

Introduction

Welcome to ISP (Integrated Soil & Plant Technologies, Inc.), and we hope that the time you spend reading this information will be rewarding. Perhaps you will join us in our mission to work with growers whose goal is to both increase their production, and to produce food that is of significantly higher quality ... both in nutritional value as well as flavor. ISP's goal is to provide growers with valuable products (or tools) to accomplish this, and to enable them to earn greater financial rewards for their efforts. We understand the importance of a positive return on investment, and this is our ultimate goal.

ISP offers supplemental nutrients, but we're not a fertilizer company. We offer multiple ways to help control disease issues, and to help control a range of insect pests, but we're not a pesticide company. ISP is a company that believes that greater success will be achieved by addressing base issues such as soil health and plant stress, rather than the symptoms that can manifest themselves if soil health or plant stress are ignored. These symptoms can range from poor soil vigor, an assortment of disease issues, excessive insect damage, to poor quality commodities that have no shelf life and little flavor.

At ISP we believe that farming is a function that should work with nature, and the wondrous benefits that nature can provide. We believe that if we can better understand these natural processes, and work within these natural "laws", then we can better harness nature's benefits to improve our yield, quality, and profitability. Our slogan reflects this philosophy, "We were green when green was just a color".

Our company name "Integrated Soil & Plant Technologies" reflects this philosophy as well. The achievement of yield and quality does not lie in just the soils we farm, nor does it lie in just the crops and varieties of these crops. Long term farming success requires that we address soil health, and the composition and vigor of the soil biome. It demands that we continually work to improve our soil's productive potential. At the same time, it requires that we consider which crops will grow best in each unique set of soil and environmental conditions. It also requires that we strive to better understand our crops, and how to maximize the potential that each one has, in other words, "how does this plant grow and develop?" We should ask ourselves, "what are the unique genetic characteristics of a specific variety, and how can we manage it to better ensure we achieve the desired outcome". We also understand that the learning process never ends, and that for each answer we believe we discover, it will always lead us to additional questions.

ISP utilizes many old time-proven principals in how we work with our clients and approach crop production, yet we're not locked to the past. We aggressively look for new knowledge and technologies that offer benefits to our clients. It's exciting to see the work that's being done in the realm of soil conservation, soil microbiology, bio-controls, and plant physiology and natural immune functions.

Our clients are those who are rarely satisfied because they know they can do better. We reflect that same belief ... we know we can always be better. We continually search for new technologies, and we continually research these technologies to better understand the potential benefits to our clients.

So, if you're one of "us" ... always searching for answers about how to improve, and excited about the new questions those answers will generate, then enjoy.

Paraphrasing, "the joy is not in the destination, it's in the journey", and farming success is a "journey" that never ends.

Thank you ...



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"I've worked with most all of the fertilizer companies out there.

You guys (ISP) are the only ones I trust anymore, you deliver on your promises.

Guys say they can't afford to use ISP ... I don't know how you can afford not to."

- J.J., Michigan grower



Soil & Yield Potential

There are many soil types with varying characteristics on this planet, but only slightly more than a third is suitable for agriculture. That being so, you are the custodian of one of earth's most precious resources ... so the question is, "How do I manage my share of this resource to not only provide for my family, help feed a growing population, but also ensure that I leave it better than when I got it?"

At ISP, we believe the first step is understanding that your soil is unique ... it probably has both positive and negative characteristics. It's your responsibility and challenge to manage these unique aspects, and to work with varied environmental challenges during any single season. When successful, you will be rewarded ... at times greatly.

good soil = potential yield

At ISP, we know you always want to produce a good crop that earns a nice profit. That's why ISP individually evaluates the factors for success with each of our customers. We look at the specifics of your soil(s), the average weather, available nutrients, variety selection and other factors, to determine where your operation could benefit from our array of products.

ISP is first a biostimulant company, and the ISP managers have experience dating back to the late 1970's. We believe that soils can be managed to lessen soil differential, and reduce soil damage stemming from modern farming techniques. Biostimulants can provide benefits in virtually all aspects of soil productive potential. We know biostimulants! We know when to use bio's, and how to use them to achieve specific changes in a soil environment, and/or to enhance plant physiological activity. ISP offers a number of well-researched and proven products to help you address your specific soil characteristics and challenges.

Yield-robbing factors include:

- Compaction
- Crusting and hydrophobia
- Poor soil biology
- Poor residue decomposition
- Less than ideal subsoil characteristics
- Nutrient leaching
- Poor nutrient availability
- Soil-borne disease
- Parasitic nematodes

All of these factors can be managed at least to some degree, and ISP can provide a few ideas and/or products to further implement your program of building your soil's productive potential ... resulting in crops that are less susceptible to inclement weather, thus providing higher, and more profitable yields.



There's a whole new meaning to the words, "Power Plant."

It's a simple fact — the plants you grow are simply “energy conversion factories,” converting captured solar energy into potential chemical energy, primarily in the form of sugars. One of the primary focuses of our research projects is to discover methods to maximize this energy capture and conversion. In theory, and to a large degree supported by our observations, the more energy that one can capture/convert, the higher the final yield. It's important to have a large plant with healthy, viable vegetative mass.

When discussing plant stress, it's important to understand that stress can come from non-living sources outside the plant (abiotic stress), or from living sources such as disease pathogens (biotic stress). For most of the growing season we manage our crops to hopefully reduce this “potential” yield loss which stems from a variety of abiotic stress factors — temperature, moisture, wind or other environmental issues.

However, possible yield loss can also be due to inadequate nutrient availability, especially during key physiological phases — stress affecting crops at a critical stages of development, with an example being fruit set. Even though the “season-long” supply of nutrients may be more than adequate, a shortage during key points of fruit set and/or maturation can result in high levels of abortion or poor size and quality. This is one form of biotic stress.

Additionally, stress is often the precursor for a variety of diseases, which can further reduce yield if not controlled. Plants have evolved a variety of ways to reduce damage from various stress factors, but plant health is the first line of defense against disease. When the plant is attempting to mature a high number of fruits (or kernels, beans, etc.) it may begin to move nutrient from older tissue to fruit and/or the growing tips. This opens the door to disease pathogens.

less stress = potential yield

ISP Technologies understands that controlling plant stress is essential for maximum yield. Helping you to manage plant stress is what we do.

This may include:

- Working with your soils to improve soil biological functions
- Working with crop or chemical residues, manures, or other aspects of soil environment
- Providing nutrient tools for increasing available energy
- Reducing the negative impact from both biotic and abiotic stress

The variables to successfully manage can seem almost endless, but with ISP Technologies so are the solutions.

**ISP: Grounded in research,
committed to quality and service**



MetaboliK SB (Seed Boost)

What is MetaboliK SB (Seed Boost)?

MetaboliK SB is a combination of major and micro-nutrients, vitamins, amino acids, root promoting peptides and biological fermentation extracts.

Key Benefits:

Formulated to be used as part of a greenhouse seeding or transplant solution, or as part of a liquid fertilizer mix for in-row placement

Improves early seedling vigor

Increased early root development

Aggressive early growth

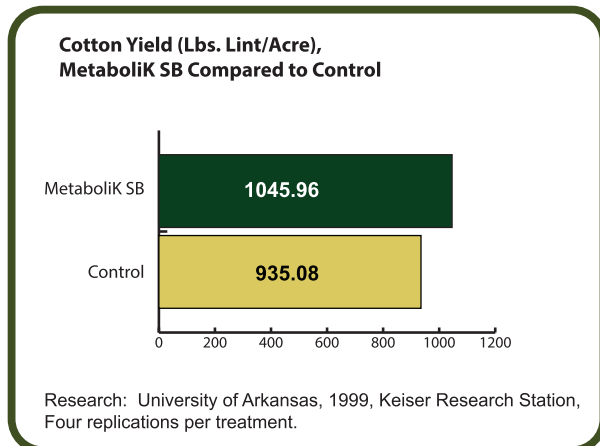
Higher crop yield

*Cost effective,
excellent return on investment*

In all instances SB increases early seedling vigor, and provides more uniform emergence. With a significant impact upon early root development, SB also provides a more vigorous seedling that better withstands the stress of transplanting.

MetaboliK SB was originally designed for the vegetable industry to help reduce seedling loss from “damping off” disease. With MetaboliK SB, seedling survival will often be increased in situations of environmental stress, thus reducing potential disease pressure.

*“Used SB on half of a field of corn ... although I did not actually weigh the difference, it obviously made at least 10 more bushel per acre ... probably closer to 15.
- L.M., Michigan grower*



Guaranteed Analysis 3 - 4 - 3

Nitrogen (N)	3.000%
Phosphate (P ₂ O ₅)	4.000%
Potash (K ₂ O)	3.000%
Calcium (Ca)300%
Manganese (Mn)300%
Zinc (Zn)200%
TSI (Total Sugars as Invert)	32.000%
Enzyme Complexes	2.400%
Carboxyphenolicpolyhydric Acid(s)..	40.000%
Inert Ingredients	14.800%

Source: Blend of molasses, bioferments and other organic acids, ammonium phosphate, potassium nitrate, chelated manganese, chelated zinc, calcium nitrate, thiamine mononitrate and urea.

Common usage rates: 8 - 16 fluid ounces/acre.

*“The planter won’t leave
the yard without
SB in the tank”
- J.J., Michigan grower*



What will MetaboliK SB do for you?

Research has shown MetaboliK SB provides an increase in all aspects of early root development, including the radicle and seminal roots which are generally considered to be determined by inherent seed vigor. This increase includes not only greater length and girth, but a higher number of fine “feeder” roots. These positive effects continue once nodal, or true, root development begins. A larger root system being established in most instances will obviously have a positive direct effect upon the early vegetative development of the plant, as well as final crop yield potential.

ISP knows that we all want a crop that emerges uniformly and exhibits strong early growth. As you’ve likely observed with your crops, if the plant is more aggressive early in the season, then there is often a corresponding increase in potential and final yield. MetaboliK SB helps ensure early vigor, a reduction in yield loss from early-season weather stress and higher yields at harvest.



Bejo experimental variety of pepper (3177), showing plant with just water (left tray), and plants treated with MetaboliK SB (right tray).

MetaboliK SB increases early seedling vigor, provides more uniform seedling emergence, and sets the stage for higher yields at harvest.

Uniform Emergence & Improved Roots

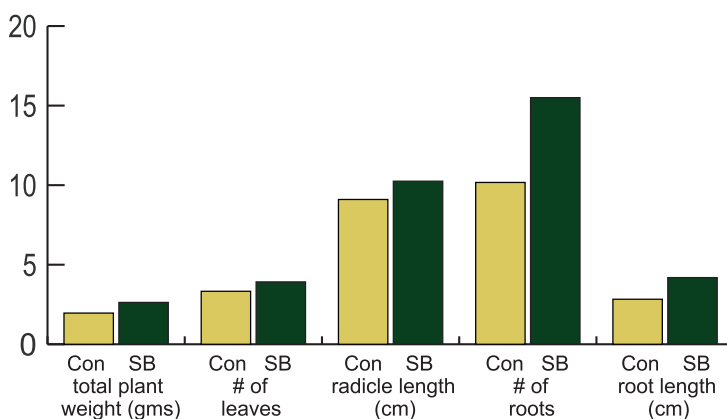
In a 2017 study performed at the Penn State University Research Station located at Manheim, PA, a solution containing MetaboliK SB was compared to just water as part of a seeding program. Several species were included, and the emergence data is shown in the table at right.

