Researcher working on corn varieties that need less nitrogen

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Jonathan Lynch has made a name for himself doing ground-breaking (pun intended) research on the roots of bean and soybean plants in an effort to improve crop yields in places such as Africa, Asia and Latin America.

The professor of plant nutrition in Penn State's College of Agricultural Sciences has worked with colleagues in China, Africa and Latin America to develop bean and soybean varieties with better root systems that produce better yields in low-phosphorus soils -- work that has major implications for the developing world.

A different but related problem has recently motivated Lynch to turn his attention to the roots of corn grown in the United States and their ability to take up another vital nutrient -- nitrogen. "This is a new direction for us," he said. "We are taking what we learned about root traits that improve phosphorus acquisition from the soil and applying it to developing corn varieties that are more efficient in taking up nitrogen."

In the last few years, corn's ability to take up nitrogen has taken on greater importance because of increasing amounts of the crop being used to generate ethanol, which has contributed to corn prices rising.

"Corn is the single biggest crop grown in this country, and the major cost for corn farmers in the United States is buying nitrogen fertilizer," Lynch said. "Only about half of the nitrogen fertilizer applied to corn is used by the crop; the rest is wasted. If we could improve the efficiency

of the corn crop by 20 percent -- that would be huge.

"Because fossil fuels are used to produce nitrogen fertilizer, we are putting so much energy into the fertilizer used in growing corn that we aren't getting much energy out of the process of producing the crop," noted Lynch. "Corn yields are low in Africa because they don't use enough fertilizer, and it is a big problem in this country because nitrogen is expensive. And that is only going to get worse in years ahead as fuel prices rise."

Applying large amounts of nitrogen fertilizer to the land to grow more and more corn is also resulting in increased water pollution, Lynch pointed out. In many of the corn-growing regions of this country, groundwater and wells are contaminated with nitrates that come from nitrogen fertilizer. "Developing more efficient corn roots would decrease water pollution," he said.

Improving the root biology of corn also would reduce air pollution and greenhouse gas emissions (in the making of fertilizer), according to Lynch. Nitrogen pollution in the environment also is linked with the creation of a potent greenhouse gas -- nitrous oxide. "It's not just the energy cost of making the fertilizer -- it's also the wasted fertilizer that generates nitrous oxide," he explained. "According to the U.S. Environmental Protection Agency, two-thirds of nitrous oxide emissions in the United States come from fertilizer. Nitrous oxide is 300 times more potent as a greenhouse gas than carbon dioxide.

"So better corn root biology could reduce water and air pollution, lower corn prices and improve the economic situation around making ethanol," Lynch contended. "And it also could improve the world hunger picture as well."

Source: Penn State