A quarterly publication for growers

BOTANICARE® GROW GUIDE

NPK
Your Simple Guide

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If you've ever asked an experienced grower or your favorite, local hydroponics shop, "Which nutrients are the best?" or "Which bloom enhancer should I use?" - then you've probably gotten the same answer, time and time again, "They all work." Assuming this is true then why are there more choices available than ever before?

The fact is, that although everyone knows that plants require nutrients to grow, many growers don't really understand how they work. After all, manufacturers have developed a wide range of nutrients, supplements, and other products through extensive research and testing to meet the specific needs of any plant type or garden, so that you don't have to.

Each year at Botanicare we receive thousands of phone calls and emails from growers all over the world with nutrient-related questions. These questions inspired us to create this edition of the Botanicare Grow Guide. By taking the time to understand some of the fundamental concepts of plant science we can make better, informed choices about what and how we feed our plants.

In this issue of the Botanicare Grow Guide we dive deeper into nutrients, supplements, minerals, organics, and most importantly how each one interacts with another and how to achieve the optimum balance. It's more than just the products you add to your feeding schedule, but truly understanding how each one works and the role it plays in maximizing the output of your garden. This is especially true in hydroponics, where you determine what the plant has access to, and when.

Today, the increasing cost of energy and water mean that it is more important than ever to operate the most efficient garden possible to maintain sustainable profits. As a consumer making product choices while filtering out the constant marketing noise can be overwhelming. Our goal is to make this publication your source for some of the core knowledge you need to become a successful grower.

Sincerely,

The Botanicare Team

Contributors:

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Simon completed a Masterate in Horticultural Science in 1993 from Massey University, New Zealand. He then held management positions in commercial plant nurseries, before starting the company Suntec NZ Ltd in 1998. Along with his wife Dr Lynette Morgan he has been involved in research and development in the hydroponics industry since 1999, and has been consultant to many large commercial projects around the world. He has been a guest speaker at many international conferences, and assisted Botanicare in the development of several successful products. More information is at www.suntec.co.nz

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SILICA IN HYDROPONICS

Silica is the second most abundant element on earth and plays a vital role in optimizing plant health and yield.

By Simon Lennard
Suntec NZ LTD

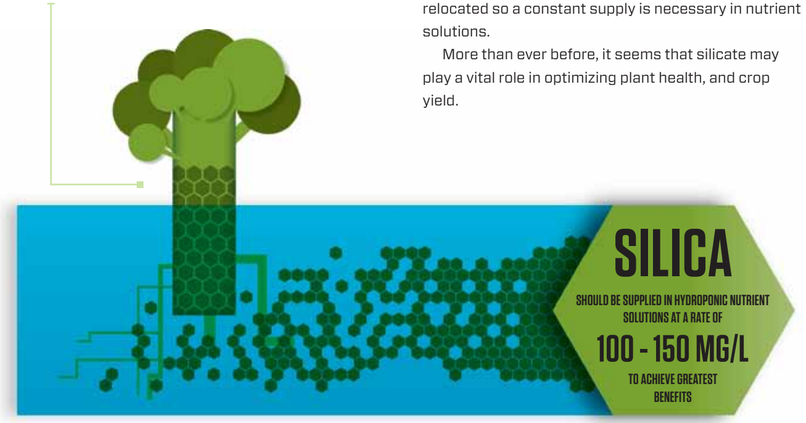
Nutrient products are often defined by their N-P-K rating, and many growers have their own opinions based on experience, of what NPK to use at different growth stages of their crop. Usually in the fine print of a product's label, are a list of other minerals and trace elements which it may contain, and we all understand that for growing in hydro, coco or any soilless system, the nutrient product needs to contain the full compliment of essential mineral ions, in the correct balance. This nutrient information, long kept as closely guarded secrets is now common knowledge.

Plants growing in natural ecosystems absorb, translocate, and use or accumulate the minerals found in the soil surrounding their root system. This range extracted from natural soils usually comprises all the mineral ions we are familiar with in hydroponics, however there a few important exceptions.

The second most abundant element on Earth is silicon, and in many soil solutions (the liquid component surrounding plant roots) soluble silica is present, as silicic acid, in roughly the same concentration as many of the mineral ions we consider important such as potassium and calcium. Plants are adapted to readily use this silica and it is possible for some species to accumulate levels up to 10% of their dry matter.