Name & Treatment	3/16	3/17	3/20	3/21	3/22	3/23
Red Morning Tomato (SB)	1	16	30	32	32	32
Red Morning Tomato (H ₂ O)	0	1	26	30	33	35
Scarlet Red Tomato (SB)	0	17	33	34	34	34
Scarlet Red Tomato (H ₂ O)	0	0	23	34	34	34
Revolution Pepper (SB)	1	1	14	32	34	34
Revolution Pepper (H ₂ O)	0	0	6	20	28	30
Green Gold Broccoli (SB)	34	34	35	36	36	36
Green Gold Broccoli (H ₂ O)	31	31	34	34	34	35
Whirlygig Zinnia (SB)	30	31	32	32	32	32
Whirlygig Zinnia (H ₂ O)	22	26	29	29	29	29
Number of emerged seedlings by date						



Red Morning tomato after washing. Control on the left, SB on the right. The SB plants were significantly more difficult to wash due to the significant increase in smaller feeding roots.

Seedling Analysis From Seedlings Grown at PSU (Emergence Chart Above.)



Across the five species there was an average of 45.7% increase in total seedling weight; a 21% increase in the number of leaves initiated; a 7.6% increase in the length of the radicle root; a 36.4% increase in the numbers of true roots initiated; and a 57.2% increase in the length of these true roots.

MetaboliK HV1 (Biostimulant)

Key Benefits:

Stimulates beneficial soil microbial species

Aids in reducing the negative effects of abiotic (environmental) stress

Increased early root development

Stimulates physiological vigor, and is often used as part of a foliar nutrient package

Higher crop yield

Cost effective, easy to use, excellent return on investment

What is MetaboliK HV1?

MetaboliK HV-1 is a powerful blend of organic acids, enzyme, and vitamin compounds, which stem from a complex microbial fermentation process, utilizing only food or organic ingredients. This process creates the basis of HV1.

To this base ferment is added ingredients which generally fall into a category of chemicals referred to as plant growth regulators or phytohormones. MetaboliK HV-1 has significant concentrations from three of the five major classes of hormonal components: auxins, cytokinins, and gibberellins. (See page 30 for additional and more specific information as to the role of these important phytochemicals.)

The bio-ferments in MetaboliK HV1 enables it to be used in a wide variety of ways. Although it's been updated and improved several times, it is the oldest product ISP offers, with experience going back to the early 1980's.

Guaranteed Analysis 0 - 0 - 0

Biofermentation Extracts (Vitamin Hormone Complex) 20.00%
Includes the following growth factors:

Adenine Complex	30 ppm
B-Vitamin Complex.....	260 ppm
Cytokinnins (Kelp Extract).....	240 ppm
6-Furfurylaminopurine.....	30 ppm
Gibberellic Acid(s)	140 ppm
Indoleacetic Acid	300 ppm
Indolebutyric Acid	200 ppm
1-Naphthaleneacetic Acid.....	280 ppm
2-Naphthoxyacetic Acid	140 ppm
Carbohydrates	6.000%
Enzymatic Penetrating Complex	47.000%
Humic Acid(s)	3.000%
Copper (Cu)070%
Iron (Fe)150%
Manganese (Mn)070%
Zinc (Zn)070%
Inert Ingredients	18.640%

Source: Fermentation extracts from yeasts and soil microorganisms, molasses, humic acid, lignosulfonate, EDTA copper, HEDTA Iron, EDTA Zinc, and PGR's as shown.

Common usage rates 12 - 24 fluid ounces/acre.

Soil Response - Averages from 1982/1983 (Data from, KS, NE, IA, IL, MO, MN, CO):

Reduction in Soil Surface Resistance to Penetration to a Depth of 8":

127 Sites - 18.2% Reduction

Improvement in Water Soak Time (1" H₂O):

43 Sites - 120.8% Faster Soak Time

Soil Reclamation:

On "cut" or leveled fields where the topsoil has been either removed, or severely redistributed, MetaboliK HV1 has shown to outperform composted chicken/poultry manure in helping to bring these soils back to a productive state.

In a 1995 project in NE Arkansas, 2 tons/acre of composted chicken litter was compared to 16 ounces/acre of HV1. The applications alternated, with 4 reps across the field. MetaboliK HV1 showed a 133% increase in the number of bolls per plant, a 7% increase in average boll weight; culminating in a 138% increase in harvested lint.



What will MetaboliK HV1 do for you?

The phytohormones in MetaboliK HV1 are carried on a base of microbial ferments, humic acids and surfactants, which have been shown to have beneficial effects on both plant development as well as the soil microbiome.

Impacting the soil microbial species can have significant effects upon a variety of soil physical and chemical characteristics. Observations, although not universal, have included:

- More rapid degradation of crop residues, thus allowing for an improvement in nutrient recycling and availability
- A reduction in soil crusting and a lessening of compaction, thus allowing for better drainage and reduced surface erosion, and Improved water soak and moisture retention
- A reduction in the incidence of parasitic nematodes and soil borne disease
- Higher yields (see 2021 Michigan data at right as an example)

“The fertility of a soil is often related to the number and diversity of the organisms it can support.”

- *Sustainable Soils,*
Benjamin Wolf &
George H, Snyder

Michigan, 2021 Field Corn

Treatment	Yield (bu/ac)
Control (West)	205.6
MetaboliK HV-1 (West)	211.6
MetaboliK HV-1 (East)	239.1
Control (East)	219.7

Yield Response From Multiple Field Crops - Averages from Early 80's (Data from the following states, KS, NE, IA, MO, MN, CO):

Grain Sorghum (milo):

1981 - Average increase of 11.62%
1982 - Average increase of 17.89%
1983 - Average increase of 12.31%

Yellow Field Corn:

1981 - Average increase of 10.31%
1982 - Average increase of 5.51%
1983 - Average increase of 8.83%

Wheat:

1981 - Average increase of 20.54%
1982 - Average increase of 18.17%
1983 - Average increase of 16.12%

Soybean:

1981 - Average increase of 12.96%
1982 - Average increase of 21.90%
1983 - Average increase of 10.59%



PhytoGro Xtra (Humic Acid)

Key Benefits:

Stimulates beneficial soil microbial species, particularly essential fungal species

Aids in the formation of soil “peds”, thus improving overall soil particle aggregation

Aids in reducing the negative effects of abiotic (environmental) stress

Aids in the reduction of free sodium and other heavy metals in a soil environment

Often provides higher crop yield, particularly over several growing seasons

Is an effective additive to residue management programs in no-till or reduced tillage operations

Cost effective, easy to use, excellent return on investment

What is PhytoGro Xtra?

The primary active ingredient in PhytoGro Xtra is the full profile of humic acid(s) (HA), which are widely used in agriculture worldwide. Positive benefits can be expected in all soil types. The high carbon content of HA’s directly impacts soil organic matter (carbon), which can be especially effective in sandy, low organic matter soils.

Additionally, PhytoGro Xtra is also effective in higher pH calcareous or sodic soils due to the ability to complex with sodium and other heavy metals, creating a much more positive soil chemistry profile.

HA is currently available from many companies, but that does not mean all humic products are the same, or of equal quality. Utilizing a unique three-way extraction process to obtain an optimum level of extraction, ISP’s PhytoGro Xtra provides a high quality HA, which is then combined with other nutrients and organic acids to create more specific and desirable responses in a growing environment.

PhytoGro Xtra is also quite user friendly due to micron filtration, which provides a product that is suitable for drip line applications.

Guaranteed Analysis 0 - 0 - 0

Mixture of various carboxyl, phenolic and polyhydric acids (Humic Acid(s))	16.000%
Bio Matrix	4.000%
Phytonutrients	8.000%
Inert Ingredient	72.000%

Source: Shale and other organic materials, potassium hydroxide, bio-ferments and other natural organic acids.

Common usage rates are from 1/2 to 2 gallons/acre.

Using PhytoGro Xtra for Nitrogen Stabilization

A number of research projects have indicated that nitrogen use efficiency can be improved by adding humic acid(s) to liquid nitrogen prior to application.

A number of our clients have achieved the same results. The mixture ratio is 1 gallon PhytoGro Xtra to each 20 gallons of liquid nitrogen.



How does humic acid(s) differ from organic matter?

The primary difference lies in the stage of degradation. When we add crop residues or manures (organic materials) to our fields, we're taking the first step toward building organic matter (OM), but we're not there yet. Although increasing the organic content of a soil will significantly add to a soil's productive potential, building OM, or more correctly referring to it as soil organic matter (SOM), can be a lengthy process. Part of the reason is that SOM is both increasing and decreasing during each season, depending upon management practices and environmental conditions.

The process of increasing the SOM content goes as follows;

- crop residues, manures, etc. (little degradation)
- organic materials (some degradation, still recognizable)
- soil organic matter (original organic source no longer recognizable)
- humic compounds (further degraded into very active compounds)
- humins (final stage, research still not certain of its role)

Humic compounds such as those in PhytoGro Xtra have gone through almost all of the degradation process, and it has been estimated that as much as 80 to 100 tons per acre of original plant and/or animal materials would be required to equal the amount of humic acid(s) in a gallon of PhytoGro Xtra. In addition to the vast amount of original material, it would also require eons of time.

We often describe soil productive potential as being comprised of three soil properties; the soil's physical structure, its chemical composition; and the level of microbial and other living organisms present in the soil. Humic acid(s) are going to impact all three of these aspects. Current scientific studies indicate that the fertility potential of a soil is determined to a very large extent by the content of humic acids. Their high cation exchange capacity (CEC) is of importance. The ability to encourage particle aggregation, thus improving pore space allowing for higher essential oxygen content and water holding capacity in a soil, is of great benefit. The most important feature of humic acids lies in their ability to bind insoluble metal ions, oxides, and hydroxides, and to release them slowly and continually to plants when required.

“Humic acid improved the yield and quality of continuous cropping peanut because of improved physiochemical properties, enzymatic activities, and microbial diversity of soil.”

- Li, Y., Fang, F., Wei, J. et al. Humic Acid Fertilizer Improved Soil Properties and Soil Microbial Diversity of Continuous Cropping Peanut: A Three-Year Experiment. *Sci Rep* 9, 12014 (2019).
<https://doi.org/10.1038/s41598-019-48620-4>



ReStore 3G (Humic)

Key Benefits:

Stimulates beneficial soil microbial species, particularly essential fungal species

Aids in the formation of soil “peds”, thus improving overall soil particle aggregation

Aids in the reduction of free sodium and other heavy metals in a soil environment

Accelerates decomposition of organic and chemical residues in the soil

Highly effective as an additive to liquid manure containments

Often provides higher crop yield, particularly over several growing seasons

Easy to use

What is ReStore 3G?

Although similar to PhytoGro Xtra, in that ReStore 3G is another humic based product, there are significant differences and usage guidelines. ReStore 3G has a significantly higher carbon content than PhytoGro Xtra, as it is not filtered as aggressively. This allows more of the original shale powder to pass into the final product, and as such should not be applied through drip irrigation. ReStore 3G also contains a much higher level of plant sugars, plus a variety of microbial organisms designed to aid with degrading hydrocarbons and other organic materials. As the name implies, it “restores” the soil, preparing it for the next crop and providing peace of mind concerning residues or an accumulation of nutrient salts.

Another potential benefit of ReStore 3G is that with its high carbon content, it may help with slowing or reducing anaerobic soil borne pathogens. Changing soil physical structure, and more rapid degradation of previous plant materials can have an impact on removing host plant residues that can provide over-wintering protection. Additionally, an increase in carbon, with the resulting impact upon soil organic matter can enhance the formation of soil peds, thus potentially improving drainage and soil aeration.



