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THE SOD Sleuths

To find environment-friendly or aesthetically pleasing grasses, researchers with the Rutgers Center for Turfgrass Science travel the world to find strains worthy of cultivation at home.

By Allan Hoffman

In the heart of Inner Mongolia, a world away from Rutgers, a Jeep is winding its way through the steppes and meadowlands of Genghis Khan country. Livestock is everywhere: sheep, horses, cattle. Now and then, atop a hillside or alongside a dirt road, a lone herdsman appears. Professor William Meyer gazes out the Jeep's window: he is looking for grass.

Professor William Meyer, director of the Turfgrass Breeding Project at the Center for Turfgrass Science, travels long distances with associates such as Stacy Bonos, a Rutgers assistant professor and turfgrass breeder. Europe and Asia yield sod strains worthy of cultivation. The work requires global sleuthing, genetic expertise, and down-and-dirty farming. "We're farmers," says Meyer, who has 40 years of experience with turfgrass. "It's dirty. It's dusty. It's cold."

PHOTOGRAPHY BY NICK ROMANENKO; WILLIAM MEYER

Here in the former Mongol Empire, Meyer, a professor of plant biology and pathology and one of the world's leading experts in turfgrass breeding, is on a mission. He wants to unearth a wild variety of one of America's most beloved grasses, bluegrass, to help him and other scientists develop what he likes to call "the perfect bluegrass." When he spots a promising patch of terrain, the Jeep comes to a dusty halt, and Meyer and two colleagues, professor James White and a postdoc from a Chinese agricultural university, step outside with their tools (pocket knives, shovels), and then walk amongst a craggy hillside or a sweeping meadow, examining the wild grasses. If a patch is worthy of their attention—if, that is, it looks like it's got the genetic goods to make it to an actual lawn or golf course one day—then they place it in a cooler for safekeeping. With 40 years of experience with turfgrass, Meyer knows how to examine a thousand-year-old pasture, even one with grazing goats or startled herdsmen, to determine whether its grass is worth collecting for further study. "I can look at it, and I can see those areas that have a lot of genetic resources," says Meyer, director of the Turfgrass Breeding Project at the Center for Turfgrass Science, which was created in 1991 and is part of the New Jersey Agricultural Experiment Station.

If you've ever felt the soft, barefooted tickle of an American lawn, you've walked on grasses developed at Rutgers. Varieties of Rutgers grass seed are everywhere, sold at Lowe's and Home Depot and neighborhood hardware stores. They're in our lawns, in our parks and athletic fields, and even at the White House and in Yankee Stadium. The Rutgers turfgrass center has the world's largest collection of genetic resources for the development of turfgrass. Working with about 25 seed companies, the turfgrass breeding program "coinvents" much of the top-quality grass seed sold to everyone from homeowners to commercial landscapers. And as far-fetched as it may seem, the types of grass from this trip to Inner Mongolia—or, perhaps, from ventures in Turkey, Italy, Uzbekistan, and points beyond—may end up in your lawn one day.

But it's a long journey from Inner Mongolia to your lawn. The development of turfgrass is an arduous endeavor, often taking five years (or longer) as varieties are tested and crossbred. For Meyer and his colleagues, like Stacy Bonos, a Rutgers assistant professor and turfgrass breeder, the work requires an astonishing mix of global sleuthing, genetic expertise, and down-and-dirty farming. It demands brainpower, patience, and a willingness to wield a shovel. Turfgrass breeders write scientific papers with titles like "Breeding for Disease Resistance in the Major Cool-Season Turfgrasses" for the *Annual Review of Phytopathology* (coauthored by Meyer, Bonos, and Bruce B. Clarke, director of the Center for Turfgrass Science and an extension specialist in the Department of Plant Biology

Collected grass is transported to Holland, where Meyer is pictured, and cultivated on a farm to produce seed for the Rutgers program. Later, Meyer and staff will plant the seeds and grow them in Rutgers greenhouses and at two farms, which have roughly 50,000 grass plots allocated for turfgrass breeding. The plants are evaluated and studied, and if a grass is resistant to a troubling disease or even possesses a striking color, it could be crossbred with existing varieties.

and Pathology at the School of Environmental and Biological Sciences), but they also need to sink their hands into the mud and muck.

