The Attributes of Amino Acids

BY KARL DANNEBERGER

Amino acids are the building blocks for proteins. A total of 20 amino acids exist that are combined into various lengths (peptides) to form proteins. In humans, nine of the 20 amino acids are considered essential. Athletes will add extra protein or amino acids to their diet as supplements to add muscle. But plants do not need supplemental amino acids because they can make all of the amino acids on their own starting with nitrate or ammonium.

Structurally, amino acids contain an amine group (NH_2) and a carboxyl group (COOH). The carbon where these two groups are attached is called the alpha carbon. The third component, the side chain which can vary in structural complexity, is also attached to the alpha carbon. The side chain is the differentiating structure of the amino acids.

Amino acids occur as one of two optical isomers. A visual analogy for optical isomers is that your left hand is a mirror image of the right hand, but the two hands can't be superimposed on each other. The amino acid optical isomers exist on one of two forms referred to as L and D. Almost all amino acids that exist in proteins are of the L form.

Although the major importance of amino acids is in the formation of proteins, they can serve as a chelating agent for micro-nutrients and as a base for certain herbicides. For example, the amino acid glycine with methyl phosphonate forms the herbicide glyphosate (Meister, 1999). Additionally, amino acids can be oxidized to urea and carbon dioxide as an energy source.

Since amino acids can be oxidized into urea, they are used as a nitrogen source in some turfgrass fertilizers. Amino acids only can be taken up by the plant as a single amino acid or peptide. Amino acids that are linked together like dipeptides (two amino acids) or larger peptides can't be taken up by the plant directly.

In organic fertilizers that contain chicken feathers, sea kelp or other sources of protein

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that are not completely hydrolyzed, then the plant depends on soil microbes to break down the protein for nitrogen utilization. The nitrogen is then mineralized and used by the turfgrass plant.

Given that single amino acids can be taken up by the plant readily and that partially hydrolyzed proteins (dipeptide or larger) are not taken up until microbial activity occurs, the analogies of "quick-release" and "slow-release" types of amino acids have been applied. On some fertilizer bags that contain amino acids, the terms "free" and "fixed" are used and are probably analogous to "quick" and "slow," respectively.

Amino acids are immobilized by coming in contact with surfaces with considerable electrical charge. In laboratory studies, amino acids are often fixed to charged membranes. In nature, amino acids can become fixed to soil particles like clay that have a charge.

Organic fertilizers containing amino acids that are in the form of partially hydrolyzed proteins have slow-release characteristics. A quick-release form of nitrogen may be needed or added to the product to get the initial nitrogen response.

Single peptide amino acids can be applied and taken up by the turfgrass plant. However, their efficiency is still being studied. To enhance the response time, amino acids (single peptides) are best applied as a foliar application to minimize the potential for being fixed to a clay particle.

Amino acids are essential to healthy turf, just as they are to human beings.

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