Guaranteed Analysis 0 - 0 - 0

Homogenous humate extracts	40.000%
Dormant fungi extract	30.000%
Concentrate of soil microbial ferments (from organic sugars, seaweed extract and sea water)	25.000%
Inert Ingredients	5.000%

Sources: Micronized Leonardite shale, Alaskan old forest compost, concentrate of microorganisms including but not limited to: {Aspergillus sp, Bacillus (Megaterium and Subtilus), Colstridium (Beijerinckii, Butyricum, Pasteriani), Enterobacter (Aerogenes and Agglomerans), Rhizopus sp, Saccharomyces sp, Torula sp}, fermented plant sugars (apple, corn, beet), natural yucca extract (saponins), gluconic acid and seaweed extracts.

Using ReStore 3G for Manure Containment Pits

A growing number of clients are using Restore 3G in manure collection systems, allowing for more rapid degradation of solids, elimination of crusting, and to aid with odor control.

The recommended rate is to add 2 gallons per 10,000 gallons of storage volume. Ideally the product would be added to waste troughs and then flushed into a bulk containment area. While not essential, an aeration system could provide even greater acceleration of breakdown.

Usage Rates & Timing

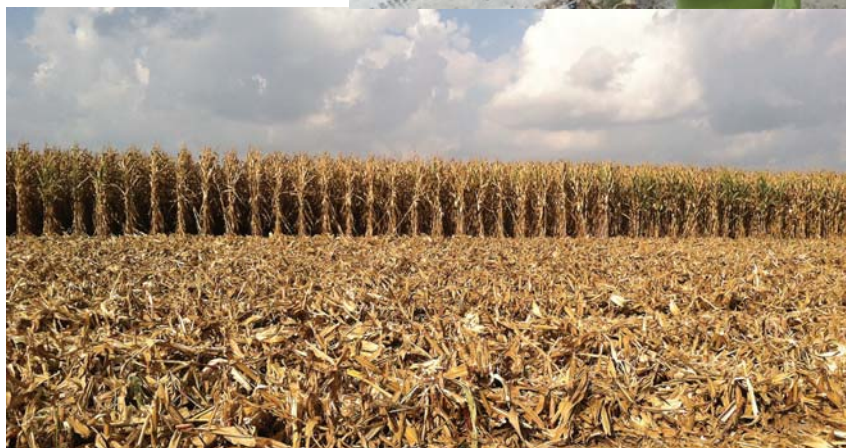
ReStore 3G is designed to be applied at a rate of three (3) gallons per acre. Due to the cost, it is designed more for high value produce and other specialty crops. It is especially useful as a management tool in high tunnels and greenhouse operations where the plants are grown in a natural soil medium, or in artificial mediums that may be used for several cropping seasons.

Residue Decomposition, Humates and Soil Microbial Populations

As no-till has come of age, and no-till or reduced tillage practices have become much more widespread, residue management has become a more common concern. Management practices that include applying small amounts (30 - 40 units/acre) of nitrogen in the fall; chopping residue into smaller pieces so that more surface area can be attacked by micro-organisms; baling, or even burning residue; and/or the application of biostimulants, are all being touted as the solution to the residue problem. It's our opinion that the most effective would be microbial degradation, and that the most desirable of the microbes for high lignin residues such as corn stover, would be actinomycetes and multiple species of fungi.

There is research showing that all of the methods listed above are effective, although there is also research showing that neither nitrogen nor cutting into smaller pieces show any benefit in decomposition. Of course, there are many comments that burning or baling residue not only results in significant loss of potential nutrient value, but that it also opens the soil back up to the possibility of erosion. About the only consensus is that residue degradation is a microbial process.

For high value crops, we strongly recommend ReStore 3G. For row crops and grains, we recommend 2 - 3 gallons of PhytoGro Xtra, coupled with 20 - 30 units of nitrogen. This will have a significant effect upon microbial populations and help in keeping residue from being a serious problem come spring. The above listed application should be applied as soon as possible following harvest.



Soluble Plant Foods

Key Benefits:

All grades contain rather high amounts of all essential trace minerals; zinc, iron manganese, copper, boron, cobalt and molybdenum

As such, plant foods aid in mineral build up for borderline deficient soils

Contain varying amounts of organic acids and vitamins that are important for other plant physiological processes

Added energy enables plants to utilize the applied nutrient in low or limited sunlight absorption

Safe to apply next to the seed or in a rooting medium, as well as to plant foliage without potentially damaging leaf tissue

Highly efficient, all nutrients are readily available for plant uptake and utilization

“There’s something special about the ISP 10-20-20, it does things that no other 10-20-20 type product can do.”

- D.Z., Illinois grower

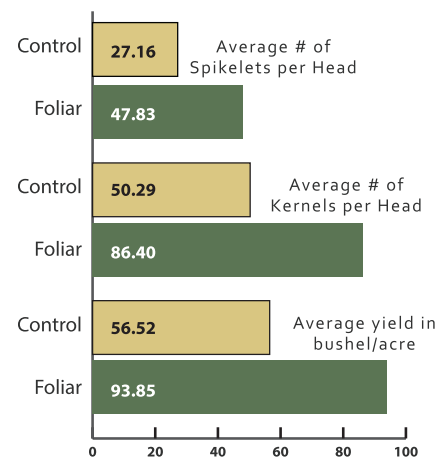
Isn't it just fertilizer?

No, ISP Soluble Plant Foods represent the ultimate in nutrient purity and quality with most components being technical or food grade materials. Although ISP Soluble Plant Foods contain significant nutrient content, they are not fertilizers and should not be considered as part of a total fertilizer recommendation for yield goals. A possible exception would be high value horticultural, fruit or vegetable crops where multiple applications per week are being applied through drip irrigation. Then the overall season-long quantity should be considered as part of your nutrient inputs.

In most instances, we recommend that the bulk of required nutrient be applied as lower cost preplant fertilizer. With a good “soil” nutrient foundation, we then use the soluble plant foods as a “metabolic trigger”, causing plant physiological activities to move into one or more specific directions. Two examples being to set additional fruiting forms (especially when existing fruits are already on the plant), or to continue to vegetate despite having high fruit counts. We accomplish this by changing the ratio of specific nutrient components within the plant fluids for a short time. This allows growers to better manage the way that their crops develop. This can enhance the flavor, improve shipping quality, and provide longer storage time before a commodity begins to go bad.



Comparison of Soft Red Winter Wheat, Control Compared to Foliar Nutrient (Soluble Plant Food + MetaboliK HV-1)



Research: Phoenix Technologies, 10 replications per treatment

Are the plant foods suitable for all crops?

Although the plant foods will certainly be effective on any growing plant, ISP is always considering the cost to benefit relationship. Due to the high quality of the materials we use, the plant foods are somewhat expensive on a “per pound” basis.

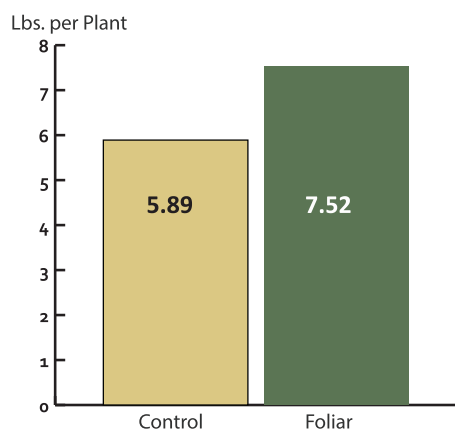


Most of the plant food we market is used on high value crops such as tomatoes, peppers, melons or other fruit or vegetable crops. Yet there are certainly windows of opportunity with most any crop. A good example would be yellow field corn, which traditionally on a per pound basis sells for much less than tomatoes.

All crops grow in a very orderly manner, and using corn as the example, there are key points in the plants development that can either significantly add or detract from the yield potential. The first is simply seedling emergence. Uniform emergence and adequate stand count is very important, and a good “pop-up” nutrient package can aid with this. In most instances we would recommend 15-30-15 applied in the seed furrow.

According to research, ear girth is determined at the 3 to 5 leaf stage, and ear length at the 7 - 9 leaf stage. While these can be important, it's the period around pollination where most yield potential is lost. Weather is certainly important, but so is nutrient availability to avoid tip loss.

Average Yield for Sweet Peppers (11 Varieties), Control (No Foliar Nutrient) Compared to Foliar Treated.



ISP Research Projects, Showcase Gardens, Coldwater, Michigan, 2012



Application:

ISP Soluble Plant Foods are designed to be used at specific points in the growing season. For example applying during planting or transplanting will aid in more aggressive seedlings and establishing high yield potential. Crop research has shown that maximum yield potential is set within a few days of emergence. In addition, weaker seeds or transplants will often have a significant improvement in vigor and survival when optimum nutrition is available, helping to provide improved crop uniformity and stand.

Stress can be significantly lessened with timely applications of plant food, and can result in harvesting an increased percentage of your yield potential. Biotic stress can be especially high during reproduction, especially if earlier-set fruiting forms are trying to mature. This stress will often result in the abortion of younger flower buds, flowers and smaller fruit, and can be a major limitation for high yields. In extreme instances, we have observed crops where a good first fruit set was achieved, but the nutrient and water demand was so high to mature that set, that when a second set of blooms developed they all aborted.

Once dissolved in water our Soluble Plant Foods form a true solution and will not settle out. Once in solution, they should be used within two to three days as the nutrient package is adequate to support a wide variety of microbial life. They will, in effect, grow in your tank. When transferring to application equipment, a filter no larger than the nozzles being used should be utilized. The plant foods are compatible with most crop chemicals so that in many instances one pass through the field can serve several purposes.

Soluble Plant Foods

Available Grades (Nutrient Combinations)

15-30-15: As mentioned on the previous page, 15-30-15 is often used as a “pop-up” on corn or other grains or fiber crops. It is also used as a phosphorus source when necessary on produce crops. Has a strong trace mineral package.

10-45-10: The highest phosphate plant food, used as a bean “pop-up”, or to correct phosphorus deficiency.

0-36-30: Very high mineral content, and is used mainly on vegetable crops to slow vegetative growth in situations where either water or the soil contains high nitrates.

10-20-20: High mineral content with a significant level of sugars, strong trace mineral package. Designed to aid with fruit set, and to reduce bloom or small fruit abortion.

9-14-24: Similar to 10-20-20, with high sugar content. Was originally designed for Michigan and Indiana where magnesium and manganese deficiencies are common.

4-18-38: Was originally designed for tomatoes, but is also widely used on most all vegetable and fruit crops. Very effective to reduce yellow shoulder and other maturation and quality issues. Also effective against frost damage (up to 5 or 6 degrees).

20-20-20: A somewhat balanced plant food, designed for general gardening and ornamental beds around a home.

“Frost was forecast, so I sprayed 4-18-38 on my tomatoes in an unheated greenhouse. Got down to 28 degrees, but I had no damage.”

- J.M., Ohio grower, 2021

5-25-25: Was originally designed for onions and other allium crops to keep the vulnerable “neck” area tighter, thus reducing the susceptibility to neck diseases. Also effective on other crops such as grains and brassicas, both of which require chloride for optimum yield.

28-16-7: Higher nitrogen content will safely stimulate vegetative growth without danger of the plant going completely vegetative. Used in many produce crops once the plant has a high fruit count, and it’s desirable to continue to have new vegetative development for future fruit set.

28-16-7 Alfalfa: Very similar to regular 28-16-7, but with a different trace mineral package. It contains high

levels of boron, and is designed to supplement this essential trace mineral in alfalfa. Also designed to maintain crown vigor, initiate new shoot development and rapid regrowth.

34-4-4-4S When vegetative development is required, 34-4-4-4S will provide it. Even so, nice levels of trace mineral aids with crop quality.

22-6-22-2S: Designed for grain crops as an application to aid with head or tip fill. Research has also shown that it can also help with disease suppression due to the chloride content.



