

# Plant Food, you say?

## Part Four: organic or mineral nutrients?

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Nowadays there is a rising consciousness about environmental and ecological issues. We are more and more attentive to what we pour into our soil, to the amount of water we use, to the way we dispose of our wastes and, of course, to what we eat and ingest on a general basis.

Preserving our planet and our health is becoming a major concern after the 20th century and its long series of “un-ecological behaviours”.

So the issue of organic versus mineral plant food comes out regularly, and it is a valid question. But it is a question that must be looked into with care, as it is easy to “simplify” the issue to the use of fertilizers, when in reality it is definitely a wider subject than that.

To better understand plant food and the way it affects plants, it is good to start with some basic information about plant nutrition and plant composition.

### How do plants grow?

Very simply, plants absorb food through their roots, and transform it into organic matter through their leaves.

**Soil and water:** Soil is the result of the mechanical alteration of rock and the chemical activity of organic transformations. It acts as a support for plants, and it provides the water, oxygen, and mineral salts they need to develop. On a strictly nutritional level, soil acts as a substrate; it is water indeed that transports the nutrients while soil retains water with more or less efficiency, depending on its water retention capacity.

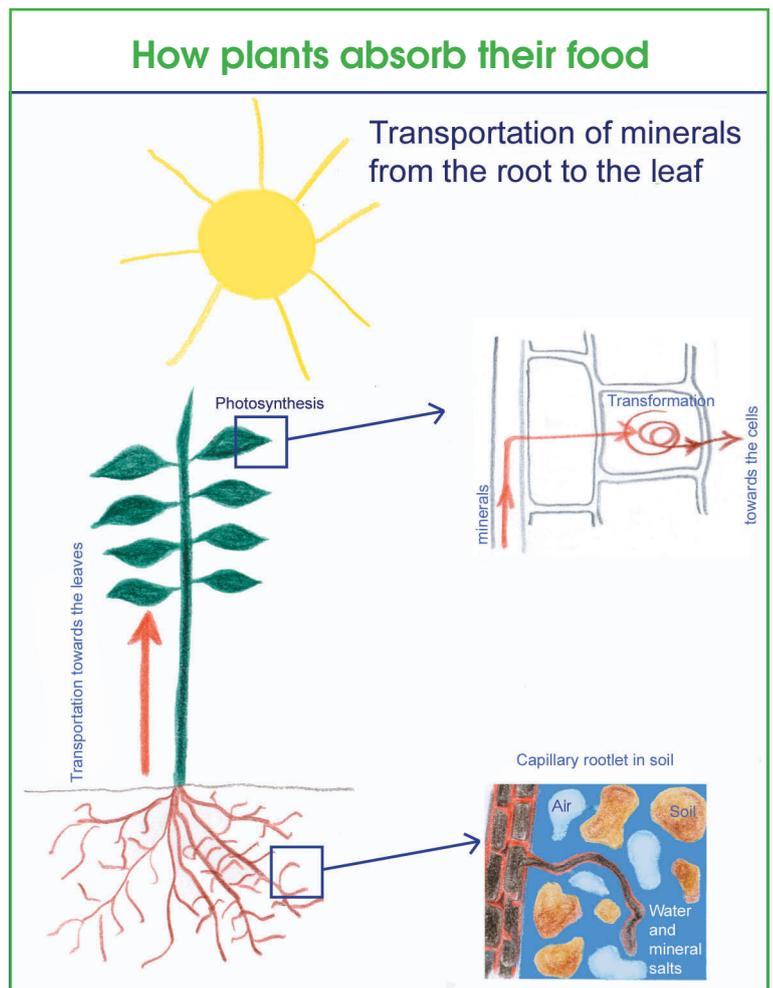
**Root absorption:** At root level you find little absorptive hairs that firmly stick to the soil particles. These hairs create a huge interaction area between the soil and the plant and enhance water absorption capability of the root surface. (This is why it is important at all times, and especially during transplanting, to be careful not to damage these small rootlets). This absorption action, under the influence of “osmotic pressure”, will transport the nutrients from the soil to the leaves. This is when “crude sap” is created.

**Transport to the leaves:** Plant food rises from the roots to the leaves. During the day, the sap goes up thanks to the evaporation and transpiration in the leaves. At night, the sap goes up thanks to the accumulation of salts and minerals at the root level, called “root pressure”.