The most important use of silica is in its role as a plant strengthening element, and it is widely reported to improve the sturdiness of stems and leaves, increase resilience to unfavourable growing conditions such as drought or salinity, and provide resistance to disease, notably powdery mildew.

Closer inspection has revealed that silica becomes incorporated into the cell walls of plants, increasing their structural strength and resistance to compression, in a similar way to the reinforcing used in concrete walls and floors.



Some of the benefits seen from using silica in ideal, stress-free conditions may simply be due to better leaf positioning and prevention of wilting giving more efficient light interception and higher rates of photosynthesis.

Silica also plays a role in moderating nutrient imbalances, allowing plants to tolerate nutrient or other toxicities, either by redistributing minerals within the plant or leaf tissue, or immobilising toxic compounds in the root system. Besides being incorporated into plant cell walls, silica forms additional layers in combination with cellulose below the leaf cuticle. This layer provides an important method of controlling water loss from leaf surfaces and additional protection from infection.

To achieve the greatest benefits, silica should be supplied in hydroponic nutrient solutions at a rate of 100 – 150 mg/L (ppm), much higher than previously thought. Silica once deposited in plant cells can not be relocated so a constant supply is necessary in nutrient solutions.

More than ever before, it seems that silicate may play a vital role in optimizing plant health, and crop yield.

SELECTIVITY OF PLANT NUTRIENT ION UPTAKE

By Brandon Jewell

The interactions between mineral cations and anions are well understood by chemists, but often overlooked by horticulturists when applying fertilizers to tailor the growth of a specific plant variety. You may have heard the phrase "It's not what you eat, it's what you absorb," a phrase that applies equally to the uptake of essential nutrients by plants. Application of an essential plant nutrient does not always mean that the plant will be able to uptake that mineral and then move it through the vascular system into the plant tissues. The availability of plant nutrients is in fact dictated by the form of mineral, environmental temperature, humidity, photosynthesis, pH of the root zone, and most importantly the relative concentration of each mineral in the nutrient solution. It is the balance of these minerals that is often forgotten when growers are formulating plant nutrient recipes and adding supplements to reach specific targeted mineral compositions.

There is a well-known system that classifies essential plant nutrients into "macro" and "micro" categories based on their concentrations in the plant tissue. Less understood is the relationship of the electrical charge of the individual ions and how it affects their bioavailability to the plant. Ions exist as either positively charged (cations) or negatively charged (anions) depending on the balance of electrons (negative) versus protons (positive).

It is the strength of the ionic charge that will affect the movement of the ions into and out of the plant. By understanding the strength of the positive or negative charge of essential plant nutrients, we can begin to comprehend the selective ion uptake mechanisms of a plant's physiology. The table below shows the elemental forms of plant nutrients and their ionic charges in the forms that are available for plant uptake.

The movement of ions into plant roots occurs by both active and passive transport. Passive transport means that the ions are carried with the uptake of water into the plant without energy from the plant. The water movement factors that affect passive transport are temperature, humidity, photosynthesis rates, concentration of ions in solution versus within the plant cell, and plant transpiration rates based on stage of growth. Active transport requires energy from the plant and ion movement is determined by competition between ions based on their individual charge. The monovalent ions (single charged) are moved into the plant more easily than divalent ions (double charged), while divalent ions are taken up more easily than trivalent ions (triple charged). This means that the plant will accumulate more potassium (a monovalent ion) than calcium and magnesium (divalent ions) due to the difference in their charge.

Plants typically maintain a negative interior (inside the plasma membrane) relative to the exterior. The slightly negative state of the cell interior and the environment must be maintained and, thus, is related to ion uptake. When there are more cations than anions present, the overall charge becomes excessively positive, and an increase in anions or a decrease in cation uptake occurs to restore physiological conditions. For example, an excess of ammonium (NH_4+) cations decreases the uptake of potassium (K+), calcium (Ca^{2}+), and Magnesium (Mg^{2}+). The same relationship exists for anions - excess anions lead to a lower uptake of anions or an increase in cations to balance the cell's charge. If nitrate (NO_3-) is the major anion in excess, then the uptake of cations such as potassium (K+), calcium (Ca^{2}+), and Magnesium (Mg^{2}+) will increase to compensate for the overall negative charge caused by excess nitrate levels.

