WHAT IS FOLIAR APPLIED FERTILIZER?

Modern foliar fertilizers are concentrated solutions using very high grade technical elements, in which the nitrogen, phosphorus and potassium are combined to the desired ratio in a controlled environment and applied in a liquid form.

The fertilizing elements used in this method are true solutions, soluble, and thus very plant available. This is in contrast to soil applied (solid) fertilizer, which is applied as a powder or granules to the soil in dry form. This then, has to be dissolved, by moisture to be plant available via the roots. In other words, it has to dissolve into the soil solution to be available.

To these foliar solutions, trace elements in the form of chelates are added, along with other additives to give a balanced fertilizer, supplying not only NPK, but all the trace elements as well as growth hormones, vitamins etc.

Many different NPK formulation combinations can be made, depending on the application required. The same elements that make up foliar fertilizer are required for plant growth and development, and are formulated to meet quite specific plant requirements.

Foliar fertilization is the most efficient way to increase yield and plant health. Tests have shown that foliar feeding can increases yields from 12% to 25% when compared to conventional fertilization.

Tests, conducted in different locations, under different environmental conditions, have reflected the following:

- When fertilizers are foliar applied, more that 90% of the fertilizer is utilized by the plant. When a similar amount is applied to the soil, only 10 percent of it is utilized.
- In the sandy loam, foliar applied fertilizers are up to 20 times more effective when compared to soil applied fertilizers.

Foliar feeding is an effective method for correcting soil deficiencies and overcoming the soil's inability to transfer nutrients to the plant under low moisture conditions.

The effectiveness of foliar applied nutrients is determined by:

1. The condition of the leaf surface, in particular the waxy cuticle. The cuticle is only partially permeable to water and dissolved nutrients and, as a result, it can limit nutrient uptake.
2. The length of time the nutrient remains dissolved in the solution on the leaf's surface.
3. Diffusion, the movement of elements from a high concentration to a low concentration. For diffusion to occur, the nutrient must dissolve.
4. The type of formulation. Water-soluble formulations generally work better for foliar applications as they are more easily absorbed when compared to insoluble solutions.

These essential elements are divided into two groups: the macronutrients; those required in relatively large quantities including carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium and sulphur and the micronutrients, those required in small quantities; including iron, chlorine, manganese, boron, zinc, copper and molybdenum.
You will see that by far the biggest proportion is hydrogen, carbon and oxygen which makes up 96% of the plant and are freely available from the air and water.
All of the other elements make up the remaining 4%, of which the major elements nitrogen, phosphorus and potassium make up 2.7%, leaving 1.3% minor or trace elements.
Carbon, hydrogen and oxygen which form the actual plant structure are readily obtainable from air and water, specifically carbon dioxide or water. Along with chlorine, which is found in most water sources, these elements are generally not considered in the formulation of foliar solutions.

Depending on the application required, foliar fertilizers can be formulated to meet very specific plant requirements.
For example a high nitrogen formulation is used when the demand in plants is for more nitrogen in relation to phosphorus and potassium, but the formulation is changed for growth periods that require higher phosphorus and / or potassium, in relation to the demand for nitrogen.
This often happens when a plant is under stress, which coincides with periods of great growth, such as when a plant is changing from a vegetative to a reproductive stage.
At the same time, the exact plant requirement for trace elements can be addressed, as a result of leaf analysis.

Certain soil conditions, such as pH, excess moisture, or cool temperatures, may render a nutrient or nutrients unavailable to the plant root.

Nutrient demand curves indicate that there are stages in a plant's life-cycle when demand for some nutrients may be greater than its physiological capacity to supply itself, even when these soil nutrients are available in abundant supply. This often occurs during the development of fruit or grain.

Data from trials on crops show that increases in yield and/or grade results from applications of foliar nutrients during these periods of peak demand.

Foliar fertilizers can be designed to meet a plant?s specific needs for one or more micro and macro nutrients--especially trace minerals and enables you to correct deficiencies, strengthen weak or damaged crops, speed growth and grow better plants, which is of course, the bottom line.
Foliar applications can be targeted to a particular stage of crop development to achieve specific objectives and is an excellent way to “fine tune” a high fertility program.

The readily- available nutrients are more easily utilized, as they are directly available to a plant and because they do not have to be dissolved by moisture before going into the soil solution and where they may be subjected to insolubalization by incident anions such as carbonate, bicarbonate, hydroxide, etc, known as fixation.

Also important in foliar fertilizers, is whether or not the products being used are chelated. Chelation, allows a nutrient to “maintain its own identity” within the spray tank, and not get tied up by other nutrients or pesticides being used with it.

These days we have materials available which are ideally suited to spray applications.

GUIDELINES FOR FOLIAR FEEDING APPLICATIONS:

- Use a sprayer that produces a fine mist
- Nozzles should be turned to the back of the sprayers so the flow of material approaches the plant at a 90 degree angle to float on the plants

Plant hormones

Plant hormones are specialized chemical substances produced by plants. Foliar fertilization is a particularly useful technique: and are the main internal factors controlling growth and development.
Hormones are produced in one part of a plant and transported to others, where they are effective in very small amounts.

Depending on the target tissue, a given hormone may have different effects.
Auxin, one of the most important plant hormones, is produced by growing stem tips and transported to other areas where it may either promote growth or inhibit it.

It also retards the abscission (dropping off) of flowers, fruits, and leaves.
Commercially, synthetic auxins are used to initiate adventitous roots from plant cuttings eg. In nurseries.
Weed control by another synthetic auxin, 2, 4-dichlorophenoxyacetic acid (2,4-D), is widespread as a selective herbicide against broadleaf weeds.