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But why travel so far to gather grass? Don't we have grass in the United States? In New Jersey? Right there on the George H. Cook Campus, where Meyer works out of a three-story brick building overlooking fields of sod and barns? Well, yes and no.

The grasses now common in the United States are not native to the continent. What native grasses existed here when European settlers arrived were considered unsuitable for grazing. "Many colonists commented on the inferiority of New England and Virginia grasses in comparison with pastures in England, and one New England settler wrote in disgust that 'it is so devoid of nutritive virtue, that our beasts grow lousy with feeding on it, and are much out of heart and liking,'" Virginia Scott Jenkins writes in *The Lawn: A History of an American Obsession* (Smithsonian, 1994). Unsatisfied with the continent's grasses, Europeans shipped grass seed to the colonies, and those grasses spread across the country.

Even now, hundreds of years later, you can find evidence of the grasses brought here by the settlers. Go to Polish neighborhoods in Boston, says Meyer, and you'll find bluegrass from Poland. Go to an Irish neighborhood there, and you'll see fine fescue from Ireland. With this bit of natural history in mind, Meyer's predecessor, C. Reed Funk GSNB'62, now a professor emeritus, collected grasses from the earliest areas planted by the settlers. By tapping into the genetic makeup of "old" grasses, breeders would be able to improve upon the qualities in commercially sold grass seed.

But you could only go so far by looking for the random patches of grass remaining from the days of the Mayflower and Myles Standish. Meyer took Funk's ideas one step further. Rather than just digging up old turf from Warinanco Park in Elizabeth, or Sheep Meadow in Central Park, how about going back to the regions where these species of grass developed? How about searching for wild grasses in Europe and Asia, where they have been growing, largely undisturbed, for hundreds of years? That's just what Meyer and his colleagues have done, engaging in a globe-trotting scientific journey to seek environment-friendly grasses. Since 1996, they have collected grasses from a broad swath of Europe, Asia, and Africa. They have traveled throughout Europe and parts of Asia, gathering samples from ancient pastures and meadows. "It's going back to the grass roots," Meyer says.

Scientists, researchers, and industry experts regard the Rutgers program as a center of leadership and innovation. "It's really the preeminent turf breeding

Meyer, left, and Bruce B. Clarke, director of the Center for Turfgrass Science and an extension specialist in the Department of Plant Biology and Pathology at the School of Environmental and Biological Sciences, evaluate fescue clones for their endurance in withstanding foot traffic. The grasses now common in the United States are not native to the continent—European settlers, finding native grasses unsuitable for grazing, shipped seed to the colonies.

program in the country," says Eric Watkins GSNB'04, a professor at the University of Minnesota who received his Ph.D. in plant biology from Rutgers and traveled to Norway to collect grasses. The Rutgers researchers have garnered widespread accolades for their work: Funk is a member of the Rutgers Hall of Distinguished Alumni; Meyer received the New Jersey Turfgrass Association Hall of Fame Award; Bonos received the inaugural Early Career Excellence in Plant Breeding Award from a broad-based group of plant breeders. The turfgrass breeding program is a royalty producer for the university, and Rutgers varieties of turfgrasses, typically developed with partners in the industry—namely, seed companies—consistently rank at the top in government tests. "We're at the leading edge," says Meyer, "and we're trying to stay there."