This up going circulation to every cell brings in the metabolites (substances absorbed by the organism as food) that feed the plant.

**Nutrient assimilation:** the nutritive elements will be delivered to and absorbed by the plant cells. These processes, and the plant’s ability to absorb and assimilate essential elements, are influenced by the purity of the water, the quality of the nutritional program, the concentration of the solution, pH, temperature, and the presence of incompatible elements, which may bind and inhibit important minerals from being available to the plants.

**Fixation of metabolites:** nutrients delivered to the leaves will be processed through photosynthesis, the primordial step in the production of organic matter. Photosynthesis uses CO<sub>2</sub> (absorbed through respiration by the leaves) and water, and transforms minerals into metabolites, the substances the plants use to live and develop.



## Plant composition:

Plant tissues are made of, or contain, many components such as proteins, polysaccharides, amino and organic acids, etc. These compounds are themselves made of 80% oxygen and carbon, the rest being hydrogen and nitrogen, and a series of essential minerals like silicon, potassium, calcium, sulphur, phosphorus, magnesium, iron, sodium, manganese, boron, copper, zinc, molybdenum and other assorted trace elements. So it is important that you always provide your plant with at least the elements cited above.

*Osmotic pressure is the ability of a solution to pass through a membrane from the side of the less dissolved salts to the side of the higher concentration, in an attempt to gain equilibrium on each side. In this case, the nutrients enter the roots by a "mechanical" absorption action, where the highest concentrated part (the plant) sucks in the less concentrated part (the nutritive solution).*

*Being mechanical, osmotic pressure explains the fact that a plant can uptake a large range of substances, some of them healthy, but some of them damaging and even toxic.*

How to provide these elements in a form that is good for plants - and for our own consumption? Some will advise organic, others will prefer mineral nutrition. The decision seems simple, and yet there are more essential factors for a plant's quality than just the origin of the minerals it absorbs.

## Organic versus inorganic

There are many definitions of "organic", the most commonly used is "any chemical compound containing carbon and hydrogen", or derived from living organisms, plant or animal. So "inorganic" or "mineral" is defined as a non-living material, neither of plant nor of animal origin, which contains no carbon or hydrogen. Interestingly enough, everything on earth is composed with the same 103 "inorganic elements", and their innumerable combinations, and nothing else. To live and propagate plants necessarily need a minimum of 13 of them, so discarding minerals as non-viable is a definite oversight.

As already said, and contrary to many texts and commercials, there is no organic fertilizer today adapted to hydroponics. The reason is quite basic: by definition a hydroponic solution contains perfectly soluble elements whereas organic matter is reduced to molecules that are too large to dissolve correctly. So many elements remain insoluble in the solution, and are consequently unavailable for plant absorption.

## The uncertainty factor:

In organic soil gardening, minerals are obtained from composting matter. Once consumed and digested by the worms, bacteria and other micro organisms in the soil, they will be released as ions (inorganic elements) dissolved in water, the only form under which plants will absorb them. While being a "natural" transformation, composting introduces an uncertainty factor in the procedure. Depending on its origin and the accuracy of its manufacturing technique, you may find toxic substances introduced in the compost or created by the composting process (harmful pesticides and herbicides carried from previous crops used in the compost, or heavy metals like lead, mercury, tin or nickel which can be present in significant quantities in the animal waste and seaweed commonly used in organic fertilizers).

In hydroponics the same inorganic ions are provided under a different nutrient presentation. These minerals are generally derived from nature, most have been purified to remove heavy metal contaminants and toxic substances, and processed to become completely water-soluble and in a pure form. Therefore, by its nature, the hydroponic method eliminates much of the uncertainty factors of organics.

Finally, from the plant's point of view, minerals are minerals wherever they come from.

Intrinsically, in soil as in hydroponics, plants absorb their food under the same form: inorganic ions dissolved in water. So the main question is not so much the origin of these elements, but rather the grower's gardening practices and his management of the plant's nutrition. Indeed you can produce toxic plants with any fertilizer, be it organic or mineral, when you don't follow basic parameters. In soil and in hydro alike.