Essential plant nutrients by ionic groups.

CATIONS			ANIONS		
Element	**Chemical Symbol**	**Plant Available Forms**	**Element**	**Chemical Symbol**	**Plant Available Forms**
Nitrogen (Ammonium)	NH_4	NH_4+	Nitrogen (Nitrate)	NO_3	NO_3-
Potassium	K	K+	Phosphorus	P	PO_4^{3-}, HPO_4^{2-}, H_2PO_4-
Calcium	Ca	Ca^{2}+	Sulfur	S	SO_4, SO_4^{2-}
Magnesium	Mg	Mg^{2}+	Boron	B	H_2BO_3, $B_4O_7^{2-}$
Iron	Fe	Fe^{2}+, Fe^{3}+	Molybdenum	Mo	MoO_4^{2-}
Manganese	Mn	Mn^{2}+	Chlorine	Cl	Cl-
Zinc	Zn	Zn^{2}+			
Copper	Cu	Cu+, Cu^{2}+			

Macronutrients. Micronutrients.

The following steps can be taken to ensure that the correct ratios and concentrations for optimal plant growth are applied.

1 Determine a target concentration of each element based on plant type and stage of growth.

2 Maintain relatively equal cation and anion levels to prevent uptake imbalances due to differences in intercellular electric charges.

3 Maintain pH in the optimal range for all elements to allow for maximum availability for plant uptake.

FINALLY

Ensure the total concentration of minerals is within the acceptable range for the type of plant being grown as well as the environmental parameters that affect concentration. Understanding the relationships that effect the uptake of plant nutrient ions allows growers to better predict the effect that each change to the nutrient solution and the environment may cause. By applying this knowledge you can avoid common nutrient imbalance related pitfalls such as deficiency, over fertilization, and lockout.

MIXING NUTRIENTS

{A beginner's guide}

1 Before adding nutrients or supplements, check the baseline EC/PPM of the water. Hard water and PPM levels above 300 (.7 scale) may hinder growth. The use of RO filtered water is recommended.

2 Add your base nutrient until the target EC/PPM level is reached. The ideal level depends on plant size, genetic variety, lighting intensity, environment, and growth phase. If you don't know where to start, consult the feed sheet or nutrient calculator provided by your manufacturer.

3 Begin adding supplements, one at a time, allowing each to mix into solution before adding the next.* Not allowing each component to mix thoroughly can cause nutrients to become unstable and fall out of solution.

4 Allow solution to mix thoroughly and measure pH. Calibrate your pH meter weekly to ensure accurate readings.

5 Adjust pH to the appropriate level based on grow media being used:

Hydroponics 5.5 - 6.2
Coco Coir 5.8 - 6.2
Soil 6.2 - 6.7

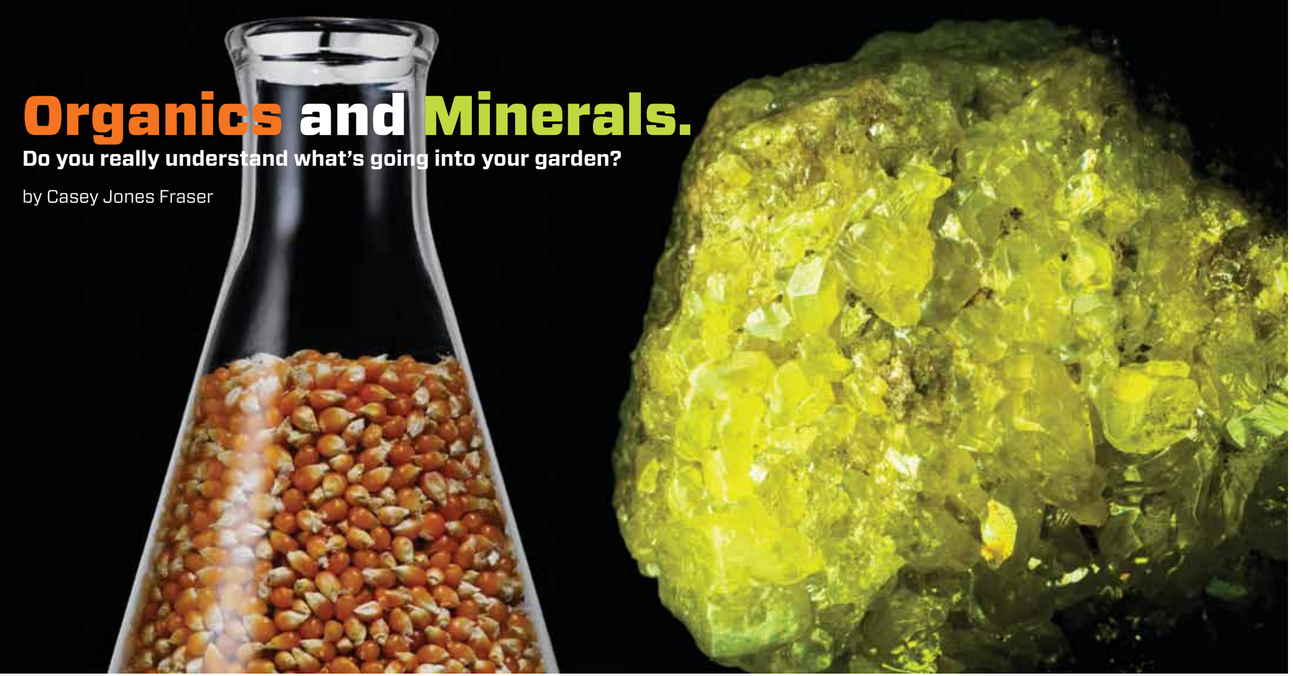
6 Now you're ready to feed your plants! Once mixed, unused nutrient solution should be discarded after 7-10 days. Check the pH of the nutrient solution each time before watering to ensure the pH has not fluctuated out of the ideal range.

