Nitrogen Fertilization in Hydroponics

It is a common mistake in hydroponic gardening to assume that the chemical forms of nitrogen that can be used in hydroponics are the same that can be used in regular soil gardening. Don't get me wrong, plants in soil and plants in hydroponic media use the exact same chemical forms of nitrogen as nutrients, what changes dramatically from hydroponics to soil gardening is the environment in which the plant is.
Let us talk about the available forms of nitrogen first. Plants absorb nitrogen either as $NO_3(-)$ (nitrate) or $NH_4(+)$(ammonium) ions. Both of these ions supply nitrogen to the plant but they have dramatic differences inside the plant's metabolic pathways. Nitrate is absorbed by the plant slowly and provides the materials needed for the synthesis of amino acids and other structures while ammonia is absorbed rapidly and causes immediate plant toxicity if present in highly enough concentrations.
This is the main difference between soil and hydroponic gardening. In hydroponics, most of the nitrogen must be supplied as NO3(-) because the hydroponic media allows ammonium ions to become toxic exceedingly fast. For example, hydroponic plants can withstand concentrations of nitrogen (as nitrate) up to about 250 ppm while concentrations of nitrogen as ammonium are only withstood up until about 30 ppm. This is the reason why urea cannot be used as a nutrient salt in hydroponic gardening to supply all the nitrogen needed by the plants.

So if plants in soil and hydroponic media assimilate the same nutrients, why can plants in soil be fed nitrogen as ammonium but hydroponic plants cannot ? The answer is quiet simple. Bacteria present within the soil are able to efficiently convert ammonium ions into nitrate ions, effectively reducing the amount of ammonium the plant "sees". In fact, plants in soil also absorb nitrate, the only difference is that there

are bacteria that can convert ammonium to nitrate, reason why nitrogen can be supplied as ammonium to plants present in soil.

So next time you are searching for a nitrogen nutrient for your hydroponic plants, remember to search for nitrate salts as more than 90% of your total nitrogen source. The most important salts for providing nitrogen as nitrate in hydroponic gardening are potassium nitrate and calcium nitrate. This is important to remember, as using ammonium salts to provide your plant’s nitrogen will ultimately kill them in hydroponic media ! (below, an image showing the effects of ammonium fertilizer in hydroponic plants)