed around the trees took time, labor and equipment. They decided to try giving the job to their sheep.

"It made life easier for both of us," says Elise Koning. "We both have off-farm jobs, so our time is limited. If we could keep sheep in the Christmas trees, it would cut down on mowing."

Koning already had the right sheep for the job. She had raised Shropshires her entire life and discovered their soft mouths discouraged them from eating conifers. A grant from the USDA Sustainable Agriculture Research and Education (SARE) program helped cover the cost of electric netting and an energizer.

They created a mobile water source using a 300-gal. IBC tote on a flatbed wagon. It supplied water to a ground-level tub through a hose and a float valve.

They designated a 1/2-acre plot for grazing and the other 1/2-acre for mowing for cost comparison. Koning notes that the first year had a steep learning curve. They were used to rotational grazing of pasture, but grazing the trees was different.

"Leaving the sheep in a paddock too long, they'd begin nibbling the trees," said Koning. "But if we moved them too soon, the grass would overgrow the trees."

They used five ewes with lambs, rotating them among five paddocks in trees only 9 to 15 in. tall. Even though it was a drought year, the sheep couldn't keep up with the grass, and some supplemental mowing was needed.

In the second year, they used 10 ewes and six paddocks in older trees that were a couple of feet high. Again, they compared grazing with conventional mowing on the other 1/2 acre.

"We found 10 was the right stocking rate," says Koning. "With one or two less, they didn't stay ahead of the grass."

Koning notes that the drought year required limited mowing. The second year was wet, with heavy growth and increased mowing.

"Our labor was the same both years with the sheep," says Koning. "However, labor increased significantly with mowing the second year."

The grazed half-acre required some extra labor for weed control. While the sheep kept the grass down, thistles still needed mowing and spraying.

The Konings are still evaluating the practice and have produced a final report for SARE (FNC24-1423). They're planning a handbook on best practices. She cautions other growers against jumping into grazing without studying the practice.

Koning is grateful for advice from European Christmas tree growers who use sheep for grass control. She notes that there's a Shropshire Sheep Tree Club on Facebook.

One concern they found was a tendency for sheep to rub their heads against trees as the trees grew taller. In 2025, Koning set out a scratch brush. While the sheep used it some, they also used the trees.

"We're trying to figure out what age of trees are least likely to be damaged," she says. "Some suggest waiting until the tree leaders are taller so the sheep won't damage them. The species of tree may also make a difference. A grower in Scotland had success grazing Fraser firs."

Koning says it remains to be seen whether they'll continue, much less expand, the practice. While initial costs for grazing made it more expensive than conventional mowing, spraying and mulching, many of those latter costs recur year after year.

"We found that 99% of the cost of grazing was items that'll be reused," says Koning. "Only 66% of conventional grass control expenses can be used long term."

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**ISU bio-oil crop residue-production site. Sites can process up to 10 tons of feedstock per day.**

# New Uses For Bio-Oil

Sealing abandoned oil wells is one of several uses being explored for oil derived from crop residue and other biomass. Iowa State University researcher Mark Mba-Wright has been working with pyrolysis and biomass for more than a decade.

"We discovered we could make biochar and bio-oil," says Mba-Wright. "We've explored so many applications for them. One of our latest studies looked at using bio-oil with old oil wells."

Mba-Wright is working with Charm Industries. The California-based company specializes in carbon sequestration. They provided the pyrolysis equipment that converts crop residue into bio-oil.

When injected into the wells, the bio-oil solidifies and seals the well, addressing an environmental concern about leaking hydrocarbons. Mba-Wright estimates there are as many as 800,000 undocumented, unplugged, abandoned oil wells. With an average width of 1.6 ft. and a depth of nearly 2.6 miles, it would take more than 216,000 gal. of liquid. Capping them can cost a million dollars each.

"A lot of companies have just walked away from their wells," says Mba-Wright. "They need to be closed due to water quality and other pollution. As social awareness grows, it's a problem they're trying to solve."

Mba-Wright's research suggests that a network of 200 mobile bio-oil production facilities could be both economically and technically feasible. Each facility would be designed to process about 10 tons of feedstock per day. The unit cost is estimated at about $1.3 million.

The study estimates that the proposed system could sequester carbon dioxide at about $152 per ton, making it competitive with other carbon dioxide removal methods while requiring far less upfront investment.

The process exposes biomass to a few seconds of high heat, with temperatures that can exceed 1,000 F. The process produces biochar, which can be sold as a soil amendment, and bio-oil, a dense, carbon-rich fluid. While there are other possible uses for the bio-oil, most would require additional processing. Sealing oil wells does not.

"Using excess crop residue (30 to 70%, depending on farm practices and soils) biomass for injection in oil wells would be a win for farmers and for oil well owners," says Mba-Wright.

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