Scientists solve mystery of tall fescue toxicity

(UPI)—It took decades of effort, but scientists finally solved the mystery of why some cattle and horses grazing on a popular feed grass were losing foals and falling ill, and found a way to solve the problem while keeping the hardy nature of the grass.

Tall fescue is a grass grown widely in the United States. Able to thrive on land which is too hilly, rocky, or otherwise inappropriate for cultivated crops, it is mainly grown as a hay crop and in pastures to feed beef cattle.

It is also used as a turf grass for residential lawns, parks, golf courses, roadsides, airports and cemeteries. Its ability to stay green and dense for most of the year with very low maintenance contributes to its usefulness in holding soil in place and filtering out impurities from storm water. This wonder grass made its way to North America as seed in hay or in seed mixtures brought over by immigrants from the British Isles or northern Europe in the 19th century.

Despite its popularity, farmers often complained of problems with livestock grazing on tall fescue. These problems became especially common starting in the 1950s when widespread plantings were made of one particular variety named "Kentucky-31."

Weight gains and milk production in cattle were not as high as expected based on the generally good nutritional content found in the forage. Cattle retained their rough winter coats well into summer and looked weak and unhealthy.

Cattle also stood in ponds to keep cool and lost tips of ears and tails, and even occasionally lost a hoof. This lead to the terms "fescue foot" and "fescue toxicosis." Horses had problems with delivering dead foals, and mares were not able to produce milk.

Researchers explored many possible leads in determining the cause of fescue toxicosis. It wasn't until the mid-1970s that scientists with the U.S. Department of Agriculture and the University of Georgia made a major discovery. A fungus was found growing in the grass being grazed by affected cattle, but that same fungus was absent in the good pasture.

The fungus only grew inside the plant, and was therefore called an endophyte, from the Greek endo-(inside) and phyton (plant). Microbiologists had actually described the endophyte more than three decades earlier, but its presence was finally linked to fescue toxicosis in cattle.

The fungus has a curious habit of growing in developing seeds. This allows the endophyte to spread after the seed is harvested and gets replanted. As the seeds germinate, the endophyte grows into the new seedling, and the life cycle starts again, without the endophyte ever leaving the inside of the plant. A plant which happens to be free of the endophyte, will not naturally get infected by the fungus from neighboring plants.

But a chemical explanation for the toxicosis problems was needed to definitively explain how fescue toxicosis occurred in the animals. The scientists suspected a class of compounds called "alkaloids" because of similarities of symptoms with other known alkaloids. Sure enough, chemical analysis revealed that a family of compounds called ergot alkaloids were produced by the fungus when growing in the plant. The toxins flowed up into the leaves of tall fescue and were consumed by the animals.

Once inside the animal, the toxins interfered with various mechanisms controlling body temperature, appetite, reproduction, milk production, and blood flow to the outer body parts, such as the feet and tail.

Solving the problem seemed to be a simple matter of ridding the plant of the fungus. Fungicide application on tall fescue pastures proved to be ineffective in eradicating the endophyte. So, seed was treated to kill the endophyte without killing the seed. That seed was able to produce new stands of tall fescue that produced no fescue toxicosis.

After a few years, however, farmers observed that endophyte-free stands of tall fescue were thinning out—especially during hot, dry summers. The endophyte was found to provide some protection against drought, which explained why tall fescue was able to adapt to conditions across so much of the southern Untied States. The endophyte also turns out to improve the plant's resistance to insects and microscopic worms in the soil called nematodes.

This presented a dilemma to livestock farmers who wanted a grass that was well adapted to poor soils, but that did not produce the toxins affecting livestock.

With additional work, scientists discovered rare strains of the endophyte that did not produce the ergot alkaloids causing fescue toxicosis, but helped the grass withstand drought and pests. Varieties of tall fescue are now being released which contain these new strains so that cattle can have their hardy fescue and eat it too.