“I used 4-18-38 to protect my crops from a frost forecast ... had an airplane spray it on my zuchinni, peppers, tomatoes and late sweet corn. Although it did not save the zuchinni, everything else was saved. The plane even ran out of material on the sweet corn ... you could see right to the line ... it was visible.”

- J.J., Michigan grower

Are the plant foods allowed for organic?

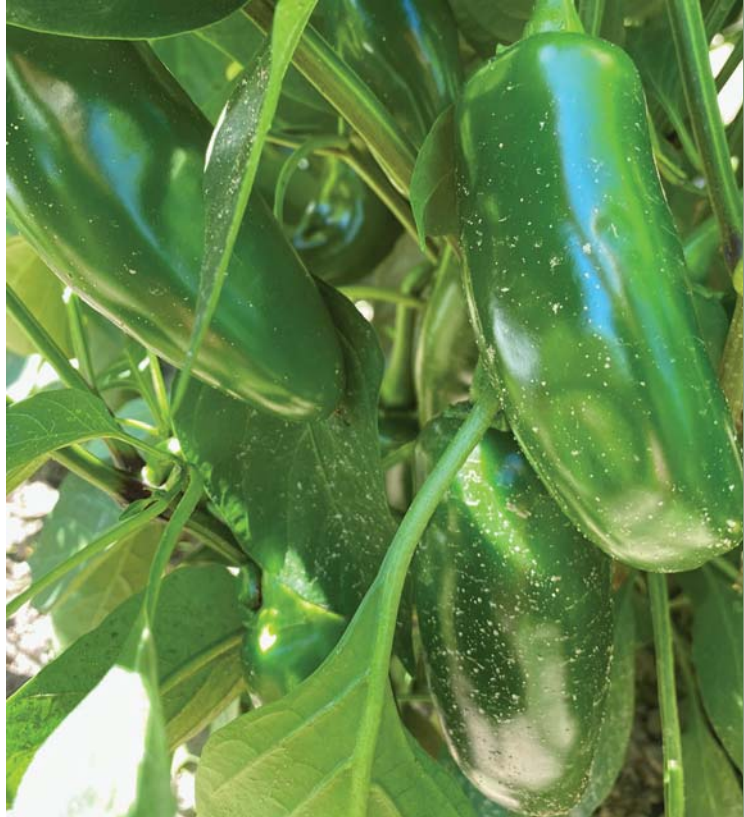
No, although the plant foods have a much higher “chemical purity” level than most organic products they are not acceptable since heavy metals and other impurities have been removed.

Will the plant foods work in hydroponic systems?

Certainly. With the purity of ingredients, and the attention to a complete nutrient “package”, the ISP plant foods are highly effective in hydroponic systems. They also work great in tomatoes, or other plants, that are using the bag and coir type of production system.

Are special blends available?

Yes, ISP can custom design almost any formulation that you need, as we do this for other clients. Custom blends are available in a minimum of two ton quantities.



Is there a grade for ornamentals?

Yes, ISP produces a 17-4-17 Horticultural plant food. The ornamental greenhouse portion of our business is the most rapidly growing sector. 17-4-17, coupled with bio's such as MetaboliK SB, HV1, SiGuard, and SiPhite provides very strong results.

Guaranteed Analysis 10-20-20

Total Nitrogen (N)	10.0000%
Ammoniacal	8%
Nitrate	2%
Available Phosphate (P ₂ O ₅)	20.0000%
Soluble Potash (K ₂ O)	20.0000%
Magnesium (Mg)	0.0500%
Boron (B)	0.2050%
Cobalt (Co)	0.0001%
Copper (Cu)	0.1250%
Iron (Fe)	0.2500%
Manganese (Mn)	0.1300%
Molybdenum (Mo)	0.0005%
Zinc (Zn)	0.1400%

Derived from: Ammonium Phosphate, Potassium Nitrate, Magnesium Nitrate, Magnesium Sulfate, Boric Acid, Cobalt Sulfate, Chelated Copper, Chelated Iron, Chelated Manganese, Ammonium Molybdate, Chelated Zinc and Anhydrous Ethylenediamine Tetra Acetic Acid (EDTA).

Above is the label for 10-20-20. Other soluble plant food grades have varying amounts of trace minerals based upon the effect we want to create, and the individual crop requirements to which the product may be applied.



Other Products (Plant Nutrient)

There are instances when a specific nutrient is required, and ISP provides several of the more common nutrients that are necessary for optimum production and quality. Following are just a few of the nutritional deficiency symptoms that, to a large degree, can be avoided.

MetaCal

MetaCal is a formulation of important organic acids and growth stimulants complexed with a proprietary blend of calcium compounds designed to effectively stimulate plant metabolism. Containing 10% plant available calcium and 10% nitrogen, the active ingredients are carried on a base of fermented molasses. This combination will be a very “high-energy” additive to any cropping program, and is especially effective during periods of high energy demand, i.e. fruit set and/or maturation.



*Blossom-End Rot
Bitter pit in apples
Poor shipping texture
Lack of flavor*

Guaranteed Analysis 10 - 0 - 0

Nitrogen (N)	10%
Elemental Calcium (Ca)	10%
Active Acid	38%
Inert Ingredients	42%

It is easy and economical to use; is non-corrosive to equipment; can be mixed with herbicides; applied to either soil or plant foliage. Although MetaCal is specifically designed for foliar application, it’s also quite effective through drip irrigation, or surface application over the row. It also makes an excellent, low-cost option of supplying calcium to rented acreage where liming is not economical. (Soil Application: For each 500 pounds of calcium carbonate required by soil analysis, use one gallon of MetaCal.)



*Yellow shoulder on tomato
(also called white core, green shoulder)
Lack of uniformity of ripening
Susceptibility to early blight
Poor shipping texture
Lack of flavor*

Guaranteed Analysis 0 - 0 - 16

Potash (K ₂ O)	16%
Polyhydroxycarboxylic Acid	34%
Inert Ingredients	50%

MetaK-16

MetaK-16 may be applied to most plants, including horticultural, turf, greenhouse, ornamental, or other agricultural crops. Potassium is a primary nutrient with most crops requiring large amounts of potassium per acre, and in many growing environments, the soil is either deficient in potassium, or cannot release adequate amounts during periods of peak demand. MetaK-16 is an excellent choice when making multiple applications of this important nutrient, resulting in both greater nutrient efficiency and yield increases.

MetaK-16 is a proprietary formulation containing 16% plant available potassium, and as mentioned, potassium is a primary nutrient absolutely essential for high quality produce. Potassium is essential for plant structural integrity, plant health and immunity, and fruit quality. MetaK-16 will help eliminate poor fruit quality during peak periods of fruit set and maturation, due to a lack of adequate potassium being released from the soil.

General Recommendations: Apply 1 - 4 quarts per acre, based upon tissue analysis recommendations. MetaK-16 may be applied by any liquid application methods, including drip and foliar methods. It is compatible with most horticultural chemistries, thus can save time and costs stemming from separate applications.



MagnaBor

MagnaBor is a 10% liquid boron, designed to correct and/or supplement boron deficiencies. Boron is a very common deficiency, and often inhibits yield, even when no visual symptoms are seen. MagnaBor is designed to ensure good pollination, and to aid with commodity quality. Boron helps ensure proper plant metabolic activity, including amino acid, protein, carbohydrate, calcium and water utilization. It also ensures good sugar translocation within the plant system, and aids in promoting maturity

Foliar: Apply with ground or aerial sprayer, with enough volume to ensure thorough coverage. DO NOT apply more than 2 qts. per acre in a single application. If the crop requires more than 2 qts., split the application allowing 14 days between sprays.



Guaranteed Analysis 0 - 0 - 0 - 10 (B)

Boron (B) 10%

Soil: MagnaBor must be applied uniformly across the field. It may be applied either alone or as part of a tank mix with other liquid nutrients or agricultural chemicals.



*Poor pollination
Brown patches in potato
Corking in apples
Excessive boll shed in cotton*

MicroZorb

Utilizing unique BioSorb (nano) technology, MicroZorb will provide enhanced absorption of foliar applied nutrient materials through leaf surfaces, thus providing the opportunity for greater crop response, particularly with glyphosate resistant varieties. Many herbicide applications will have a negative effect upon all plant species that are in contact with the chemistry. This may be observed as a short term discoloration, or a "stall" in plant growth and development. MicroZorb is designed to reduce this physiological disturbance, and encourage the plant to continue growing with minimal slowdown. Common usage rates are from 1 - 4 quarts/acre.



*Herbicide "stall"
Poor intake of foliar applied nutrient*

Guaranteed Analysis 0 - 0 - 0

Mixture of various carboxyl, phenolic and polyhydric acids (Humic Acid(s))	8.00%
Boron (B)	.50%
Copper (Cu)	.50%
Iron (Fe)	1.65%
Manganese (Mn)	3.00%
Zinc (Zn)	4.50%
Phytonutrients	.70%
Fermented Sugars	45.00%
Inert Ingredients	38.30%

Organic Products Natural Alternatives

Several years ago ISP made the decision to further enlarge our line of organic products. Consumer interest in organic, or pesticide-free commodities, is increasing rapidly, and a number of our clients were beginning to grow some organic produce. ISP has had four organic products for several decades, which are shown on these pages. Several years ago, ReStore 3G, was approved for organic production, and it's described in the humate section.

ReStore Xtra™ SOIL ACTIVATOR

A solution of soil microbe extracts and growth promoting substrates

Guaranteed Analysis
0-0-0

Active Ingredients

Concentrate of soil microbes carried in a solution of ferments from organic sugars, seaweed extract and seawater	85%
Acetic Acid	5%
Inert Ingredients (Pure Aqueous Solution)	10%

SOURCE: Concentrate of soil microorganisms including, but not limited to: (Aspergillus sp, Bacillus [Megaterium and Subtillis], Clostridium [Beijerinckii, Butyricum, Pasteriani], Enterobacter [Aerogenes and Agglomerans], Rhizopus sp, Saccharomyces sp, Torula sp), fermented natural plant sugars (apple, beet and corn), natural yucca extract (saponins), acetic acid, gluconic acid and seaweed extracts.

ReStore Xtra Soil Activator was developed as an organic solution for increasing microbial activity in the soil, and bio-physical responses in the plant. As such, benefits may include improved mineralization and decomposition of residues, higher yield, better soil texture (friability), reduced compaction, and improved water retention and drainage. ReStore Xtra could be considered the organic version of MetaboliK HV1

Formulated to be applied to the soil at a rate of 32 fluid ounces per acre either in the fall or spring. A light incorporation may be beneficial.

ReStore Xtra may be used as a liquid compost starter for pile, area, tank, or lagoon; and is suitable for composting all types of organic wastes such as farm manure, straw, saw dust, wood chips, cotton gin trash, town garbage, etc. Can handle a carbon to nitrogen ratio up to 50. Use 150 ml per ton of compost material with enough water to cover the compost pile.

CalStore™

CHELATED LIQUID CALCIUM

Guaranteed Analysis
0-0-0

Active Ingredients

Elemental Calcium	10%
Organic Sugar Acids	42%

Source: Blend of molasses (sugar cane, cane molasses) fermented with yeast, vinegar, fine ground limestone and attipulgite clay.

CalStore is a formulation of organic sugars and unidentified growth factors complexed with a proprietary blend of calcium compounds, and may be applied to either the soil or plants. A number of non-organic clients also use CalStore on their produce as they do not wish to have the 10% nitrogen that MetaCal contains.

Soil application is 1 gallon of CalStore per 500 pounds of lime recommended. Foliar rates from one to eight gallons per acre.



