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FORAGE

Drought Tolerance: An Important Characteristic for Tall Fescue Persistence

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Drought is the most crucial constraint to crop productivity. Most of Earth's surface area is not suitable for crop production due to severe water limitations, and the scenario is likely to get worse

especially in the southern Midwest and southeastern United States. Recent climate models suggest an increase in aridity in many areas of the world. More than 35 percent of the world's land is considered arid or semiarid. Even in areas of high rainfall, crops experience water stress due to uneven rainfall distribution. Drought can cause significant crop yield loss and under severe conditions up to 100 percent crop loss is experienced.

THE PROBLEM

The Southern Great Plains has experienced severe to exceptional drought conditions each year. In 2011, exceptional heat and drought conditions prevailed throughout the south-central U.S. (Fig. 1). Drought caused \$7.62 billion losses in agriculture in Texas, the costliest drought to date. At the same time, drought-related agricultural losses in

FIGURE 1: EXCEPTIONAL DROUGHT STRESS PREVAILED THROUGHOUT THE SOUTH-CENTRAL REGION OF THE U.S. IN 2011.

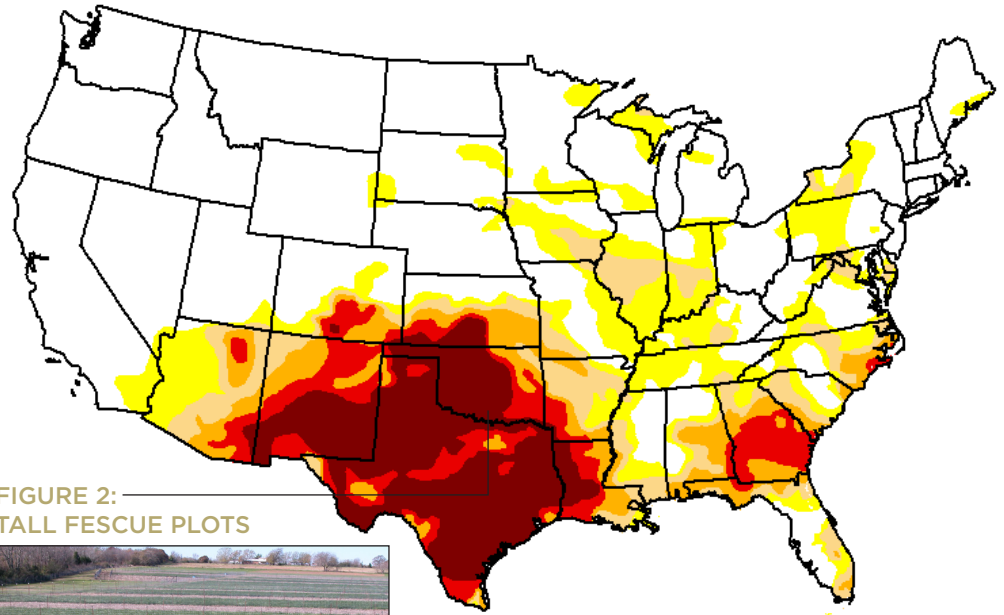


FIGURE 2: TALL FESCUE PLOTS



Tall fescue plots in Ardmore, Ok. as seen in 2011. 100 percent stand loss in summer-active Continental, but summer dormant can survive well.

\$1.6B

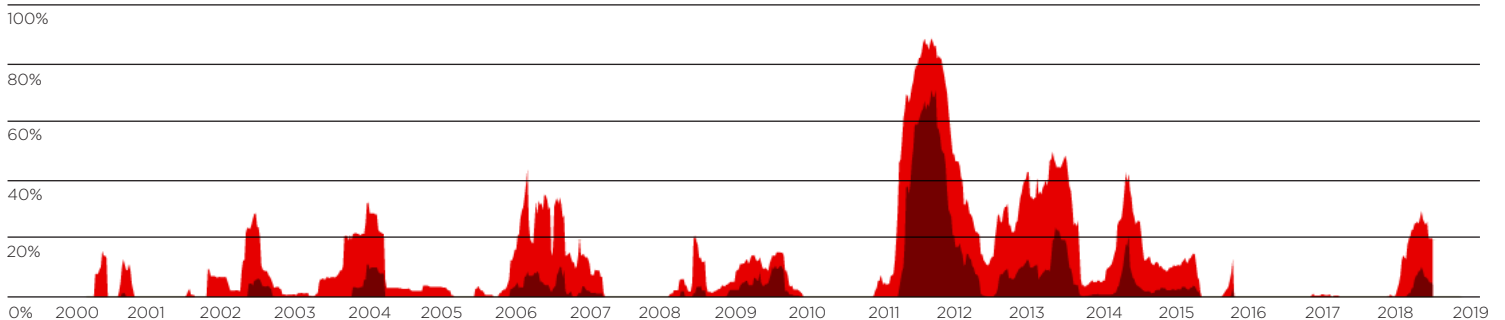
The state of Oklahoma suffered \$1.6 billion in agriculture losses during the drought of 2011.

\$7.6B

Drought caused \$7.6 billion losses in agriculture for the state of Texas during the drought of 2011; the costliest drought to date.

EXTREME AND EXCEPTIONAL DROUGHT CONDITIONS SINCE JAN. 2000 FOR THE SOUTHERN GREAT PLAINS

In 2011, more than 60 percent of the Southern Great Plains region was in extreme drought conditions with 80 percent reaching exceptional.





Oklahoma accounted for \$1.6 billion. Developing drought-tolerant crop varieties is important for sustainable agriculture in the region.

GROWING TALL FESCUE IN THE REGION

Tall fescue is an important cool-season perennial hay and pasture grass in the temperate regions of the world. It is also used as turf and in conservation plantings. Tall fescue is grown on more than 35 million acres in the U.S. There are two types of tall fescue. The Continental, which grows continuously during the summer, is called summer-active tall fescue. The Mediterranean tall fescue remains dormant during summer and is commonly known as summer-dormant fescue. As a perennial crop, once planted, it should persist for at least five to seven years. But 20 to 40 percent stand losses have been observed every year due to hot, dry summers that prevail in the region. In 2011, 100 percent stand loss was recorded in Continental fescue, though Mediterranean-type persisted well (Fig. 2). Thus, cultivation of Continental fescue can be restricted to higher rainfall areas east of Interstate 35. Mediterranean fescue can be grown west of Interstate 35 under extreme drought stresses. Mediterranean fescue possess a drought-avoidance mechanism; the Continental fescue lacks this characteristic.

DROUGHT-TOLERANT TALL FESCUE VARIETY DEVELOPMENT

Drought tolerance can improve persistence of Continental tall fescue in the Southern Great

FIGURE 3: DROUGHT SCREENING

Protocol developed at the Noble Research Institute. From left to right: A 14-inch cone with two blotting papers at 6 inches between sand and metro-mix. A cone with an established plant, both root and shoot growth can be measured. Segregation of tolerant and susceptible plants can be observed.



Plains. To develop drought-tolerant varieties, the first step is to identify drought-tolerant plants from the natural variations. At the Noble Research Institute, we have developed an effective greenhouse test for identifying the desired plants from germplasm resources and breeding populations. Using the protocol, plants with high water-use efficiency and/or

drought-tolerance were selected. Selected plants and plants from common varieties were planted in the field for the verification of greenhouse-screening results. Data collection is in progress. Genotypes confirming drought tolerance will be used to develop a drought-tolerant variety for cultivation in the Southern Great Plains. 🐄