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Plants That Take a Lickin' and Keep On Tickin'

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At the Yakima Training Center in Washington State, researchers evaluate how ARS-developed grasses respond to damage from military tanks, soldiers, and equipment. Damage in tank tracks is apparent in the photos above.

Ever have one of those days when you wake up feeling like you've been run over by a tank? Welcome to the world of plants that end up on a military training site. For them, getting run over by a 70-ton tank, a 27-ton Bradley fighting vehicle, or an assortment of other hefty, wheeled or tracked machines is all in a day's work.

But the Army has a secret weapon for restoring and revegetating these hard-working sites when the training maneuvers are over. The military has enlisted the help of a top-notch team of ARS plant geneticists, led by Kay H. Asay, to develop training-resilient plants. Now in its sixth year, the project is based at the ARS Forage and Range Research Laboratory in Logan, Utah, and is funded by ARS and the U.S. Department of Defense Strategic Environment Research and Development Program, Washington, D.C.

Asay and colleagues are offering improved lines of native and introduced grasses. The new plants are better able to withstand trampling by soldiers and grinding and crushing by their busy vehicles. That's important because military training installations "are some of the most intensively used lands in the United States," says Asay.

According to Army agronomist Antonio J. Palazzo, who works at Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, the outdoor maneuvers that inadvertently shred and mash plants are essential to training. "Today's soldiers can learn a lot from training sessions with Nintendo-type simulators and from classroom lectures," he says, "but they still need real-world experience, or what we call live training. That means living outdoors several days at a time and learning how to shoot mortar rounds accurately when you're short of sleep and exhausted.

"At the same time, we have a responsibility to manage ecosystems as best we can. And presidential initiatives now instruct us to use native plants when possible and to help stop the spread of invasive weeds."

So Palazzo recruited Asay and colleagues for help. The Logan scientists have an impressive track record when it comes to developing rugged plants that flourish in the harsh rangelands of the arid West. Their new varieties, for example, offer nutritious forage for livestock and wildlife, stabilize erosion-prone slopes, and provide an option for landscaping roadsides.

Several of the rangeland varieties developed by the research team are among the best performers in tests at two Army bases where they have established test plots—the Yakima Training Center near the city of Yakima, in central Washington, and Fort Carson, south of Colorado Springs, Colorado. The findings from these sites should be applicable to many other military bases throughout the West, where there's an ongoing need for low-maintenance, noninvasive, self-sustaining plants.

Agronomist Palazzo's part of the research includes getting to the root of the revegetation problems; he is working

with the Logan team to compare the ability of candidate plants to quickly form vertical roots or lateral ones called rhizomes. He also measures how well test plants resist being uprooted by tanks or other traffic.

Asay and colleagues Kevin B. Jensen and Blair L. Waldron of the Logan laboratory work with Palazzo to select species—or mixtures of species—for testing at the two Army bases. They try different planting designs; for example, they might vary the spacing within and between rows. They monitor plant performance in study plots at the bases and in nurseries at Logan. They select and cross promising parent plants and then scrutinize the offspring, looking for superior candidates for further testing.

The scientists are collaborating with an expert in rangeland restoration, R. Deane Harrison, formerly of USDA's Natural Resources Conservation Service.

Meanwhile, in laboratory experiments at Logan, Steven R. Larson and Richard R.-C. Wang use high-tech procedures to probe plant genetic material—or DNA. They are looking for traits that dictate adaptability and boost chances of plant survival. Larson, for example, has provided some of the first-ever information on the range of genetic diversity in several bluegrass species. Wang has pinpointed markers signaling the presence of an unwanted, purplish color in wheatgrasses caused by the pigment anthocyanin.

Earlier observations by the Logan team's research leader, N. Jerry Chatterton, suggest that the pigmentation is often a sign that the plant may grow more slowly than others during early spring. A slowpoke plant might not be able to outcompete faster-growing weeds.

Yakima—Sagebrush and Bunchgrass

Snow-covered in winter and typically dry and parched all summer, the Yakima Army Training Center lies in the shadow of the Cascade Mountains. The center is populated primarily by sagebrush and bunchgrasses. Few trees flourish there—except the cottonwoods, willows, and box elders that line the banks of creeks and streams. Rocky outcrops of basalt lava dot the landscape, which climbs gently from 1,200 feet to peaks nearly 5,000 feet high. Wildlife is plentiful, including jackrabbits, mule deer, elk, pheasant, sage grouse, barn owls, bald and golden eagles, and dozens of species of songbirds.

Many native grasses thrive at the training center, including Sandberg bluegrass—a relative of the familiar Kentucky bluegrass and a favorite forage of mule deer and elk. Blair Waldron is closely monitoring a nurseryful of Sandberg bluegrass collected from more than two dozen different sites. The goal: To develop a variety that is more genetically diverse and thus better adapted to a broader range of environments.

A search for plants with improved adaptability and chance of survival.

Snake River wheatgrass has been the top-performing native grass at Yakima. Kevin Jensen is working to make it even more resilient. He has an experimental strain ready for advanced testing.

Vavilov Siberian wheatgrass, developed at the Logan lab, is among the best of the nonnative plants tested so far at the Yakima base, followed by CD-II crested wheatgrass, also a product of Logan's plant-breeding program.

Revegetation in the Foothills

On the other side of the Rocky Mountains, the scientists are helping develop better plants for Colorado's Fort Carson. Extending eastward from foothills of the Rockies to the fringes of the Great Plains, the base boasts prairielike ecosystems of blue grama, western wheatgrass, little bluestem, and needle-and-thread grass; oak woodlands; shrublands covered with pinyon pine and juniper; and montane forests of ponderosa pine.

This 137,400-acre expanse supports prairie dogs, coyotes, foxes, black bears, mountain lions, bobcats, elk, mule deer, and over 200 kinds of birds.

The Logan team is eager to finish work on an improved western wheatgrass. "Right now," says Waldron, "Fort Carson needs a native plant that develops quickly. Typically, it may take 2 or 3 years to get a healthy stand of western wheatgrass established. That's too long. It presents too much opportunity for topsoil to erode and for noxious weeds like cheatgrass—which is very aggressive and highly flammable—to take over."

Customized Seed Mixes

Other work for Fort Carson may yield a superb seed mixture. This customized blend will include the top-performing species for bringing back damaged sites. One mix that's doing well combines the Logan laboratory's new RoadCrest crested wheatgrass and the lab's older Bozoisky Russian wildrye with the Army's own blend of natives like slender wheatgrass, Indian ricegrass, sideoats grama, and lovegrass.

"If you seed only natives, they don't hold up against fast-growing weeds," says Asay. "But the combination of RoadCrest, Bozoisky, and natives that we're testing crowds out most weeds and holds the soil in place. That means the native grasses have a better chance to get established."—By **Marcia Wood,** ARS.

This research is part of Rangeland, Pasture, and Forages, an ARS National Program (#205) described on the World Wide Web at http://www.nps.ars.usda.gov.

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