Ultra Gro Plant Food
Quality and Performance Creating Value

GROWERS BULLETIN

ULTRA GRO PLANT FOOD COMPANY

Nitrogen in Action

Even though nitrogen is almost 80% of air, it is not available to plants unless it is converted in some manner by weather, microbes, man and/or animals. A very small amount is introduced into soil by electrical storms (about 5#/acre/yr) where they occur. The chief source of soil nitrogen is fixation by microbes in soil and from plant residues and animal wastes. Nitrogen in plant and animal wastes must be reduced by bacterial decomposition, oxidation and reduction to finally be mineralized to a form usable for plants. Organic matter usually has about 5% N, but at best only 2 to 4% of this is made available during an average season. Microbial nitrogen fixation is a process by which N from the air is converted to forms available to plants. The symbiotic (nodule forming) bacteria are associated with legumes, while free-living organisms do not need a host plant for their action.

These as well as chemical fertilizer production are directed by man. Prior to 1914, most nitrogen products were based on Chilean sodium nitrate deposits. The high sodium content is a major problem with this. The Haber-Bosch process involves very high temperatures and pressures to convert atmosphere nitrogen into ammonia. This makes N available but capital and operating costs make it expensive. N is also produced by fractional distillation of air. Both of these processes require much electrical energy and production is often located near hydroelectric sources.

Nitrogen is an essential element of proteins, nucleic acids and many other constituents of living matter. Nitrogen is most generally available to plants as the nitrate ion (NO_3). Nitrogen applied to soils in the ammonia form is mainly bound to soil particles and does not move through the soil.

For it to be changed into the mobile nitrate form it must be converted by microbial action. Because this, application of fertilizers as close to the crop root area as possible is best, both from the speed of action and economic value considerations.

In most soils, over 90% of the N content is organic. This eventually is broken down to ammonia and nitrate by bacterial action. Total N in ag soils is generally 0.02 to 0.5% (on a dry weight basis), with half bound in amino acids and sugars within the “humus” material. Nitrogen in humus is very important in maintaining soil fertility. It serves as a reservoir of N, and its rate of decay and N release to plants roughly parallels plant growth – rapid in warm growing season and slow in the cold weather.

Plants use N to form amino acids which are transported up into the plant and converted as needed. N is present in proteins, Chlorophyll, nucleic acids and enzymes. Chlorophyll is needed for photosynthesis (carbon assimilation and energy from the sun). Enzymes control all of the metabolism of the plants.

Nitrogen promotes plant growth and most plants contain 1 to 3%. Crops usually remove 50 to 100 #/acre. Early growth in spring is fueled by N in already formed woody tissues. So, a fall N application is a good move. This may be done either to the soil or in a foliar.

Nitrogen deficiency can result in slow growing and stunted plants, chlorosis in older tissues, and firing of tops and margins of leaves. Since N moves within plants from older to newer tissues older tissues become chlorotic when it is in short supply. In such cases foliar applications are the best and quickest remedy. This gives a ready source of nitrogen to satisfy demand until soil applications can become effective.
As mentioned earlier, microorganisms are important in the nitrogen cycle of soils. Fungi and bacteria

ofdecompose proteins, chitin, urea, and many other material to cause the conversions between the varied forms of N which include ammonia, nitrogen gas, nitrite, and nitrate. When nitrogenous material decays the first product is ammonia. This can be used by some plants, however most of it is taken up by microbes and is converted over to the more easily assimilated nitrates. In heavy and water-logged soils where anaerobic conditions can prevail N can be lost through conversion to gaseous forms. This is called denitrification.

In microbial N fixation, both nodule-formers and free living microbes, the enzyme responsible is termed nitrogenase. It consists of two distinct protein parts. Both need iron to function and one must have molybdenum (Mo). We have found instances where hay was failing because of lack of moly. Other essential elements for N fixation are calcium, phosphorus and cobalt. The use of legume crops for N fixation requires attention to soil analysis because of the increased demand on P and K, as well as certain micro nutrients.

Soluble forms of N can be leached from the soil by excess water in certain soils. Nitrate pollution of some surface and ground waters is under discussion in some areas. Over use of fertilizers and feedlot waste runoff are listed as prime causes. Already some states are employing restrictions, and agitation for feeder regulations is in progress. Caution and more proximal application of fertilizer is not only sound for health reasons but can result in monetary savings for the farmer.

Written exclusively for Ultra Gro Plant Food by Dominic J. Colasito, Ph.D.