Their work is taking on a particular urgency, given concerns about global warming, the use of pesticides, and water quality. By looking in far-off lands for genetic variations of the grasses now popular in the United States, Rutgers' turfgrass breeding program is producing environment-friendly grasses requiring less water, pesticides and fertilizer, and maintenance. These trips bring the researchers to what Bonos calls the "centers of diversity" of popular turfgrass varieties, like bluegrass and fine fescue. (Settlers brought only a small amount of seed here, and so there is much less diversity in the United States.) By tapping into that genetic diversity, researchers are more likely to find plants with desirable characteristics, such as drought tolerance and resistance to disease. Add drought tolerance to a popular grass, and water usage can decrease dramatically. Find a gene with resistance to a particular disease or insect, and less fertilizer or pesticides will be needed. Bring these qualities together in one grass, and you can dramatically decrease the inputs (water, fertilizer, pesticides, gasoline) needed to maintain a golf course or a front lawn.

Yet Rutgers researchers don't go looking to dig up just any patch of grass growing in Norway or Turkey. They want old grass. Very old. They want grass that's been growing in a meadow or pasture for something like 500 or 1,000 years. They want grass that's made it through the elements, the seed falling to the ground and the superior plants growing above the weaker ones. "We look for big patches of surviving grass," says Meyer. "We're looking for clones that have been there for 500 years, that have taken over all their weak sister plants."

In trips from Spain to Sweden, and beyond, they have searched for areas where, hundreds of years ago, trees were chopped down and sheep and other livestock were put out to pasture. No effort was really made to grow the grass. It just grew. And grew and grew—until, years later, researchers like Bonos

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By searching regions of southern Italy, left, and France for genetic variations of the grasses popular in the United States, Rutgers' turfgrass breeding program is producing environment-friendly grasses requiring less water, pesticides and fertilizer, and maintenance. By exploiting this genetic diversity, researchers are more likely to find plants with desirable characteristics, such as drought tolerance and resistance to disease.

and Meyer appeared with their knives, intent on collecting the hardy and intrepid surviving plants. "Over those couple hundred years you can find genotypes that are strong," Bonos says. "You use natural selection as part of your criteria."

And, being experts in grass, they can look at a New Jersey lawn—or a Pyrenees mountainside—and tell one grass from another. Consider this: the Rutgers program now includes more than 2,000 varieties of bluegrass. "They're genetically diverse," says Meyer, "and when you look at 1,000 of these next to one another, you can see there's every color and shape under the sun."

On a typical trip, they may travel from 1,000 to 1,500 kilometers over nine days, stopping at 130 locations. One meadow might yield 50 samples and another one just two or three. But that's just the beginning, because the grass collected in these far-off locations has a long way to go before it's turned into seed sold commercially. Packed in coolers, the grass will be transported to Holland, where the Dutch botanist and farmer Peter den Haan will cultivate the plants on his farm for a year to produce seed for the Rutgers program. Back at Rutgers, Meyer, Bonos, and a variety of graduate students and staff members will plant the seeds and grow them in Rutgers greenhouses and at two farms, one in Adelphia and the other in North Brunswick. The farms typically have upwards of 50,000 grass plots allocated for turfgrass breeding. The plants are evaluated and studied. If it's a grass that has a quality worth pursuing—resistance to a troubling disease or even possessing a striking color—it will be crossbred with existing varieties. Eventually, a new variety may be developed and sold commercially.

But this description elides the realities of the work. The years of farming. The days spent analyzing data. The dirt and the dust. The pollen. Glamorous trips abroad? Not quite, because the days can stretch from eight in the morning until 10 at night, much of the time spent in a cramped vehicle. "I imagined I'd be walking along the countryside," says Jonathan Bokmeyer GSNB'09, who traveled to Hungary ("an amazing trip") and is now a research scientist with the Monsanto Company. "What you really do is drive in a car for hours at a time. We started in old parks in Budapest and drove into the countryside. You're looking for any area that's been undisturbed for hundreds of years. We covered the entire country in the car."

Yet Meyer clearly loves what he does, even when describing the disappointments, like a great-looking bluegrass from Lithuania decimated by disease when it was planted here in New Jersey. "It just broke my heart," he says. "We didn't give up on it." Meaning, well, it may still have something to offer, genetically speaking, in the quest for that perfect bluegrass. •