



## ***Biological Nitrogen Fixation***

5/1/2015

Nitrogen. At standard conditions, elemental nitrogen is a colorless, odorless, and inert diatomic gas that makes up 78% of the Earth's atmosphere.

**Nitrogen is needed by all living organisms.** As most of you know, nitrogen is a critical component of fertility programs. To have a healthy crop and good yields, you need to have enough nitrogen in your soil. But do you need to apply all of that nitrogen? The answer is "no".

If you have biologically active soils on your farm, then there's a good chance that you have **nitrogen-fixing bacteria** in your soil. And if you don't have biologically active soils, you should definitely incorporate **SP-1™** and **Residue®** into your fertility program. Both of these AgriEnergy Resources biological products have a diverse mix of microbes, with plenty of N-fixers to convert atmospheric nitrogen into forms that can be used by your crops.

The process of **biological nitrogen fixation** involves diazotrophs (N-fixing bacteria) converting atmospheric nitrogen to ammonia. There is often a symbiotic relationship between plants and diazotrophs. The microbes fix nitrogen which can be used directly by the plants. In return, the plants provide the microbes with a protected environment and a supply of energy-rich food (root exudates).

**Microbes only fix nitrogen when it is in short supply;** N-fixation is an energy-intensive process and diazotrophs only fix nitrogen when they need to. Most N-fixing bacteria that inhabit the soil fix nitrogen for their own use/benefit. If there is

not enough nitrogen available around them, their nitrogenase enzymes kick in and they start converting  $N_2$  into forms that they can use.

Some of that nitrogen also becomes available to plants, especially when the N-fixing microbes inhabit the rhizosphere (zone surrounding the roots). **Nitrogen fixation in the rhizosphere is more common than in bulk soil** because the high energy demand of N-fixation can be met by the carbohydrate-rich plant exudates in the rhizosphere.

Free-living diazotrophs are commonly isolated from corn, wheat, sorghum, rice, and sugarcane. Studies have shown that these crops can get some of the nitrogen they need from biological nitrogen fixation. In several of those studies, N-fixation activity was detected only after amending the soil with a carbon source. In other words, N-fixation increased when a carbon-rich food source was added to the soil near the rhizosphere.

During much of the growing season, crops are able to feed microbes with their root exudates. **You may be able to increase biological nitrogen fixation by adding carbon and sugar sources, such as humates and molasses, to your soil.** Not only will this stimulate microbial activity, it will also provide fuel for diazotrophs to fix atmospheric nitrogen.

Talk to your AgriEnergy Resources representative to see what products are available that contain these important microbial food sources. Keep in mind that plenty of soil microbes are able to fix nitrogen without carbon amendments. There are always lots of variables to consider such as soil type, existing microbial diversity/numbers, fertility program, and weather.

**In general, the more N-fixing microbes you have out there, the better.** If you have high numbers of diazotrophs out in your soil fixing nitrogen, then you can decrease the amount of nitrogen fertilizer you apply, which adds more dollars to your bottom line.

***Biological farming practices that utilize and encourage N-fixing microbes make a whole lot of sense!***