Buffer pH is a measure of reserve acidity and is used by the soil testing laboratory to estimate lime requirements. Low buffer pH readings indicate high amounts of reserve acidity, and therefore, high amounts of lime will be recommended. The soil pH should always be lower than the buffer pH except on some alkaline soils. Instead of using buffer pH, some laboratories calculate lime requirement form CEC and base saturation while others make this determination based on aluminum level.

Plant Nutrients—major and minor

Nitrogen

Nitrogen (N) has a pronounced and often dramatic influence on the growth and yield of crops. Management of soil and fertilizer N is difficult because N undergoes numerous transformations and is easily lost from the soil. These losses concern growers for two principal reasons: 1) the losses can and often do adversely affect plant growth and crop yield, and 2) when N is lost in the nitrate form, there is a chance for contamination of groundwater and drinking water supplies.

The Nitrogen Cycle

The N cycle (Fig. 1) illustrates N inputs, losses and transformations. When inputs exceed plant needs, nitrates can accumulate in the soil and pose a threat to groundwater. Conversely, when plant-available forms of N from the soil and any inputs are too low, crop growth suffers. The key to successful management of N is to find the relatively "thin line" region between too much and too little N. It is not an easy task. N transformations and losses are affected by soil conditions and the vagaries of the weather.

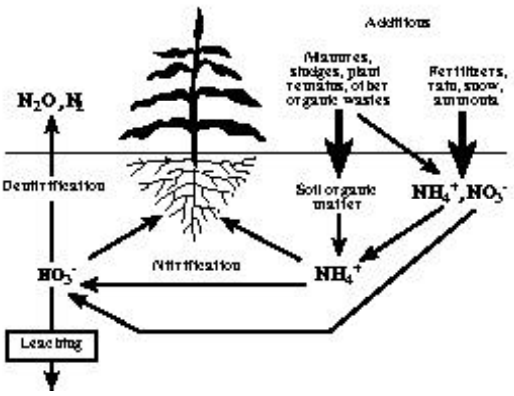

Figure 1. The nitrogen cycle.

Nitrogen Inputs

As can be seen from the N cycle, there are several different sources of the N used by plants:

Soil organic matter: The total amount of N in the plow layer of agricultural soils is surprisingly large. One can estimate the total N in pounds per acre in the six to seven inches of surface soil by multiplying the soil's organic matter content by 1,000. Thus, a soil with 4% organic matter contains about 4,000 lbs N per acre.

The amount of this total N available to plants in any one year, however, is relatively small. Research has shown that for most soils 1% to 4% of the total N is converted annually to forms plants can use. For soil with a total of 4,000 lbs N per acre, a 1% to 4% conversion would produce 40 to 160 lbs N per acre annually for plant use. If the crop needs 200 lbs N per acre for adequate growth and development, additional N must come from nonsoil sources. Manure and/or commercial fertilizer are the most likely candidates to furnish this supplemental N. On well managed soils used for small fruit production, 20 to 30 lbs of N per acre will result from each percentage of organic matter during the growing season.

Previous cow manure applications: Up to 50% of the total N in cow manure is available to crops in the year of application. Between 5% and 10% of the total applied is released the year after the manure is added. Smaller amounts are furnished in subsequent years. The quantity of N released the year after a single application of 20 tons per acre of cow manure is small (about 15 lbs N per acre). However, in cases where manure has been applied at high rates (30 to 40 tons per acre) for several years, the N furnished from previous manure increases substantially.

The buildup of a soil's N-supplying capacity resulting from previous applications of cow manure has important consequences for efficient N management, two of which are:

1. The amount of fertilizer N needed for the crop decreases annually;
2. If all the crop's N needs are being supplied by cow manure, the rate of cow manure needed decreases yearly.

In cage layer poultry manure, a higher percentage of the total N in the manure is converted to plant-available forms in the year of application. Consequently, there is relatively little carry-over of N to crops in succeeding years. This is due to the