Foxtail Millet for the Central Plains

"Farmers have learned at our field days that the time-honored practice of growing winter wheat, then letting land remain fallow, or cropless, is a waste of precious moisture and cuts into their profit margins," says Randy L. Anderson. "Now, they're discovering that there's enough moisture on the central Great Plains for a crop rotation that includes foxtail millet, along with wheat.

"Best of all, growers net more profit with new crop rotations," he says.

Foxtail millet joins other crops like proso millet and sunflowers in crop rotations that are slowly replacing the older routine of wheat one year, then fallow the next.

The area gets about 16-1/2 inches of precipitation annually, or 33 inches every 2 years. That's more water than a single wheat crop needs during the 2 years. Adding another crop, like millet, before wheat safely harvests the surplus water while leaving enough for a successful wheat crop.

Growers would plant foxtail millet as a forage for livestock. Proso is grown for its grain.

"One foxtail millet variety, Golden German, provides up to 6,100 pounds of dry matter per acre. That compares with about 3,800 pounds from Manta, another variety," says Anderson. He is an Agricultural Research Service agronomist at the Central Great Plains Research Station near Akron, Colorado.

But Manta provides 13 percent total protein versus 10 percent for Golden German and two other varieties, White Wonder and Butte. Manta also matures up to 3 weeks earlier than the other three varieties. An earlier harvest extends the period before the winter wheat is planted. That allows more precipitation to accumulate and thus helps ensure the success of subsequent crops.

Farmers could have their cattle graze foxtail millet that is cut and left in windrows. This would eliminate the cost of baling, handling bales, storing them, and then feeding to livestock.

Anderson cautions farmers that foxtail millet serves as an alternate host for the wheat curl mite, the insect that transmits wheat streak mosaic virus. Wheat streak can cut yields by up to 50 percent. He recommends farmers spray a herbicide or till soil to kill all millet plants after harvest. This eliminates the mites and prevents future virus transmission.—By **Dennis Senft,** formerly with ARS.

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Hypernodulating Gene Found in Soybeans

By boosting nitrogen fixation in soybeans and other legumes, farmers might be able to cut down on the nitrogen fertilizer they apply to other field crops grown in rotation.

Agricultural Research Service scientists in the Plant Physiology Research Unit at Urbana, Illinois, have identified a single gene that regulates hypernodulation in soybean root systems. "We're now attempting to map the gene and produce a soybean cultivar that has this trait and also produces high yields in the field," says plant physiologist James E. Harper.

On their roots, soybeans and other legumes create nodules that are tiny homes for a type of bacteria that takes nitrogen from the air and enzymatically converts it to ammonia that plants can use for growth and seed development.

Scientists speculate that the more nodules a plant produces, the more nitrogen is left in plant tissues to be returned to the soil when the plant dies and decomposes. This extra nitrogen is then available to a following crop.

Conventional soybean cultivars provide about 40 pounds of residual nitrogen per acre. If hypernodulated soybean lines were to double the residual nitrogen returned to the soil, this would provide over half of the nitrogen needs of most corn varieties.

ARS scientists know that the chemical signal to regulate nodule formation in the soybean root comes from above ground—from young leaves—during the first 4 weeks of plant growth. But they don't know what the chemical is or how it signals plant roots to regulate nodule number.

"If we can learn what this chemical is and how it works, we can use the information to regulate hypernodulation in soybean lines for commercial use," says Harper.

Hypernodulated soybean lines can circumvent the natural nodule suppression that exists in commercial cultivars. For example, a typical commercially available soybean cultivar generates 70 to 200 nodules on its root system during the first 4 weeks of growth. A hypernodulated mutant soybean generates up to 1,000 during the same period.

Harper proved by using rooted leaf cuttings that the hypernodulation signal comes from young soybean leaves. His research group also showed that the signal is common between soybean and mung bean plants. They did this by grafting a hypernodulated soybean shoot to a mung bean root, inducing hypernodulation on the mung bean.

If scientists can identify the nodule control signal, they may be able to induce hypernodulation in other legumes.—By **Dawn Lyons-Johnson,** ARS.

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