COMMON CONVERSIONS

1 tsp = 5 ml
1 tbsp = 15 ml
1 oz = 30 ml
1 cup = 240 ml

IDEAL pH (BY SUBSTRATE)

Hydro 5.5-6.2
Coco Coir 5.8-6.2
Soil 6.2-6.7



Organics and Minerals.

Do you really understand what's going into your garden?

by Casey Jones Fraser

Many growers give themselves labels based on the types of inputs they use in their gardens, often referring to "strict organic practices" or "sterile, mineral-based hydro". Perhaps you're the type of gardener who avoids "chemicals," or only uses "organics", but can you define these terms? What makes something truly organic? Every grower should understand what they put into their gardens and why.

What is a chemical?

When we use words like chemicals or chemistry, we are simply referring to the study and use of elements from the Periodic Table. The elements found in the Periodic Table are the basic atoms that make up everything on this planet and many chemicals that exist in the natural world.

All Plants produce chemicals throughout their life cycle. In an organic garden, we rely on microorganisms to convert organic matter into chemical forms that are taken up by plants. Chemicals can originate from natural sources. In some respects, organic gardening is a natural way of feeding chemicals to plants.

So, the next logical question: What is Organic?

Chemists and physicists will tell you that nearly any compound containing carbon is organic, whether that compound is natural or not. The truth is many natural substances are not organic. For example, certain types of naturally occurring rocks are crushed to make fertilizers that contain inorganic phosphorus. Those rocks are technically inorganic, even though they were mined directly from the ground.

Many gardeners and agricultural professionals use the word organic to describe fertilizers and plant products that are derived exclusively from plants and animals (manure, kelp, bone meal, etc.). By that definition of the word, Organic growers cannot use inorganic substances, even if they occur naturally.

One thing to keep in mind: many organic garden products contain inorganic salts. Two popular examples are bat guano and seaweed extract. Because these are derived from animals and plants, they qualify for organic gardening. However, the lab analysis shows a dash of inorganic material included in the final products. Confused yet?

What are Minerals?

The Periodic Table contains (among other things) the 17 elements required for plants to live: carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, boron, chlorine, copper, iron, manganese, molybdenum, nickel, and zinc. Many scientists and university studies give evidence that silicon should be added to that list as well.

Minerals occur in nature, but they are not sourced from plants or animals. These minerals may come from crushed rocks, or they may be generated in a lab via chemical processes. When looking at basic elements and minerals, there is no difference between the crushed rock form and the laboratory derivative. It may take millions of years to accumulate rock formations, which then have to be mined and pulverized, so the laboratory version is much faster. Mining can be quite harmful to the environment, not to mention, expensive and unsafe for workers. Depending on the specific element, one method may be better suited than another for obtaining these minerals with the least environmental and budgetary impact.