PhytoStore™

PLANT GROWTH ACTIVATOR

Active Ingredients

A mixture of various carboxyl, polyhydric acids (Humic Acids)	16%
Bio Matrix	4%
Phytonutrients	8%
Inert Ingredients	72%

Source: Ground shale and other clays, fermentation products derived from cultures of soil organisms, chelated zinc, chelated manganese, chelated copper and chelated iron..

PhytoStore is an organic version of Phyto-Gro Xtra, and in itself is a highly effective humic additive. It will aid in the uptake of soil phosphate, help increase the overall carbon levels in the soil, and act as a soil microbial stimulant. With this increase in microbial activity, there is usually more plant available phosphate.

It is suitable for both soil and foliar applications, and will; (1) Stimulate seed germination and emergence and early plant vigor, (2) enhance soil and foliar

nutrient efficiency, (3) aids in promoting increased activity of soil microorganisms, and (4) aids in reducing compacted soil conditions. PhytoStore is compatible with most fertilizer and/or microbial or enzymatic formulations that are neutral or slightly alkaline in pH.



FoliarStore™

FOLIAR NUTRIENT/ACTIVATOR

Guaranteed Analysis
0-0-0

Active Ingredients

Source: Fermentation blend consisting of sea plants, protein from non-GMO organic soybean, old growth forest compost, soft rock phosphate, liquid fish emulsion, lignite, concentrated sea water and natural sugars.

FoliarStore Nutrient Activator is a biologically active growth promotant, providing a rich array of organic materials including peptides, seaweed and compost extracts, humates, and other bio-fermentation extracts. Comprised of nature's own natural compounds, both from the sea and from organic mineral deposits, FoliarStore will enhance natural growth and fruiting processes increasing both production and quality.

For best results, applications of 2 - 4 quarts per acre should begin as soon as leaves are large enough to absorb and utilize nutrient, and continue at 10 - 14 day intervals through primary growth.

Other Organic Products:

In addition to these effective and time-proven products manufactured by ISP, we added several other products as well. Searching Europe, South America and Asia, we chose products that were well-researched, field-proven, and among the most effective in their respective categories.

We then took these products into our own research programs, and the "best of the best" are shown on the following two pages. We also compared our organic production program to the ISP biological production program, as well as conventional production programs, and were very pleased to see that the ISP Organic held its own, especially compared to conventional production methods. We believe that ISP currently offers the most effective organic program on the market today.

Organic Products Natural Alternatives



ITALPOLLINA® 4-4-4 SOIL IMPROVING FORMULA

4-4-4 is a unique source for composted chicken manure to which is added microbes, peptides and other growth promoting products. It is truly unique in the category of composted manures, and quickly improves the microbiological, physical and chemical components of the soil.

The exclusive manufacturing process provides a non-leachable, pathogen-free source of nutrients and is suitable for all soil types. Utilizing a unique grinding process, 4-4-4 also is free of weed seed, and the pelleting process is performed without the use of chemical agents, or other adhesives. In our trials it performed extremely well when compared to other composts, being not only the most productive product, but the most cost effective when compared to the production results.

TIFIMAX™ TRICHODERMA ATROVIRIDE MICRONIZED POWDER

Trichoderma atroviride* 1x10¹⁰
 Glomus spp 10 spores/g
 *Trichoderma atroviride, strain MUCL45632
 (patent P1876232)

TifiMax is a micronized wettable powder designed to provide beneficial fungi to the growing environment (whether artificial medium or soil) to aid with greater protection from soil borne pathogenic organisms. The patented strain of Trichoderma becomes active at cooler temperatures than most pathogens (or similar products), thus enabling colonization of the seedling root prior to infection. In our seeding trials, TifiMax treated plants showed a stockier, more sturdy seedling that withstood environmental stress significantly better than the untreated. TifiMax is highly recommended in any nursery seeding or transplanting situation.

In addition, TifiMax was effective in providing in-field protection from phytophthora, significantly reducing crop damage. (Usage rates are 4 - 8 ounces per 35 cubic feet of growing medium. In-field usage rates are from 8 to 16 ounces per acre at transplanting, either in transplant solution or through drip irrigation. Repeat application in 30 days.



Pepper field in west-central Indiana that has a history of phytophthora.

TifiMax was used in the 2021 season, and little damage was visible. There was only several small low-lying areas (shown below) that still showed infection.



ECOVAM GXT GUARANTEED ANALYSIS
 Total organic nitrogen (N)2%
 2% Water Soluble Nitrogen

DERIVED FROM: Soy Protein Hydrolyzed

ALSO CONTAINS NON-PLANT FOOD INGREDIENTS

Bacillus amyloliquefaciens	1 x 10 ⁷ CFU/g
Bacillus licheniformis	1 x 10 ⁷ CFU/g
Bacillus megaterium	1 x 10 ⁷ CFU/g
Bacillus methylotrophicus	1 x 10 ⁷ CFU/g
Bacillus pumilus	1 x 10 ⁷ CFU/g
Bacillus subtilis	1 x 10 ⁷ CFU/g
Funneliformis mosseae	5 sp/g
Rhizophagus intraradices	5 sp/g
Pisolithus tinctorius	198 sp/g
Sclerotinia citrinum	32 sp/g
Trichoderma atroviride *	1 x 10 ⁷ CFU/g



EcoVam GXT Ultra SP is a water-soluble powder that utilizes proprietary production processes to deliver multiple solutions for nursery growers & specialty agriculture. It contains amino acids and peptides derived from plant proteins, beneficial bacteria of bacillus, Trichoderma and Mycorrhizae fungi in a water-soluble formula. Experimental for the 2022 growing season, it's expected that it will replace TifiMax in the nursery seeding/transplanting markets.



Bioterra

2.1-1.2-0 GREEN

BIOTERRA GREEN 2.1-1.2-0 is a liquid fertilizer obtained from proteins of salmon, hydrolyzed enzymatically under controlled conditions. Protein hydrolysate is the organic material obtained by the hydrolysis of proteins to their constituent amino acids and short polypeptides. These are a source of ORGANIC NITROGEN.

When it comes to fish-derived nutrient sources, Bioterra Green stands alone. The salmon are raised in some of the most pristine waters in the world off the southern coast of Chile, and as a result provides a product that is very low in heavy metals and other contaminants found in other fish products. In our trials, it created a visual response within 24 hours of application, and provided a response equal to four times a comparative fish product.

GUARANTEED ANALYSIS 2.1 - 1.2 - 0

Total Nitrogen (N) 2.1%
2.0% Water Soluble Organic Nitrogen
0.1% Ammoniacal Nitrogen
Available Phosphoric Acid 1.2%
Derived from salmon protein hydrolysate
Stabilized with Phosphoric Acid

Amino acids are the foundation of plant immunity, and the plant's ability to withstand stress from any source. BioTerra Green aids in reducing stress. Intended for foliar and/or hydroponic use only. Do not mix with urea, copper or sulfur products. Mix well prior to use, and for foliar application mix 3 gallons BioTerra Green to 100 gallons of spray solution. Do not irrigate over the foliage for three days following application.



dreggo

**Guaranteed Analysis
0-0-0**

Active Ingredients

Derived from Proprietary Blend of Essential Oils; including citronella, cinnamon, garlic, and camphor.

[Ingredients are accepted for use under CFR40, 180.1001 (c)]

dreggo

insect exciter & repellent

*controls small insects
(aphids, thrips, mites, etc.)*

disrupts beetles & larger insects

safe to use, zero days re-entry

*no resistance buildup in targeted
pests*

There is a large amount of research on using essential oils for protecting plants from both disease and insect damage. Some of these oils are predominantly anti-fungal, while others are more effective in repelling and controlling insects. Dreggo is a combination of essential oils, shown to provide a significant level of protection against many of the small insects such as thrips, mites, aphids, etc. Part of this protection may be due to a repellent activity, while at the same time the oils are capable of blocking the insects ability to breathe. Dreggo is safe for humans, and has a zero re-entry period. Positive results have been reported in a number of greenhouse and field operations, providing safe and effective options to common pesticide usage. Standard application rates range from 16 - 32 ounces of dreggo per 100 gallons of spray solution. To maintain effective control, dreggo should come into contact with 100% of the plant surfaces. Although completely natural, dreggo is NOT currently approved for organic usage.

SiGuard/Silicates (Plant Protection)

What is SiGuard?

Silicate (Si) is rapidly becoming a standard product in the horticultural community. ISP offers four different products in our “family” of silicates.

SiGuard: An 84% soluble silicate powder

SiGuard L: A 42% liquid formulation

SiMag 58: Silicate with EDTA chelated magnesium

SiMan 911: Silicate with EDTA chelated manganese

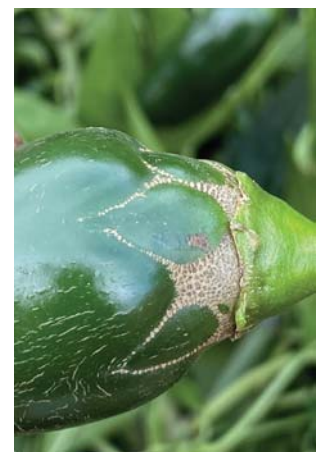
Based upon amounts found in plant tissue silicon is beginning to be recognized as perhaps fitting into plant nutritional requirements with other secondary nutrients such as calcium, magnesium and sulfur.

Although vinecrops are currently known as the greatest accumulators, all plants take up silicon and use it in the construction of cell walls which greatly contribute to a plant’s structural strength. “Plants deprived of Si are often weaker structurally,” (Epstein 1999).

Increasing available (soluble) Si directly increases the amount deposited in cell walls. It then becomes part of the wall matrix; making them stronger. In addition to this structural role, Si appears to protect plants from both insect attack, and specific diseases, plus aiding the plant’s ability to withstand environmental stress.

Many of our clients with ornamental greenhouses are seeing significant benefits in insect control, and have been able to reduce, if not eliminate pesticide usage. This observation has been especially positive with smaller insects such as aphids, mites, thrips and white-flies. Based upon information from other research, Si appears to essentially coat the insects with Si, thus limiting their ability to breathe.

In ISP research trials, we have also seen very significant control of broad mites in peppers with an application of SiGuard directly sprayed down into the top of the flowers.



Broadmite damage on jalapeno

Key Benefits:

As part of numerous plant metabolic activities/processes, Si directly aids with overall plant health

Can counteract the negative effects of excessive N.

Increasing Si levels greatly assists in powdery mildew management

Alleviates a number of abiotic stresses such as lodging of small grains, drought, temperature extremes and chemical stresses such as high salt levels

Suppression of aphids, mites, western flower thrips and other small sucking insects and mites

Easy to use, cost effective

Increases yield

*“We get powdery every year on our summer squash. Using SiGuard, it helped reduce the pressure, and I could pick for another 10 days. On my acres, every picking would gross another \$20,000.00.”
- J.J., Michigan, 2020*



SiGuard

Guaranteed Analysis

Soluble silicate powder 84%

Packaged in resealable 16 pound pails.

SiGuard L

Guaranteed Analysis

Soluble silicate (SiO₄) 42%

Inert Ingredients 58%

Packaged in 2.5 gallons, 250 gallon IBC.

SiMan 911

Guaranteed Analysis

Manganese (Mn) 9%

Silicon (Si) (non-nutrient)..... 11%

Packaged in resealable 4 pound pails.

SiMag 58

Guaranteed Analysis

Magnesium (Mg) 5%

Silicon (Si) (non-nutrient)..... 8%

Soluble Potash (K O) 5%

Packaged in resealable 4 pound pails.

Application & Other Information?

SiGuard: Proven to aid in the suppression of powdery mildew (PM), grey mold (botrytis), and to aid in building resistance to other mold, fungal and/or bacterial infections. It also acts as a guard against aphids, thrips, mites and other insect pests that can cause severe leaf damage. Apply 4 - 6 ounces/acre every 7 to 10 days.

