Study: Grass, fungus combination affects ecology

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The popular forage and turf grass called tall fescue covers a vast amount of land in the U.S. -- an area that's estimated to be larger than Virginia and Maryland combined -- and a new study by ecologists at Rice University and Indiana University suggests there is more to fescue than meets the eye.

Results of the six-year study, which are available online in the *Journal of Applied Ecology*, show that a symbiotic fungus living inside fescue can have far-reaching effects on plant, animal and insect communities.

"Competition and environment have traditionally been seen as the driving forces for community dynamics, so it's significant to see that the composition and diversity of a plant community can be affected by changing a few genes in an invisible fungus inside one species of grass," said study co-author Jennifer Rudgers, Rice's Godwin Assistant Professor of Ecology and Evolutionary Biology. "This suggests that cooperative microorganisms should not be overlooked as significant contributors to ecological diversity."

Tall fescue is hearty, low-maintenance and stays green year-round, which makes it a favorite for home lawns, golf courses and highway rights-of-way across the U.S. But fescue, which is native to Europe and North Africa, can also be highly invasive in North America. It can also sicken livestock, thanks to a symbiotic fungus called Neotyphodium coenophialum. The fungus and fescue have a mutually beneficial relationship. The fungus lives inside the plant, where it gets shelter and

food, and in return it laces the plant's leaves with toxic alkaloids that are a turnoff to some plant-eating animals.

In 2002, Rudgers and Indiana University ecologist Keith Clay, a study co-author, selected 42 grassland plots, each about 1,000 square feet, at the Indiana University Research and Teaching Preserve north of Bloomington, Ind. The researchers selected two varieties of fescue called Georgia-5 and Jesup, and two varieties of the fungus, called KY-31 and AR-542. KY-31 is a common variety that produces alkaloids that are toxic to mammals, and AR-542 naturally lacks these alkaloids. Additionally, some plots were planted with grass and no fungus.

Over the next six years, the team returned to the plots several times. The investigation was painstaking. In randomly selected areas, the researchers counted individual flowers, cataloged the number and species of every plant and even counted the number of stems of grass that had been gnawed by plant-eating voles.

The investigation offered specific results for conservation managers: Jesup with either fungus works best for maintaining a fescue monoculture; and if a symbiotic fungus is desirable, the combination of Georgia-5 and AR-542 supports maximum plant diversity and minimal invasiveness.

The study also suggested that the ecological effects of plant-microbe symbiosis aren't easy to predict. For example, the researchers found that voles were less likely to eat fescue that contained either fungus, including the AR-542 variety, which lacks mammal-toxic alkaloids.

"That indicates that plant-microbe symbioses have complex ecological effects," said Clay, professor of biology and director of the Indiana University Research and Teaching Preserve. "It signals the need for more investigations of the long-term effects of cooperative symbiosis."

Provided by Rice University