In recent years, there has been increased discussion regarding the use of high-quality or low-quality minerals in plant foods. The real difference in quality can be determined by the level of contaminants in the final product. Pure, uncontaminated elements are the same, regardless of the source. Elements and compounds that are not available to plants can bog down roots and slow nutrient absorption and availability. For the highest quality mineral plant foods, avoid contaminants and questionable ingredients.

The truth is many natural substances are not organic.

Reasons for using organics

There is little argument that mineral fertilizers can more easily burn plants if used carelessly. Overfeeding is always a concern, but is less likely when using organics. Microbes and fungi must work to convert elements into plant available forms, which slows reactions in the root zone as it becomes nutrient rich. While overfeeding with organics is possible, the microbiology at work in the root zone offers a natural buffer.

The flavor of organically grown tomatoes, culinary herbs, and resin-producing plants is often said to be better and more complex than crops grown with minerals. The fact is that low-quality, or high-quality harvests can be grown with either mineral or organic inputs. One reason why well maintained organic gardens often produce very deep aromas and flavors is, in part, because overfeeding has been avoided.

Reasons for Using Minerals

We live in an age where plant chemistry and biology have been analyzed to an exacting degree. Scientists have discovered which elements are taken up by plants, and the specific ratios required for optimum performance. Mineral nutrient formulations can be made using highly available forms, allowing plants to absorb them right away. This process can lead to faster growth, bigger harvests, and increased quality.

Many hobby gardeners grow delicious tomatoes in their backyards, using mineral salts from the local garden center. Even without organics, mineral-grown crops can offer increased flavors and aromas, as long as the grower does not over-use plant foods or harvest prematurely. Attention to detail is required when using mineral fertilizers, and there is no need to sacrifice quality by overdosing plants. When given the correct amounts of mineral inputs, plants can achieve optimum health. Overall plant health is the key to both higher yield and quality.

Hybrid Nutrient Systems

Growers all over the world have achieved big yields and potent flavors by using organics and minerals together. Both offer unique benefits, and there is no reason you can't use them in tandem to get the best of both worlds.

Many naturally occurring inorganic compounds are not only safe for plants, they are safe enough for you to eat! Don't reject the idea of using organics, minerals or both before doing some research on the pros, cons and effectiveness of each type of nutrient.

What are you feeding your plants? Not every garden product should be assumed to be safe or effective. Learn about the elements your plants require, and the additional organic inputs that offer increased quality. With a little bit of knowledge and high quality plant nutrients whether organic, mineral, or both, your garden will flourish!

ASK BOTANICARE

Common hydro questions answered.
Q and A with Bluelab.

We all understand the importance of applying nutrients at the correct strength and the appropriate time to achieve successful crop production. This is why we utilize tools like EC/PPM meters to accurately measure these levels. To understand how these tools work, and to better grasp what happens when we measuring a nutrient solution, we spoke with Cindy from Bluelab USA and asked her some of the more common questions we encounter.

• What is the difference between EC, PPM, and TDS?

EC = Electrical Conductivity
PPM = Parts Per Million
TDS = Total Dissolved Solids

All meters/pens measure EC. The EC measurement is then converted to PPM or TDS using the following formulas;

EC X 700 = PPM 700: Example: 1.00 EC = 700 ppm.
Or 1.3 EC x 700 = 910 ppm

EC X 500 = TDS (or PPM 500): Example: 1.00 EC = 500 ppm.
Or 1.3 EC x 500 = 650 ppm

PPM is a way of expressing very dilute concentrations of substances.
Just as percent means, out of a hundred, parts per million (PPM) means out of a million.

• How does my EC/PPM meter measure my nutrient solution?

All meters and pens, measure the Electrical Conductivity (EC) of your nutrient solution. Pure water, like reverse osmosis (RO) water, has no conductivity. This is why, when you place an EC or PPM probe into pure water, it does not register on the meter. When you add nutrient solution it conducts electricity. The more nutrient solution you add, the higher the conductivity level, which causes the reading on your device to rise.

Bluelab // Guardian Monitor
getbluelab.com

• Which PPM/TDS scale should I use?

It depends on which "scale" your nutrient company uses during manufacturing. For example, Botanicare utilizes the 700 PPM scale. All Bluelab meters/pens read EC, PPM 500 (TDS), or PPM 700, allowing you to match your meter to your nutrient scale.

