'Grassroots action' in livestock feeding to help curb global climate change

September 13 2013

In a series of papers to be presented next week, scientists offer new evidence that a potent chemical mechanism operating in the roots of a tropical grass used for livestock feed has enormous potential to reduce greenhouse gas emissions.

Referred to as "biological nitrification inhibition" or BNI, the mechanism markedly reduces the conversion of nitrogen applied to soil as fertilizer into nitrous oxide, according to papers prepared for the 22nd International Grasslands Congress. Nitrous oxide is the most powerful and aggressive greenhouse gas, with a global warming potential 300 times that of carbon dioxide.

"Nitrous oxide makes up about 38 percent of all greenhouse gas emissions in agriculture, which accounts for almost a third of total emissions worldwide," said Michael Peters, who leads research on forages at the Colombia-based International Center for Tropical Agriculture (CIAT), a member of the CGIAR Consortium. "BNI offers what could be agriculture's best bet for keeping global climate change within manageable limits."

Scientists at CIAT and the Japan International Research Center for Agricultural Sciences (JIRCAS) have researched BNI collaboratively for the last 15 years.

"This approach offers tremendous possibilities to reduce nitrous oxide emissions and the leaching of polluting nitrates into water supplies, while also raising crop yields through more efficient use of nitrogen fertilizer," said G.V. Subbarao, a senior scientist at JIRCAS.

As a result of recent advances, scientists have developed the means to exploit the BNI phenomenon on a large scale:

- CIAT researchers have found ways to increase BNI through plant breeding in different species of Brachiaria grasses. The new techniques include methods for rapidly quantifying BNI in Brachiaria together with molecular markers, which reduce the time needed for field testing.
- Center scientists have also just gathered evidence that a maize crop grown after Brachiaria humidicola pastures gave acceptable yields with only half the amount of nitrogen fertilizer normally used, because more nitrogen was retained in the soil, thus reducing nitrous oxide emissions and nitrate leaching. The researchers determined that BNI had boosted nitrogen-use efficiency by a factor of 3.8.
- In addition, scientists have developed hybrids of Brachiaria humidicola and delivered these, with support from the German government, to farmers in Colombia and Nicaragua for productivity and quality testing. Previous grass hybrids have increased milk and meat production by several orders of magnitude, compared to native savanna grasses, and by at least 30 percent, compared to commercial grass cultivars. Based on evaluation of the new hybrids and with the aid of simulation models, researchers are studying where else the hybrids can be introduced and on how large a scale.

"Livestock production provides livelihoods for a billion people, but it also contributes about half of agriculture's greenhouse gas emissions," Peters explained. "BNI is a rare triple-win technology that's good for rural livelihoods as well as the global environment and climate. It defies the widespread notion that livestock are necessarily in the minus column of any food security and environmental calculation."

"The problem is that today's crop and livestock systems are very 'leaky,'" said Subbarao. "About 70 percent of the 150 million tons of nitrogen fertilizer applied globally is lost through nitrate leaching and nitrous oxide emissions; the lost fertilizer has an annual estimated value of US$90 billion."

"BNI has huge possibilities for reducing nitrogen leakage," said CIAT scientist Idupulapati Rao. "Grassland pastures are the single biggest use of agricultural land—covering 3.2 billion hectares out of a global total of 4.9 billion. In Brazil alone, 11 million hectares of grassland have been converted to maize and soybean production, and another 35-40 million could be shifted to crop production in the near future. Instead of more monocropping, developing countries need to integrate Brachiaria grasses into mixed crop-livestock systems on a massive scale to make them more sustainable."

Originally from sub-Saharan Africa, Brachiaria grasses found their way to South America centuries ago—possibly as bedding on slave ships. Improved varieties of the grass are widely grown on pasturelands in Brazil, Colombia, and other countries, and they have recently been taken back to Africa to help ease severe shortages of livestock feed.

In a major breakthrough, JIRCAS scientists discovered several years ago the chemical substance responsible for BNI and developed a reliable method for detecting the nitrification inhibitor coming from plant roots. Scientists at CIAT then validated the BNI concept in the field, demonstrating that Brachiaria grass suppresses nitrification and nitrous oxide emissions, compared with soybean, which lacks this ability.

Other research has shown that deep-rooted, productive Brachiaria grasses capture large amounts of atmospheric carbon—on a scale similar to that of tropical forests—a further plus for climate change mitigation.

"Our work on BNI started with a field observation made by one of our scientists in the 1980s—back then it was nothing more than a dream," said Peters. "But now it's a dream with an action plan and solid scientific achievements behind it."

BNI research forms part of a larger initiative referred to as LivestockPlus, which proposes to deliver major benefits for the poor and the environment through innovative research on tropical forage grasses and legumes.

The LivestockPlus initiative takes place within the global framework of the CGIAR Research Program on Livestock and Fish, led by the Kenya-based International Livestock Research Institute (ILRI). The program aims to increase the availability and affordability of meat, milk and fish for poor consumers and raise the incomes of smallholders producing these commodities.

Provided by Burness Communications

Citation: 'Grassroots action' in livestock feeding to help curb global climate change (2013, September 13) retrieved 27 April 2024 from https://phys.org/news/2013-09-grassroots-action-livestock-curb-global.html