Mixing: When mixing SiGuard, fill mix tank with the majority of the water (hot water is recommended though not a necessity), then add SiGuard and mix for a minimum of several minutes. If applying with other crop protection chemicals, dissolve SiGuard prior to adding these products. SiGuard is a high pH product, and it may be advisable to buffer spray solutions.

SiGuard L: Easy to use, but avoid spraying on glass objects. High pH, so spray solution may require buffering. (NOTE: please follow label directions when combining SiGuard L with other ISP nutritionals.) Common usage rate is 16 ounces per acre, applied every 7 to 10 days.

SiMan 911 & SiMag 58: Magnesium deficiency is common in high tunnel/greenhouse tomato production from the Great Lakes area to the east coast. Manganese deficiency is becoming more common in the same geographic area, especially in the southern Michigan and Indiana areas.

SiMan 911 and SiMag 585 will aid in providing these essential nutrients to the crop, and have some of the silicate protection as well. In severe conditions of disease and/or insect pressure, these two products will need to be supplemented with other control products.



Tomato High Tunnel, Variety Red Deuce Illustrating the difference in late blight infection between control plants (above) and plants that had received bi-weekly foliar nutrients and SiGuard (right).

Silicates (and phosphites) have shown such a significant enhancement of plant physiological activities, that they are now considered to be biostimulants by the European Biostimulant Council

SiPhite (Plant Protection)

Key Benefits:

A proprietary and highly efficient blend of phosphite and silicate.

Offers both contact and systemic modes of action.

Activates the plants natural defenses (immune system).

Aids in reducing abiotic stress from negative weather conditions.

Compatible with most fertilizers and other control products.

Cost effectively increases yield.

What is SiPhite?

SiPhite is a proprietary combination of silicate and phosphite, specifically formulated to reduce plant stress and to enhance defensive, or protective, measures within the plant itself. SiPhite offers three different modes of action with the first being the silicate.

The second and third modes of action are a result of the phosphite in SiPhite. Phosphite, and silicate, are both listed as natural or organic fungicides.

Phosphite is a phosphorus compound but is not considered to be a nutritional form of phosphorus like phosphate. Instead it causes a physiological effect within the plant to strengthen the plants defensive activities. It also has an immediate, and detrimental, impact upon many yield robbing fungal and bacteria species. In other words, through both contact and systemic activities or plant responses, it aids in the control of disease.

SiPhite is formulated to be applied at a rate of 1 to 2 quarts/acre per application (.75 - 1.5 fluid ounces per 1,000 square feet).

Guaranteed Analysis

Mono- and Dipotassium Salts of Phosphorus Acid	45%
Potassium Silicate	15%
Inert Ingredients (Modified water)	40%

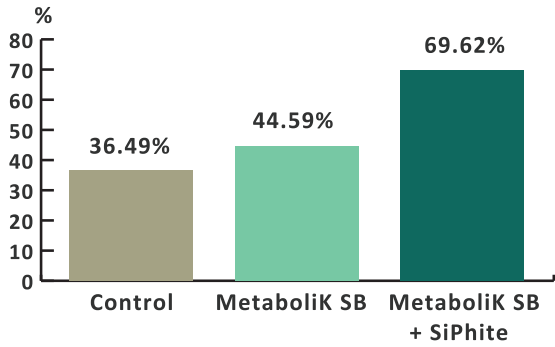
"I noticed a small outbreak of downy in my cucumbers, and normally downy is a death sentence for cukes. I aerally applied 2 quarts per acre of SiPhite, and another quart every week thereafter.

*I picked cukes for another 28 days!
- J.J., Michigan grower*

Wrapper tobacco in Wisconsin with SiPhite; beautiful rust and leaf spot control.



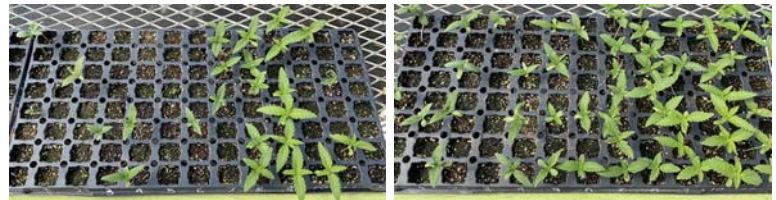
2021 Cannabis Seeding Trial, showing percent emerged with direct seeding.



The graph above illustrates emergence data in a 2021 cannabis trial. Info on seeding cannabis states to soak and pre-germinate the seeds, then plant. These were simply direct seeded into the seeding trays. It was interesting to see the difference; a 90.79% increase when compared to control.

Total usage may total up to 6 quarts/acre during the full season, (4.5 fluid ounces per 1,000 square feet). SiPhte is effective when used as part of a seeding application; broadcast sprayed, foliar applied, injected thru drip lines, or as a drench for bare root transplants. There are a variety of options, but keep in mind that preventative applications are significantly more effective than trying to stop a disease outbreak once it has become established.

Based upon visual observation, as well as trial data, SiPhte can directly impact yield potential. It's believed that the plants are better able to withstand biotic stress.



Cannabis seedlings direct seeded in trays. Control in left photo, SiPhte and MetaboliK SB in right photo. 12 varieties in each tray.



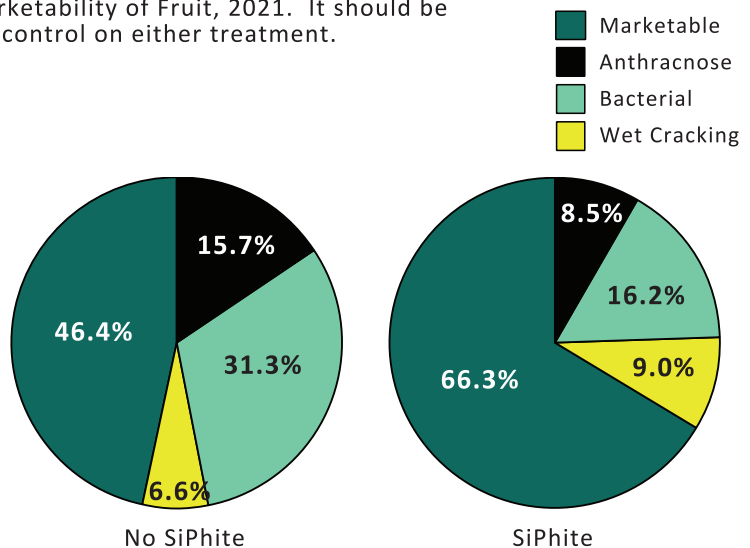
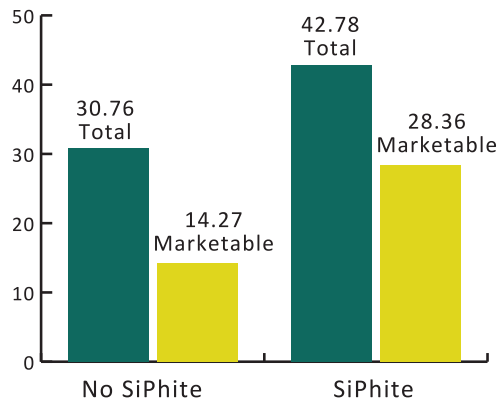
Photos illustrate Italian Paste tomatoes (shaped like a red slicer) at the last picking on September 24. The two beds were 7' apart. Control is the picture at left, the SiPhte at right.

The yield data is shown in the graphs below. There was no fungicide or other chemical disease products used in this trial. The purpose of the project was to see if SiPhte had an impact on disease, and percentage of marketable yield. It did, and even had a surprising impact on total pounds produced.



Comparison of SiPhte to Control For Yield, and Marketability of Fruit, 2021. It should be noted that no pesticides were use to aid in disease control on either treatment. Variety: Italian Paste Heirloom

Pounds Per Plant



Torch (pH Buffer)

Why are there so many pH buffers and additives on the market? Is there really any difference in them?

Key Benefits:

Extremely effective at both pH buffering and conditioning chemistry spray solutions

Reduces chemical resistance of pests by providing better kill in initial pass

Aids in protecting chemistry investment

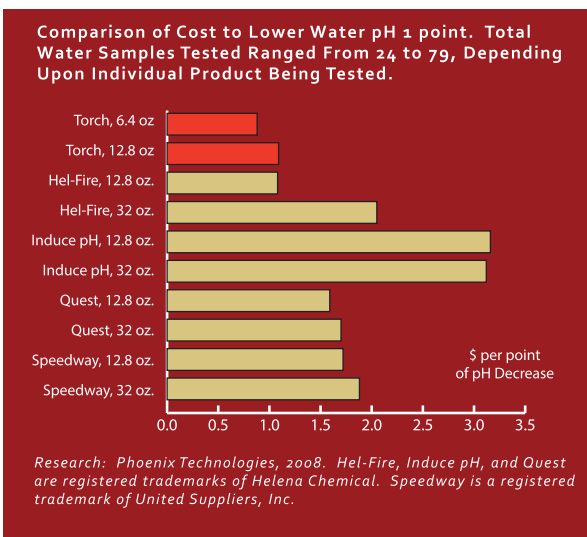
Very easy to use

Low cost on a per acre basis

Many crop protection chemicals are more effective when the application solution is somewhat acidic. Glyphosate is a common herbicide that is most active at a solution pH of around 4.5. In addition, glyphosate is susceptible to reacting with free cations in water.

However, most of our water is neutral to somewhat alkaline, and a high percentage of water is “hard” (containing cationic elements). Many insecticides and some herbicides suffer from alkaline hydrolysis if the solution pH is above 7. This can result in a severe loss of active ingredient and, of course, poor chemical performance requiring a second application.

Today, the market is saturated with a large selection of pH buffers and tank mix additives, most promising that they can provide the optimum pH level for crop protection chemical applications. So how do you know which is really the best for you?



The Torch Test

We decided to test it ourselves. Water samples were collected from West Texas, Oklahoma, Kansas, Colorado, Missouri, South Dakota, Illinois, Indiana and Michigan. These 79 samples came from a variety of sources, including city and untreated rural wells.

Average pH prior to buffering was 7.73. Torch was added at a rate of 1/1000, resulting in an average solution pH of 2.58, at a cost of \$1.09 per point of pH decrease. We were impressed.

A clear winner

Torch was the clear winner for pH adjustment, and was the second best product tested when measuring solution EC (electrical conductivity).

The bottom line is Torch provides more than twice the pH effect, at only 60% of the per acre cost of the closest competitive product!



Photo on opposite page (lower right) illustrates bindweed kill using Torch as a buffering agent with glyphosate on previous years corn crop. Bindweed is an easy weed to “burn down”, but difficult to actually kill. Torch helped the chemical to actually achieve a kill. Left side of photo is where the solution was not sprayed.

Photo at left illustrates “kill” on Russian Thistle in a dryland cotton field in West Texas. Note size of thistle, and overall herbicide effectiveness. Herbicide used was glyphosate with Torch added as a pH buffer.

Torch was also compared to several competitive products. Not only was Torch the most effective at buffering solution pH, but was also the most cost effective. After seeing those results we were even more impressed. (Shown in graph at bottom left of this page.) It became obvious that even at half the label rate, Torch outperformed most of the competition.

Torch is probably the most copied pH buffer/conditioner on the market today. But only Torch is the original ... and often the original is the best!

"It's economical and easy to use. Most importantly is that we had no call-backs where we used Torch. It also worked great in cotton defoliation."

- B.D., aerial applicator, Texas

If you want to spend less money per tank load of spray, pick up and carry smaller containers of product, and increase the chances of a good weed/pest kill, then Torch is your product of choice.