• Is one scale better than another?

EC is the only true measurement and does not have to be converted so EC is always the same. If you use PPM/TDS, which is most popular in the US, you need to make sure your meter is set to the same scale your nutrient is using, since there are 2 different conversion formulas. In short, it's best to use the scale that your nutrient manufacturer recommends.

• Which inputs increase PPM? Do minerals (salts), amino acids, humic/fulvic acids, and trace minerals also raise PPM?

Any mineral, trace mineral, or input that is able to dissolve (disassociate into ionic form) into a solution can be measured. Amino acids and other organic acids such as humic and fulvic with the ability to be present in ionic form will also contribute to the EC/PPM measurement.

• Are there any minerals/inputs that my meter does not read?

No. Provided they are disassociated into ionic form, any and all minerals and their charged ions will contribute to the overall electrical conductivity reading, which raises your total EC/PPM.

• Does my meter work with fully organic nutrients?

No. Your meter will not read a "completely" organic nutrient solution. It is important to note that, when supplied to plants in an organic form, nutrients still must cycle (break down) into their inorganic form before becoming available for plants to uptake.

NPK

A simple guide. BY ADAM COMBS

PPM FEEDING CHART WITH EC CONVERSION

GROWTH STAGE	EC	.5PPM	.7PPM
Seedling/Clone	0.1	50	70
	0.2	100	140
	0.3	150	210
	0.4	200	280
	0.5	250	350
Early to late Vegetative	0.6	300	420
	0.7	350	490
	0.8	400	560
	0.9	450	630
	1.0	500	700
	1.1	550	770
	1.2	600	840
	1.3	650	910
	1.4	700	980
	1.5	750	1050
	1.6	800	1120
Transition	1.7	850	1190
	1.8	900	1260
	1.9	950	1330
Flower	2.0	1000	1400
	2.1	1050	1470
	2.2	1100	1540
	2.3	1150	1610
	2.4	1200	1680
	2.5	1250	1750
	2.6	1300	1820
Aggressive/ CO_2 Enriched Feeding	2.7	1350	1890
	2.8	1400	1960
	2.9	1450	2030
	3.0	1500	2100

When it comes to indoor and outdoor gardening, it is important to understand the significance of the N-P-K ratio. You may already know that these symbols stand for the essential elements Nitrogen, Phosphorous, and Potassium. They are almost always listed on the front of plant fertilizers in numerical form, i.e. (2-2-4). What insight do these symbols and numbers give the gardener and why is this ratio important?

In the gardening world, nitrogen, phosphorous, and potassium (N-P-K) are known as primary or macronutrients, because they are required in larger quantities than other elements for plant growth and survival. As a result, these nutrients are usually depleted from the growing media first. This is why the management of N-P-K is so important to your garden.

To understand how much N-P-K is in the plant fertilizer being used in your garden, let's use the above example of 2-2-4. If a fertilizer has an N-P-K ratio of 2-2-4, then it contains 2% nitrate, 2% phosphate (which contains phosphorus), and 4% potash (which contains potassium). Therefore, the N-P-K ratio represents the availability of Nitrogen, Phosphorous, and Potassium, by weight, contained in a plant fertilizer. It is also important to note that the N-P-K ratio of organic fertilizers is typically lower than that of synthetic fertilizers. This is because only nutrients that are immediately available to the plant may be listed on the label. Most organic fertilizers contain slow-release nutrients that will become available over time.

When applying fertilizer it is important to research the needs of the plants you are growing. Although everything in your garden needs N-P-K, different plant varieties may require different application rates and timelines for each of these primary nutrients.

Nitrogen (N)

- A component of all living cells and a necessary part of all proteins, enzymes, and metabolic processes in the synthesis and transfer of energy.
- Also a component of chlorophyll, the green pigment in plants, responsible for photosynthesis.
- Helps plants with rapid growth, increased seed and fruit production, and improves quality of leaves and vegetation.
- Helps plants produce proteins needed to develop new tissue.

Phosphorous (P)

- Like nitrogen, phosphorus is essential to the process of photosynthesis.
- Stimulates root and shoot growth, helps the plant set buds and flowers, improves vitality, and increases size and yield.
- Involved in the formation of all essential oils, sugars, and starches.
- Helps the plant convert solar energy to chemical energy, mature properly, and withstand environmental stress.