Producers have been using foliar fertilizer since the early 1950’s. Even though the subject of foliar fertilization was little understood, ‘experts’ told farmers that they shouldn’t use them, because in comparison to solid type fertilizers, foliars contained fewer nutrients.

Nutrient demand curves indicate stages in a plant's life-cycle when the need for some nutrients may be greater than its physiological capacity to supply itself, even when these soil nutrients are abundantly available. Highly soluble potassium and nitrogen-based fertilizers can be easily washed out from the soil, and phosphate fertilizers can attach themselves to ions of potassium, magnesium, aluminum and iron into chemically insoluble form for plants.

Foliar nutrients on the other hand are mobilized directly into plant leaves, which are the goal of fertilization to begin with, increasing the rate of photosynthesis in the leaves, and by doing so stimulate nutrient absorption by plant roots.

Foliar fertilization is by far the most effective way to apply micro nutrients or trace elements, and supplement the major elements. The readily available nutrients are more easily utilized, because they do not have to be dissolved by moisture and go into the soil solution.

Foliar fertilizers used in conjunction with solid fertilizers, can be used to quickly correct a nutrient imbalance and stimulate increase in root uptake. In addition, foliar fertilization can correct deficiencies, strengthen weak or damaged crops, speed growth and grow a better plant, which is of course, the bottom line.

Fertilization:

Tissue studies of plants have found more than 60 different mineral elements, although it has generally been accepted that 16 -17 elements are essential for plant growth.

Many farmers are well aware of the consequences of low levels of copper or cobalt in pasture, and in some areas selenium, as well as magnesium (grass staggers), even iodine and zinc and in many cases calcium (as in milk fever).

There are many cases where several of the nutrients are missing or are at such low levels that supplementation of the animal is necessary, otherwise the animal would die or be severely undernourished.

Subclinical trace mineral deficiencies occur more frequently than recognized by many livestock producers and can be a bigger problem than acute mineral deficiencies, because the specific symptoms that are characteristic of a trace mineral deficiency are not seen.

Instead, the animal grows or reproduces at a reduced rate, uses feed less efficiently and operates with a depressed immune system. The end result is inefficient production and lower profitability.

When micro-nutrients become a limiting factor, water, fertilizer and other high-energy production inputs are wasted.

In most cases the elements needed by the plant are also needed by the animal which feeds on the plant.

Some elements needed by the animal are not required by the plant, but plants takes them up and make them available to the animal, and therefore plays a significant role in animal health. Selenium, iodine and cobalt are examples.

Seven trace minerals have been shown to be needed in supplementing animal diets. They are iron, copper, zinc, manganese, cobalt, iodine and selenium.

Soils:

Soils are derived from weathered parent material.
If the original material was low in a particular element or nonexistent, so too is the resulting soil.
Soils can become depleted of minerals and trace elements which too are absorbed into the likes of meat, milk, bone, wool, vegetables and fruits, as well as the major elements, and many soils are naturally deficient in one or more of these elements.
Soils can be radically different, with localized deficiencies of trace elements like copper, cobalt or selenium.
Because our supply of minerals comes through the food chain, from the plants and animals we eat, and because these same minerals are essential ingredients of these same plants and animals, any that are missing can have serious implications for plant, animal and ultimately our own health.
One has to conclude then, that this is where fertilization should start.
Even though the major element solid type NPK fertilizer is required in the largest amounts, if used exclusively, sooner or later a deficiency of a minor element can occur in soils low in that particular element, and it too should be replaced.
Foliar nutrients can quickly correct a nutrient imbalance, and are by far the most effective way to apply micro nutrients or trace elements and supplement the major elements , because foliar nutrients are readily available and more easily utilized by the plant than soil nutrients.

University of Tennessee - Prof. T.S. Osborne, Agronomist
"... research indicated that only 10 to 12 per cent of phosphorus fertilizers as taken up by plants in the first year; the rest was "locked in" the soil or washed away. Fertilizer applied to soil is largely wasted because it is either bound by soil particles or is washed out of the root zone. If chemical elements could go directly into leaves and bypass the wastefulness of soils, a tremendous saving would result.?
?... the foliage of plants can take in nutrients much as roots can. Many nutrients are readily taken up by foliage, including bark of dormant trees; even at temperatures below freezing. Elements such as phosphorus, nitrogen, and potassium move both up and down from the point of application at rates similar to those following root absorption."

University of Michigan - Drs. Witter and Turkey as quoted in Readers Digest magazine
"... leaves lap up food like blotting paper and it spreads in a few hours from tip to root. In many cases, as much as 95 percent of the food sprayed on the leaves is used immediately by the plant, where under some conditions, the roots take up no more than 10 percent of the same amount placed in the soil."

Louisiana State University - Drs. A.L. Bertrand and L. L. Rusoff
"Trader elements were used to ascertain conclusively that plants absorb nutrients through their foliage, fruit, flowers, and twigs as well as their roots."

Agricultural Chemicals Magazine
"Phosphorus availability studies have given a ratio of 20 to 1 in favor of foliar feeding over soil feeding. There seems little doubt that where soil fixation exists, foliar applications of nutrients constitute the most efficient method of fertilizer "placement" and with plants of sufficient leaf area, foliar feeding with ALL the elements can make a significant contribution toward the total nutrient requirement."

Ontario Agricultural College - Dr. T.E. Bates
"We increase corn yields 7 bushels per acre at five different locations with liquid fertilizer placed directly with the seed. The corn also received the recommended amounts of fertilizer in a band. The most startling difference is in the size. Some fields were half again as tall two weeks after the core cam up."