Surfactants and Anti-drift

In addition to a strong buffering and conditioning effect, Torch also has a significant percentage of premium non-ionic surfactants, and an organic acid "safener" which offers greater crop protection when applying herbicides. Additionally, we include an anti-drift agent for application safety and peace of mind. Label rate with Torch is 1 gallon per 800 gallons of solution, but based upon individual water qualities, it can range from this to less than half label rate.

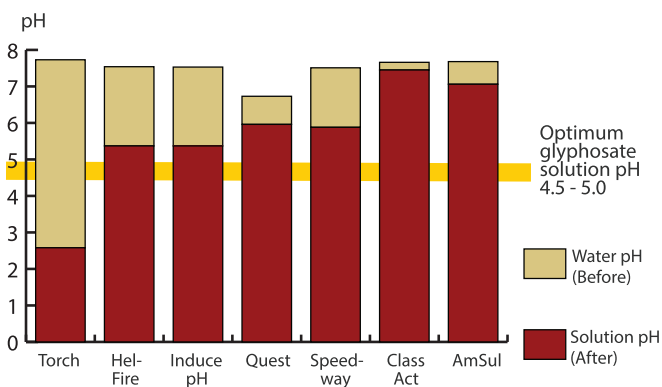
"I add Torch whenever spraying glyphosate. Although I also use half-rate AMS to help condition the water, Torch really shows in any kind of stress situation ... it will almost 'rain-fast' glyphosate."

"Last year, the custom sprayer left Torch out of the first load, and you could really see the difference to the row. The grass was thick where Torch wasn't used, and virtually clean where it was."

- J.R., Kansas grower



Effectiveness of Several pH Buffers/Water Conditioners for Lowering Water pH (Uniform Ratio of 1 Part Product to 1,000 Parts Water; AmSul at Rate of 15 Pounds Per 1,000 Parts Water.)



Research: Phoenix Technologies, 2008.

Hel-Fire, Induce pH, Quest; Registered trademarks of Helena Chemical Co. Speedway; Registered trademark of United Suppliers, Inc.



Other Research & Field Trials

ISP - Committed to Performance

Every season ISP is performing multiple research projects and/or field trials. During the last several decades, this has involved our own in-house projects, independent research company projects and university trials. A significant percentage of our profitability goes to support these projects. Why? Because you rely upon us for the most solid, proven answers to your questions. At ISP we never guess ... we know! And if we don't know, we'll tell you ... and we'll also start searching for the answer to your specific production challenge. We're very good at what we do, and we are continually striving to get better.

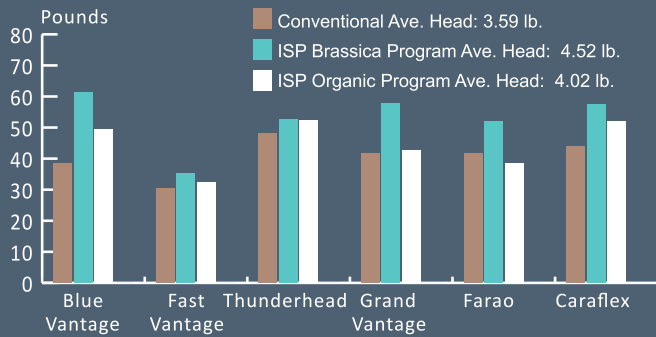
Key Benefits:

Security and peace of mind for our clientele

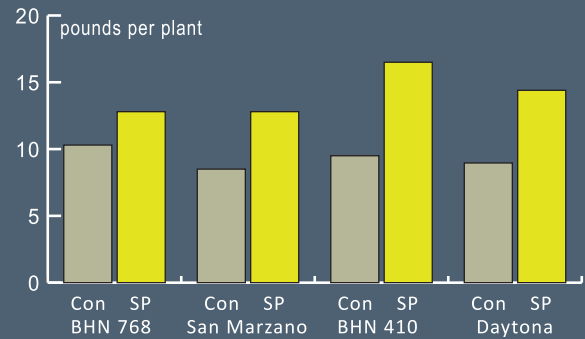
Forming relationships where our clients know we care about their profitability

Successful history ... promising future

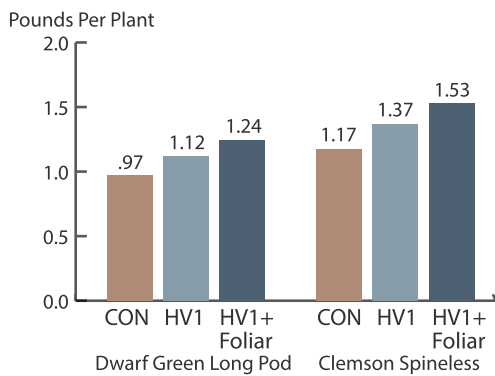
2021 Cabbage Project: Comparison between a conventional fertility program, ISP Brassica Program, and the ISP Organic. There were 3 replications per variety and treatment. The data illustrated is the total of the 3 reps.



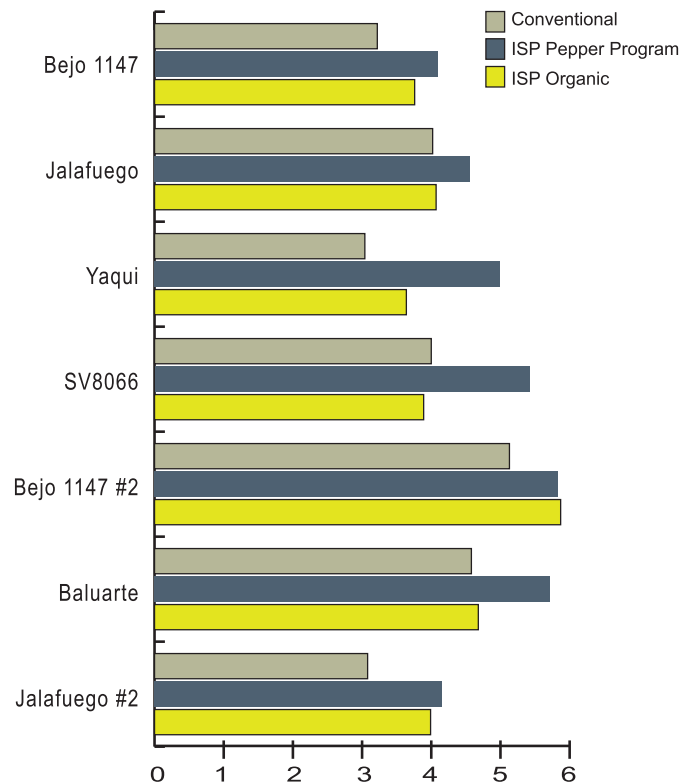
2021 Tomato Projects: Comparison of paste tomato varieties with and without SiPhite (shown as CON & SP). BHN768 had two replications, and Daytona had three. Data shown in graph is the average on those varieties.



Okra 2020: Yield Comparison On Okra Between Untreated Control, Metabolik HV-1, and HV1 with 5 Foliar Plant Food Applications.

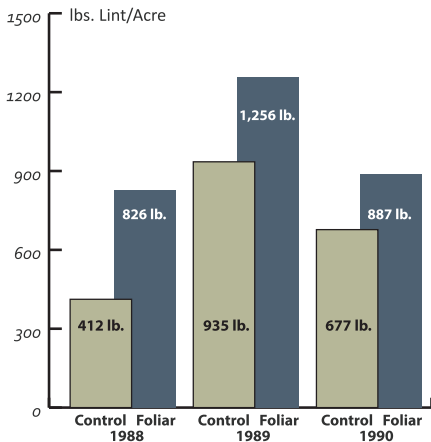


Jalapeno 2021: Comparison of Yield (average pounds per plant) between a conventional fertility program, the ISP Pepper Program, and the ISP Organic Pepper Program.



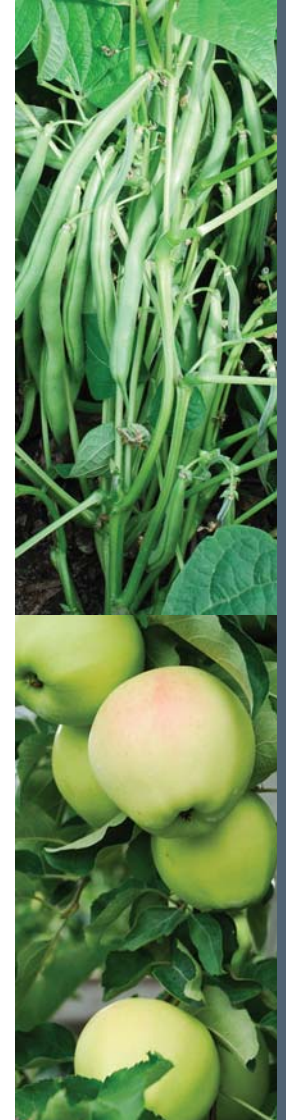
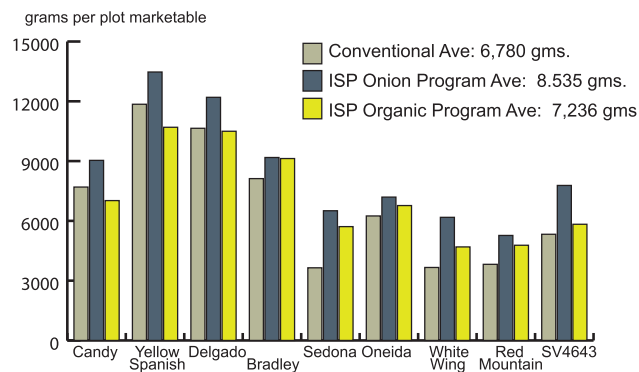
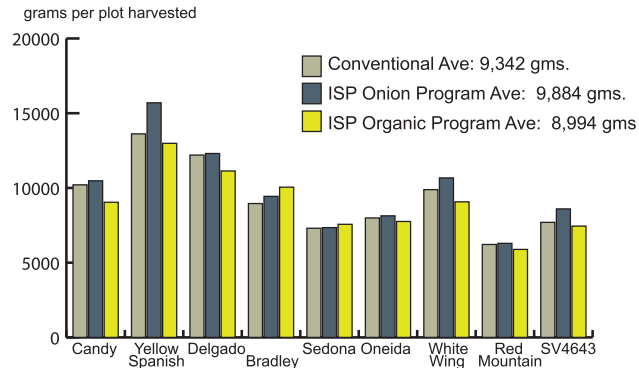
ISP's approach toward research is not just to determine whether or not a yield increase was achieved, but to analyze the plants and data to more fully understand how any differences were achieved. Once that understanding is gained, it's replicable. While cotton yields are much higher now than in the late 1990's, the response is the same.

Average Cotton Yield (Lbs. Lint/Acre) Control Compared to Foliar Applied Soluble Plant Food 10-20-20 + MetaboliK HV-1.

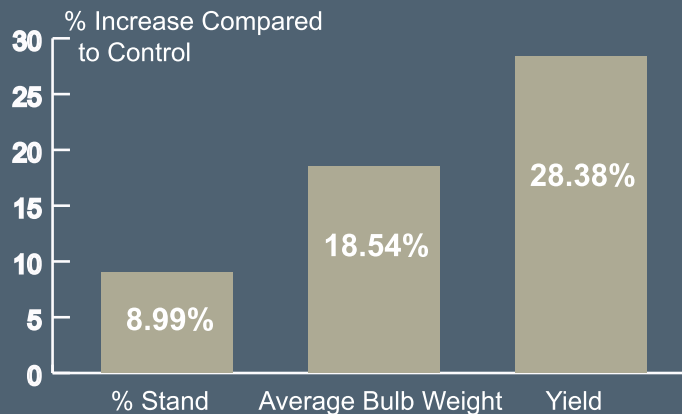


Research: University of Arkansas, Keiser Research Station, 5 Reps per Treatment

2021 Onion Project: Comparison of Yield (grams per plot) between a conventional fertility program, the ISP Onion Program, and the ISP Organic Onion Program. There were originally 60 plants per plot planted, although at harvest no plot had 100% stand. Weather conditions were not good during harvest. Onions were harvested, checked for disease at harvest, and if present, weighed and discarded. The remaining (harvest weight) were then checked again 60 days post harvest (marketable weight).



