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Legume inoculation in Florida

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What is legume inoculation?

Legume inoculation is the practice of introducing specific bacteria into the soil with legume seed, usually when planting. The bacteria belong to the genera *Rhizobium* or *Bradyrhizobium* but are commonly referred to as "rhizobia," "legume bacteria" or "root nodule bacteria." They infect the roots of leguminous plants a few days after seed germination. Within one or two weeks, small nodules appear on the roots as a result of these infections. Mature nodules may be round, cylindrical, or lobed, depending on the plant species.

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What is successful inoculation?

The presence of nodules on legume roots proves the bacteria have successfully infected the roots. This is important because the rhizobia living in the nodule enter into a "symbiotic" or mutually beneficial relationship with the plant. The plant and the bacteria work together to reduce or "fix" nitrogen gas (N_2) from the air into ammonium (NH_4^+) in the plant root. As ammonium, it can be used by both the bacteria and the plant as a nutrient for growth. A pink color within the nodule indicates nitrogen is being fixed. This can be observed by crushing or slicing nodules which are about one week old. Very young nodules have a white interior and very old nodules have a brown interior. Little or no nitrogen is fixed in these nodules.

Why is inoculation important?

The ability of the plant-bacteria combination to "fix" and use an otherwise unavailable form of nitrogen is of considerable economic importance to farmers. The symbiotically-fixed nitrogen supplements soil nitrogen, which is low in most soils. This is especially true for the mineral soils of the Southeastern coastal areas, where leaching,

erosion and removal of crop residues have severely reduced the supply of soil nitrogen.

Nitrogen is a key element for living cells. It is an essential part of protein, the building block of plant and animal tissue. Nitrogen is the plant nutrient that most often limits crop growth, for two main reasons. First, plants need more nitrogen than other nutrients in order to achieve good growth. Second, soil nitrogen is constantly being lost through run-off, leaching, denitrification and removal of nitrogen-containing crop residues from the soil. Denitrification is the process of changing plant-available nitrate nitrogen to atmospheric nitrogen, which then diffuses as a gas to the atmosphere. Denitrification results in a loss of soil nitrogen and is opposite in effect to the process of "nitrogen fixation" carried on by rhizobia.

Soil nitrogen is replenished primarily from fertilizers and nitrogen fixation. Nitrogen fertilizers may be inorganic materials such as urea, ammonium nitrate or ammonium sulphate. Nitrogen fertilizers are immediately available for plant uptake. They are rather expensive because of the process involved in their manufacture.

As a soil residue, "organic nitrogen," or rhizobia-fixed nitrogen, is not immediately available for plants. Numerous kinds of soil organisms must first decompose the organic residues. This results in a slow but continuous release of inorganic nitrogen which can be used by growing plants. Because of the slow release, nitrogen is not lost through leaching.

Do all leguminous plants fix nitrogen?

A leguminous plant is one that has seed pods. Beans, peas, soybeans, lupine, peanuts, and cowpeas are common legumes with prominent seed pods. Other legumes with less conspicuous seed pods are clover, lespedeza, beggarweed, crotalaria, hairy indigo, trefoil, alfalfa, and vetch.

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