Putting Out the (Grass) Fire

ARS Scientists Use Other Methods to Curb Weeds, Diseases on Grass Fields

Your front lawn has patches of bare dirt. You go to the local nursery and get grass seed to fill these patches. But where do the seeds actually come from?

The Pacific Northwest is home to most of the U.S. grass seed farms, which produce more than 800 million pounds of seed annually. This seed is sold in global markets, where it is used to produce turf, forage for livestock, and grass buffers that provide conservation benefits. Because U.S. and overseas markets demand high-quality pure seed, farmers once routinely burned their fields after each season to control weeds and diseases—along with removing leftover straw from harvest.

The reduced air quality caused by burning eventually led to legislation in some states that mandated limits on burning, beginning in the mid-1980s. Grass seed straw is no longer burned in Washington, while only about 10 percent of the grass-seed acres in Oregon are still burned.

Scientists at the ARS National Forage Seed Production Research Center in Corvallis, Oregon, have recently completed a 10-year study aimed at finding acceptable alternatives for economically producing grass seed crops without use of fire in western Oregon, where burning was first curtailed.

"This was a very successful project, and the results are now being implemented," agronomist Jeffrey J. Steiner explains.

The researchers found not just one alternative to fire, but rather a package of practices growers can choose from. For example, they found that many seed growers could chop all their straw back onto their fields and not reduce yields. They can also use no-till planting without hurting seed yields. These practices have additional benefits because they reduce soil erosion and enhance the habitat quality of adjacent streams that harbor salmon protected under the Endangered Species Act. Research by plant physiologist Stephen M. Griffith has shown that the amount of nitrate-nitrogen in shallow ground water leaving seed fields is reduced as much as 50 percent when no-till planting is in use.

PEGGY GREB (K11036-1)

Research leader Gary Banowetz (left) and farmer Don Wirth examine decomposing straw after grass seed harvest. ARS scientists have shown that straw residue doesn't have to be removed by burning but can instead remain on the field without reducing future seed yields.

The scientists also found that using no-till farming for grass seed is significantly cheaper than conventional tillage because it usually takes less energy and manpower to do it. Conventional tillage requires many passes of equipment across the field to prepare the soil for planting. Fortunately, the soils and climate of the Northwest allow farmers to adopt no-till practices.

Farmers using no-till are doing so as a way to help clean their fields by keeping crop and weed seeds from being buried by tillage and to increase soil organic matter. Grass seed farmers using no-till can also start planting a month earlier in the spring because the soil is more stable than when traditional tillage is used in the fall.

One of the original reasons to burn the straw was to combat blind seed disease. "This was a problem that threatened the entire grass seed industry before farmers started burning their fields in 1948," according to plant pathologist Stephen C. Alderman. Farmers were worried that during the phaseout of burning, the disease would reappear.

His research showed that the disease would not appear on a large scale, and only low levels of the disease have appeared in the last 10 years. He explains that growers are now using cultivars that flower late in the spring when warm, dry weather conditions inhibit the growth of the fungus that causes blind seed disease. Rainy summers may produce a little more of the disease, as may the planting of older cultivars. But overall, blind seed disease is under control.

As for weeds, farmers have had to adjust their management practices without burning to control these pests. Agronomist George W. Mueller-Warrant conducted research showing that certain weeds were more easily controlled when the straw was chopped back onto the fields, while other weeds required different herbicides for their control.

In general, weeds are still being adequately controlled. He is now developing maps using geographic information system tools and records from grass seed testing and cultivar certification organizations to study how different weed

distributions move through time over a large region. Mueller-Warrant wants to find out why weeds grow in certain areas but not others and use this information to develop better management strategies.

Every year more than 1 million tons of straw are left after grass seed fields are harvested. Straw has little direct economic value to the seed farmers because it costs so much to transport.

Many farmers who do not chop their straw back onto their fields sell it—one-half million tons—to brokers who export it to Asian markets, where it is used in livestock feed.

Looking for alternative ways for farmers to make a profit, the scientists are studying methods of turning straw into electricity or other value-added products, such as alcohol, on the farm, so that it doesn't have to be shipped elsewhere for conversion. "We're cooperating with a coalition of partners in Spokane County, Washington, including farmers, industry, Bonneville Power Administration, and a local utility company, as well as environmental groups, who will set up an on-farm test facility to look at different ways to turn straw into energy products," research leader Gary M. Banowetz says.

Just as farmers in the Midwest are turning corn into ethanol, grass seed growers in the Pacific Northwest may be able to do the same thing with straw. Banowetz explains that the process to turn straw into alcohol is more difficult—and more expensive—than with corn. To reduce the costs, his laboratory has hired a postdoctoral researcher to find genes that are turned on after grass is cut and combine portions of these genes with genes that control cellulose-degrading enzymes to speed the process of straw breakdown for faster fermentation. The laboratory is also cooperating with engineers to make an on-farm reactor to turn straw into gas that can be used to power a generator or to produce alcohol.

Even if farmers leave half the straw on the field to reduce erosion, and the process of ethanol production is 70 percent efficient, 33 million gallons of ethanol could be produced annually from the remaining grass straw of the Northwest, according to Banowetz.—By **David Elstein,** ARS.

For more information about this research, see the August 1997 issue of *Agricultural Research* magazine.

This research is part of Integrated Agricultural Systems, an ARS National Program (#207) described on the World Wide Web at www.nps.ars.usda.gov.

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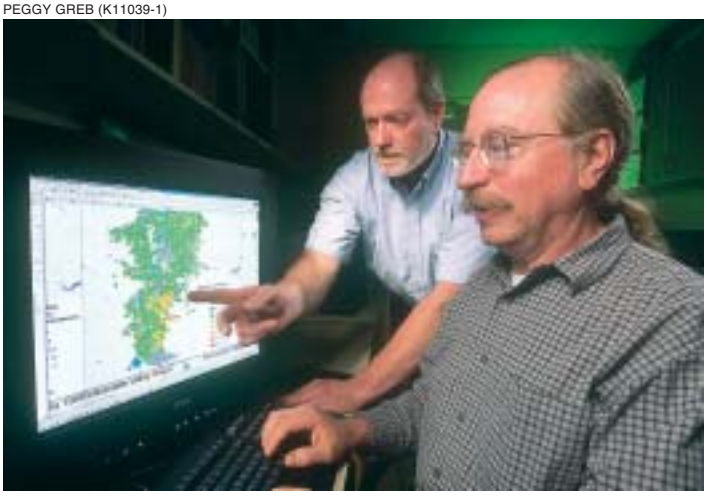
PEGGY GREB (K11042-1)

In the future, grass straw may be a profitable energy source. Technician Machelle Nelson (left) and Oregon State University cooperator Cynthia Lipp sample a native grass for analysis of compounds that affect biomass quality when the straw is converted to energy products.

PEGGY GREB (K11044-1)

Microbiologist Karen Dierksen harvests perennial ryegrass tissue to look for proteins expressed after the plants are cut and dried in the field before seed harvest. Some of these proteins may be useful for increasing efficiency when straw is used as a fermentation feedstock.

PEGGY GREB (K11039-1)



Agronomist George Mueller-Warrant (front) and hydrologist Gerald Whittaker look at weed distribution patterns that have changed over time with the introduction of different grass seed production practices.