Multiyear Garlic Project: This project began with questions concerning the better varieties of garlic to grow. During the 2019 growing season, we had 58 varieties in our garlic project, comparing the effects of MetaboliK HV1 on yield and average bulb weight compared to an untreated control. For the 2020 season, there were 96 varieties, and only 38 for the 2021 season, although many of the varieties had from 3 to 5 replications. Location for the 2019 and 2020 season was Hesperia, MI, the 2021 season at Coopersville, MI. Both locations were sandy loam soils, with relatively low organic matter and fertility. Data from the 2021 season is shown at right.



Varieties included both softneck, California Early being the best; and hardneck, Carpathian, German Stiffneck, and Redneck Wild being exceptional.

Feed Quality Comparison, 4th Cutting Hay, Ohio, 2014.

	No Foliar:	ISP Alfalfa Foliar:
Crude Protein	21.6	23.1
Relative Feed Value	139	150
Relative Feed Quality	136	161
Est. Milk Per Ton	1,681	1,875



Nutrition & Disease Susceptibility

“The level of severity of most diseases can be reduced through proper management of nutrients.”

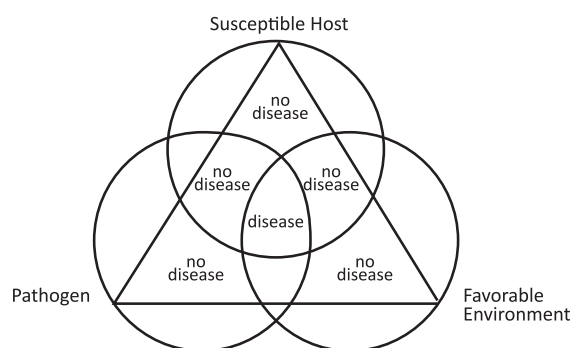
What is disease?

Both plants and animals have natural immune responses that aid in protecting the organism from becoming “sick”, and nutrition is a vital aspect of optimum immune responses. ISP believes that a diseased plant is a plant that has, for a variety of possible reasons, become weakened to the point where natural immune responses are no longer effective in the continuation of optimum plant health. As an example, we have observed multiple instances where susceptibility to early blight in tomatoes (photo at right) can be suppressed with higher levels of potassium being available to the plant, particularly during early fruit set.

- Food and Agriculture Organization of the United Nations



The “Plant Disease Triangle” is often used to illustrate how and why plant disease occurs. These three sides of the triangle are a pathogen organism, a susceptible host plant, and favorable environmental conditions that allow the pathogen to become active or is conducive to spread. Disease can only become an issue when all three aspects are present. Without all three conditions being met, then infection cannot occur.



All pathogenic organisms have a set of environmental conditions that allow them to become active and/or reproduce. Weather plays a role in the appearance of disease, and we’ve all seen how varying weather can either inhibit or encourage the presence of disease. But even if pathogens have become active, the cycle requires a susceptible host plant to continue. The key word in this phrase is susceptible. This involves at least two specific aspects; that the potential host is sensitive to that particular pathogen; and, that the plant’s natural immune

response has become weakened to the point where infection is possible. **To a certain degree, disease is a symptom of an underlying issue ... not the issue itself.** Identifying which plants are becoming susceptible to either disease or insects is the basis of most IPM programs, usually through a combination of either plant energy images and/or traps.

As grower’s, we have very little control over the weather, and little control over pathogens as many are carried through the air. But it is our belief that we can influence the susceptibility of a plant to infection, and this begins with nutrition and controlling specific stress factors. This was discussed earlier to a small degree, but high fruit counts can easily lead to a lack of adequate nutrition. A lack of adequate nutrition then leads to a breakdown in necessary physiological functions which are essential for optimum plant defenses or immune responses.

The ISP nutritional products offer tools for maintaining optimum nutrition. The biological products offer tools to improve soil microbial functions, improve nutrient uptake, and be more resistant to negative weather factors. In the past several years we’ve continually become more active in adding products that are even more directly active in aiding the plant to maintain greater resistance to a variety of potential issues. These products include essential oils, amino acids, peptides, silicates and phosphites.

FAQ

What are biostimulants?

The term “biostimulant” is defined in the 2018 Farm Bill as “a substance or microorganism that, when applied to seeds, plants, or on the rhizosphere, stimulates natural processes to enhance or benefit nutrient uptake, nutrient use efficiency, tolerance to abiotic stress, or crop quality and yield.” Biostimulant products typically include ingredients from one or more of the following general categories. ISP is active in all but the Chitosan/Biopolymer category.

Beneficial microbes. The action of these products is based on the activity of live fungi and/or bacteria. We would also include material extracts derived from microbial growth and/or fermentation.

Humic and fulvic acids. These acids occur naturally in soils as a result of the breakdown of organic matter.

Protein hydrolysates. These include small peptides and amino acids, the building blocks of all proteins.

Seaweed and plant extracts. Seaweed extract may contain minor nutrients and plant hormones such as cytokinins. Plant extracts may contain substances that can stimulate plant metabolism or natural defense systems.

Inorganic compounds. These are mineral-based molecules such as phosphites, and minor elements such as silicon.

Chitosan and other biopolymers. “Biopolymers” are specific molecules derived from plant or animal sources; for instance, chitosan is derived from the shells of crustaceans.

What are Phytohormones?

By definition, “Plant hormones are not nutrients, but chemicals that in small amounts promote and influence the growth, development, and differentiation of cells and tissues. Plant hormones shape the plant, affecting seed growth, time of flowering, the sex of flowers, and senescence of leaves and fruits. They also affect which tissues grow upward and which grow downward, leaf formation and stem growth, fruit development and ripening, plant longevity and even plant death. Hormones are vital to plant growth and lacking them, plants would be mostly a mass of undifferentiated cells.”

“Auxins are compounds that positively influence cell enlargement, bud formation and root initiation. They also promote the production of other hormones and in conjunction with cytokinins, they control the growth of stems, roots, flowers, and fruits. Auxins, especially 1-Naphthaleneacetic acid (NAA) and Indole-3-butyric acid (IBA), are also commonly applied to stimulate root growth when taking cuttings of plants. The most common auxin found in plants is indoleacetic acid or IAA.

Cytokinins or CKs are a group of chemicals that influence cell division and shoot formation. They also help delay senescence or the aging of tissues, are responsible for mediating auxin transport throughout the plant, and affect internodal length and leaf growth.

Gibberellins play a major role in seed germination, affecting enzyme production that mobilizes food production that new cells need for growth. They promote flowering, cellular division, and in seeds growth after germination. Gibberellins also reverse the inhibition of shoot growth and dormancy induced by ABA.”

- Source: Wikipedia



Will ISP products replace my usual fertility?

Although overall efficiency is usually improved, in most instances, no, the ISP products are not going to replace basic fertilizers. They are designed to enhance or add to the fertility program you're already using. The plant foods can obviously replace some of your fertilizer program, but best results are achieved with a good fertility base.

Are there product usage and application guidelines available?

ISP has basic program recommendations available, but these guidelines are based upon average soil types, environmental conditions and management capabilities. In most instances these guidelines should be adjusted to fit your unique parameters. The majority of our Distributors and field representatives have recommendations better suited to their personal areas. In other words, what challenges do you need to overcome, what is the potential value of your commodities, what markets are you selling into, are there quality bonuses available, and how much available labor do you have? Always consult with your local representative.

Many of our clients initially are attracted to the potential of a significant yield increase, and we can provide this. In many specialty markets though, quality is the most important factor, and ISP provides not only the potential of a yield increase, but significant quality improvement as well. As individual clients gain experience

with ISP products they make additional adjustments to further maximize their profitability, not just their yield.



What makes the ISP approach toward crop production different?

Different may not be the correct term, but at ISP we really study plants, and even how different varieties may grow. We often have different recommendations based upon specific varieties, especially with tomatoes and peppers. Taking tomatoes as an example, a tomato does not just happen to appear on the plant. Tomatoes obviously grow from fruiting trusses, and fruiting trusses develop at about node six or seven on the main stem, then every two to three nodes thereafter. In addition, as the plant develops, secondary fruiting branches will develop from the main stem, and eventually trusses will develop on these secondary sources. In most all cases, the goal is to increase yield. To do so, we want a fairly large plant with a high number of fruiting trusses (we refer to this as "building the frame"). One simply needs a high number of potential fruiting sites. But we also want exceptional fruit quality and flavor, and every fruiting form has to be addressed from a nutritional standpoint. So the more fruiting forms we're able to set, the more potential nutritional stress we add to the plant. It is this biotic or nutritional stress that ISP is exceptional at being able to control.

Is the program cost effective?

Yes, often remarkably so. As mentioned our goal is not simply yield per acre, rather it's profitability per acre. There are times when we will probably increase your investment into your crop, or perhaps we may actually be able to help you decrease it. One of our clients stated it this way, "you may say you can't afford to use the ISP products ... it's been my experience and opinion you can't afford not to. It makes that much of a difference." As mentioned, in most cases we will increase your yield per acre, but to take advantage of this increase there must be a market. Potential market demand is of extreme importance.

Does the ISP approach work on all crops?

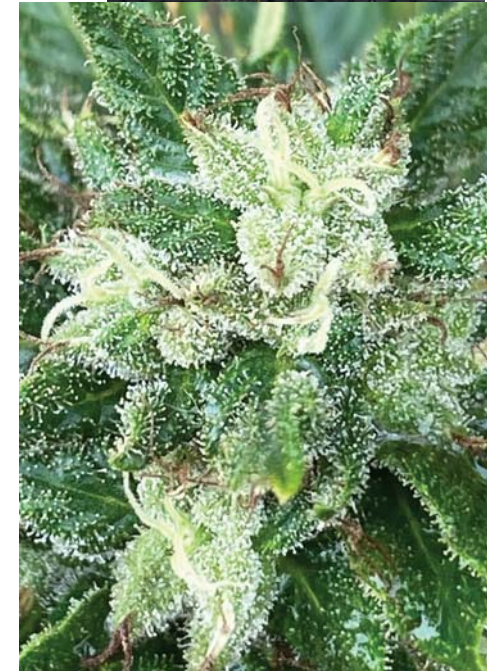
Yes, since all crops grow and require nutrient. It could be said that ISP specializes in tomatoes, peppers, melons, and alliums, but at the same time that's not completely accurate either. We work with more acres of corn and beans than tomatoes and peppers, but the corn program is not nearly as intense as one designed for a vegetable crop.

The personnel with ISP have been active since the late 1970's, and have worked across most areas of the United States. At last count, they had a working, "hands-on" experience with over 120 different crops, and probably ten times that many specific varieties. As mentioned, every year we perform field trials looking at new varieties, how they grow, and whether there is a genetic characteristic that requires special attention.



So whether you grow row crops such as corn, beans, cotton or sorghum; grains or forage crops; sugar beets; hops, hemp or cannabis; any of the berries; most of the fruit crops; and most all of the vegetable crops ... ISP has the experience.

Plus we're adding new crops every season as our ornamental and turf business grows.



ISP Technologies ... Exceptional Products for Exceptional Growers