*Eventually all living matter will decompose to become composed only of inorganic elements.*

## Nutrient management

Wherever they grow, plants respond to specific diets and need a certain combination of minerals to develop harmoniously. Because of the osmotic pressure phenomenon, plants can absorb about anything a plant can suck in, beneficial and harmful elements alike.

This means that :

- ◆ Depending on the accuracy of the formula you use, you will provide enough of each mineral your plant needs - or not. So choosing your formula with care is highly important, and choosing a formula adapted

to the quality of your water (soft or hard) is even more important.

- ◆ If you are not careful and feed too much or too little, you will create toxicities (too much minerals) or deficiencies (too little minerals). So follow the directions on the labels of the nutrient you work with.
- ◆ If you already apply your own recipes, it is best to keep an EC on the lower side of the scale to avoid too much salt build up. Contrary to what many think, plants don't need to be overfed.
- ◆ The pH of the irrigating solution influences directly the way minerals remain available for absorption. So try to keep your pH between 5.5 and 6.5 as much as possible. There is no need to adjust it too drastically as plants live perfectly inside this range, and too much adjusting is harmful rather than beneficial. Especially if you use simple diluted acids. You may think these conditions are specific to hydroponics. But it is not so. To remain in a form available to plants nutrients must bathe in a specific environment. Highly acidic or alkaline soils for instance, are as detrimental to plants as a highly acidic or alkaline nutritive solution.

This is why good quality water, regular EC and pH check, and a pure and exhaustive nutrient formula are of the utmost importance. Indeed, no matter if you grow in soil or in hydro, what your plants need is proper food availability!

## Soil and its nutritional capacity.

### Can soil alone provide all that a plant needs?

Some will say that soil is not just a substrate, and they are right. Soil in itself is a complete microcosm that carries much more than just minerals.

Soil is composed of a mineral part, an organic part, and living organisms.

A good quality soil contains a good balance of minerals provided by the erosion of rock in variable proportions of sand, silt and clay. It must be crumbly to insure good root penetration and good aeration. It must have enough water retention capacity in order to keep the roots moist at all times, and to prevent matter from leaching down into the deep ground waters.

A good quality soil must contain a sufficient quantity of humus too as, by decomposing organic matter, humus will continually renew mineral content. At the same time humus will prevent soil from packing and insure adequate soil aeration and good water retention.

A fertile soil must house a good quantity of living organisms. 1 kg of good soil contains: 3000 billions bacteria, 400 millions fungi, 50 million algae, 30 million protozoa, nematodes and other worms, and a whole lot of diverse insects! The role of these beneficial micro organisms is to transform organic matter into the inorganic minerals required by plants and to mix and stir the earth to keep it moist and well aerated.

All these characteristics bring what could be called the "tang of the soil", a particular flavour that comes with the earth. But all soils are not equal, and very few contain all you need for a comprehensive nutritive program. Some are fertile, of course. Some are poor, others are totally inadequate, and a few may even be toxic. Some are easy to adapt with a little fertilization, and others need complete transformation.

### Can a mineral nutrient bring you the same qualities as a fertile soil?

The first reaction would tend to say no.

But then again, mineral nutrients are generally pure, perfectly soluble, and readily available to plants. If well chosen, they bring to the plant not only all the primary and secondary elements it requests, but also the widest range of micro and sub-micro elements.

Even better, if you take a closer look on your supplier's shelves, you will find that some high-end plant food manufacturers offer an array of products that "bring earth to hydroponics". This means that with those products you are getting closer to soil conditions: fulvic acids, silicate powders, plant extracts, beneficial micro-organisms, etc. By following their application charts and applying a balanced and comprehensive program, you will improve your plant's diet tremendously, and bring a "tang of earth" to your hydroponic operation.



So when choosing your nutrients, the main question is not so much whether they are organic or mineral, but rather if their formulation is precise enough to leave no toxic elements in the plant, if they are complete, if they are made with purified mineral salts, and if the assortment - and the quality - of the micro and sub-micro elements they contain is adequate enough.

For the rest it is not only the nutrient that makes the difference, as we just said, but the grower's handling and managing. And if you want to make sure your plants are totally clean and proper for consumption, don't hesitate to rinse them well before harvesting, either by adding only water with adjusted pH, or by using an end of life forcing solution during the last 10 days of the plant's life, whichever nutrient you use, and however you are growing, in hydroponics or in soil.

