LINCOLN—Plant scientists long have known they can alter crops genetically to improve performance; they've been doing it thousands of years.

But what if they could dramatically improve crops by leaving the genes themselves unchanged but instead change how they're expressed in a way that would be passed down to future generations?

That question is at the heart of research at the University of Nebraska-Lincoln's Center for Plant Science Innovation, and the results so far are encouraging. The findings, expected to be commercialized in the next couple of years, could play a role in helping meet the world's dramatically increasing need for food, said Sally Mackenzie, Institute of Agriculture and Natural Resources plant scientist.

Specifically, scientists focused on a gene called MSH1, short for MUTS Homolog1, which is present in every plant. They discovered that if they "silenced" that gene in some plants, their growth patterns changed dramatically – dwarfed, highly branched and behaving as if they have seen high levels of stress, including cold, heat, sale, drought and high light. Then, after they reintroduced the gene and crossbred it with a plant that wasn't altered, the crossbred plant showed signs of enhanced growth, vigor, lodge resistance, high biomass production and higher yield.

Those changes in some cases were huge: up to a 100% increase in above-ground biomass, up to a 70% increase in yield in sorghum, for example.

"We changed the way the plant is expressing its genes, even though we didn't change the genes themselves," Mackenzie said. The process is called epigenetics.

Mackenzie stresses these key points about her lab's work:

It's not transgene-mediated modification, which is controversial in some parts of the world and heavily regulated, thus slow to reach the market.

It's worked in several crops so far—not so-called model crops, but actual agronomically useful crops, most importantly soybean, sorghum and millet, and also tobacco and tomatoes.

These changes can occur in just two generations of plants, rather than the 10 or more it can take for genetic modification to take hold. That's appealing given the sense of urgency in figuring out how to feed a world whose population is expected to reach 9 billion by 2050.

The potential of epigenetics to improve other crops is unknown. It's possible that most of the potential already has been reached in corn, for example, because it's been heavily hybridized. Until now, scientists couldn't know what percentage of improvements in corn was due to genetic changes and what percentage was due, unwittingly, to epigenetics.

Besides soybean and sorghum, it seems likely there's great potential for epigenetics to improve crops such as cotton and dry beans.

"And if you could do this in rice and wheat, you could perhaps change the world," Mackenzie said.

"It's promising, but I don't want to overhype this," Mackenzie said. Yet to be determined is whether these effects will be stable and able to be scaled up as the techniques are commercialized and expanded to more fields and more crops.

"It's important we explore this for every potential it offers for addressing some of the challenges in agriculture," she added.

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