Potassium (K)

- Absorbed by plants in larger amounts than all mineral elements except nitrogen and, in some cases, calcium.
- Helps plants build protein, aids photosynthesis, improves fruit quality, and reduces diseases.
- Promotes flowering, fruiting, and ripening.
- Helps regulate metabolic activities and improves plant vigor.

FERTILIZER WITH 2-2-4 NPK =

NITRATE	PHOSPHATE*	POTASH*
2%	2%	4%
	*(CONTAINS PHOSPHORUS)	*(CONTAINS POTASSIUM)

*** Phosphorous and Potassium percentages are expressed as compounds versus elemental. While this is the method of labeling in the United States other parts of the world use elemental calculations. In order to calculate the elemental percentages multiply the Potassium by .83 and the Phosphorous by .43.

Make it your KIND®

Fully customizable.
For fast flowering annuals.
Any media. Any system.

KIND represents the culmination of more than 15 years of knowledge and expertise, combined with extensive experimentation and testing. KIND provides optimal plant nutrition in perfect balance to meet your plants' demands at any stage of growth, in any medium. A fusion of science and nature, KIND is formulated using high quality minerals fortified with completely soluble, natural and organic ingredients. KIND is hand crafted in small batches, dye free, and runs clean.

KIND is formulated with N-P-K ratios that are optimized to allow for 100% customization. This allows the user to adapt to the specific needs of any grow media, at any stage, while maintaining the ideal balance for optimum plant growth. KIND is more versatile, easy to use, and effective than any nutrient ever created. The proprietary KIND formulas eliminate the need for additional calcium and magnesium supplementation due to water quality or specific grow medias. This ground breaking nutrient system meets the demands of the most experienced growers, and the aspiring hobbyist. This level of control allows you maximize growth for any plant, in any environment, no matter what Kind you grow.

Benefits:

- **Kind's unique formula is easy to customize for specific plant needs, growth cycles, gardening methods and grow medias.**
- **Enhanced calcium, magnesium and sulfur levels.**
- **Designed for fast blooming annuals.**

The CNS17 series is a high quality, mineral based, nutrient system that yields premium results at an economical price.

Grow & Bloom

CNS17 is extremely concentrated and contains all seventeen essential elements necessary for growing fruiting and flowering crops. Most nutrient systems are comprised of multiple parts, which prevent certain elements from precipitating or "falling out of solution," in their highly concentrated state. The proprietary suspension technology used in CNS17 makes it possible for this formulation to contain sufficient concentrations of all the essential elements in a single bottle while remaining available for plant uptake.

Ripe

CNS17 Ripe was developed to meet the needs of fruiting and flowering plants during the ripening period ensuring maximum crop size and yield potential every round. Replacing your CNS17 Bloom nutrient with CNS17 Ripe during the final two weeks before harvest adjusts the nitrogen to a minimum level while leaving the phosphorous and potassium at ideal ranges. This specialty formula promotes and enhances the critical final stages of fruits and flowers by increasing flower density and size.

Benefits:

- **True one part formulas.**
- **Economically priced.**
- **Highly soluble formula excels in DWC, Aeroponic, and NFT systems.**

The Pure Blend Pro Series provides growers with the benefits of organic growing in an easy to use, one part, water soluble fertilizer.

Each formula is a blend of natural minerals and organic extracts combined with a complex vitamin and amino acid base that is easily absorbed by plants. Premium organic acids and minerals are blended in combination with precise amounts of select trace elements, organic plant extracts, and ultra soluble humates to create an exceptionally balanced food source for your plants, and essential beneficial microbes.

For use in hydroponic systems, Pure Blend Pro Bloom provides plants with all essential major, secondary, and trace minerals needed for fast growth and vigorous crop development. This highly concentrated and versatile bloom formula is completely water-soluble, and is readily absorbed by plants in all hydroponic growing methods.

Pure Blend Pro Bloom Soil Formula was developed for plants cultivated in soil or coco based mediums which require higher levels of phosphorus and potassium. This media specific formula meets these unique requirements and feeds your plants and the soil they grow in.

Benefits:

- **Natural and organic-based nutrient for optimal flavor and aromas.**
- **Will not cause clogging or buildup.**
- **Easy to use one part formulas.**