

A close-up photograph of an almond branch against a clear blue sky. In the foreground, a large, white almond flower is in full bloom, showing its five petals and numerous yellow stamens. To the right of the flower, a dark brown, textured almond nut is attached to the branch. The background is a solid, bright blue sky. The overall composition is clean and focused on the natural elements of the almond tree.

ACRES^{USA}

HEALTHY SOIL PROBLEM SOLVING 2022

12 PROBLEMS | 12 SOLUTIONS



HSS RETURNS
IN PERSON!
(with a farm tour)

HEALTHY SOIL SUMMIT

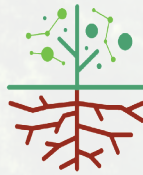
SACRAMENTO, CALIF. | **AUG. 2-3, 2022**

AN ESSENTIAL EVENT FOR RANCHERS, GROWERS & FARMERS WHO
ARE IMPROVING THEIR **SOIL HEALTH MANAGEMENT SYSTEMS**

Our two days of workshops will help you:

- **discover** various soil management systems that all build resilience;
- **connect the dots** between carbon sequestration and water storage;
 - **balance** your soil chemistry and biology;
 - **measure** mineral deficiencies and excesses;
- **learn** tactics like cover cropping, intercropping and livestock integration;
 - **and more!**

HEALTHY
SOIL
SUMMIT



ACRES USA
The Voice of Eco-Agriculture

Soil.AcresUSA.com

1-970-392-4464

2022 HEALTHY SOIL PROBLEM SOLVING

This 4th annual booklet connects readers with eco-agriculture services and products. You can find it inside Acres U.S.A. magazine, at the Healthy Soil Summit, and beyond.

4 FUNDAMENTALS

How balanced biology, chemistry, soil structure, air, and water work together.

7 SOLUTIONS TO

Page 7: Water Retention

Page 9: Soil Microbiome

Page 11: Unbalanced Chemistry

Page 13: Nitrogen Efficiency

Page 15: Soil Biology

Page 19: Nutrient Pollution

Page 21: Organic Compliance

Page 23: Soil Degradation

Page 25: Soil Input Timing

Page 27: Soil Health

Page 29: Stress

Page 31: Capital Funding

SPONSORS:

Sea-90 Ocean Minerals | AlgaEnergy | Advancing Eco Agriculture | Pacific Gro | Tainio Biologicals, Inc. | Live Earth Products | Apical Crop Science | Nature Safe Fertilizer | Corigin | Grower's Secret | PhycoTerra | Biome Makers | Regenerative Food System Investments | Ward Laboratories, Inc.

CONTACT INFORMATION

General Information: info@acresusa.com
Advertising: advertising@acresusa.com
Learn more at www.AcresUSA.com



ACRES^{USA}

Acres U.S.A. (ISSN 1076-4968) is published monthly by Acres U.S.A., P.O. Box 1690, Greeley, Colorado 80632-1690 (mail); 603 8th St., Greeley, Colorado 80631 (freight); phone 800-355-5313. Periodicals Postage Paid at Greeley, Colorado and additional mailing offices. POSTMASTER: Send change of address notices to Acres U.S.A., Attn: Circulation Department, P.O. Box 1690, Greeley, CO 80632-1690.

© Copyright 2022, Acres U.S.A.

Acres U.S.A. is a registered trademark of Questor Regen Co. Reproduction of material in this issue in any form without permission of the publisher is prohibited. No permission required for photocopies made for personal use. Requests for permission to reprint must be in writing to Acres U.S.A., P.O. Box 1690, Greeley, Colorado 80632-1690; email info@acresusa.com.

Acres U.S.A. advertisements are accepted on the premise that denial of the right to sell is also the denial of the right to buy. We do not imply that any product or service is of merit under all circumstances and we have no way to evaluate products. Users must make their own judgments and fit eco-products to their own systems of management.

The Fundamentals of Healthy Soil

BY NEAL KINSEY



SOILS ARE PUT TOGETHER IN PLATES. Some soils are colloid or sub-angular. They have a prism shape or one best described as long triangular. In any case, it all boils down to plates, one sitting atop the other. The ideal soil in terms of a textbook example is 45% minerals, 5% humus, and 50% pore space, of which half is occupied by water and the other half by air. The question poses itself: how do we get the minerals to be 45 to 47%, and specifically how do we get the correct amount of air and water into soil if it does not already have it? The answer is less complicated than the question. In fact, when you get the mineral balance in its correct equilibrium, you will have achieved the right mix of air and water in the soil.

The chemistry of the minerals also affects the physical structure of a soil. Therefore, the only way to deal with the textbook mandate is to first correct the

biology and minerals. If the mineral component is imbalanced, it is never possible to achieve and correctly maintain the right amount of air and water. The mineral component, in turn, depends on base saturation percentages and the soil's humus level.

This complex determines how much air and water space a soil will permit. When a soil audit reveals a correct mineral balance and at least a minimal humus content, any air and water problem will be minimized.

Obviously, poor soil structure means too little space in the soil. Heavy equipment compacts the soil by restricting the amount of space between soil particles. Either air or water has to give way. To construct the proper environment for plant roots and soil microorganisms, minerals in the right amount in effect govern the physical structure. Good soil structure which has 25%

air, 25% water and 50% minerals and humus, in essence is based on mineral building blocks.

There are several ways to influence soil structure favorably. One of those ways is to use manures, composts, mulches, biological stimulants, or anything that encourages microbial activity in a soil and/or supplies their needs for survival. Deep tillage — rippers, plows, chisels — all can create a temporary effect by breaking up hardpan and plowpan barriers, but this physical approach should not be seriously considered as a long-term solution without first correcting key nutrient levels. A third way is to use deep-rooted plants such as sweet clover or alfalfa. It is also possible to use a soil conditioner. And finally, soil structure can be influenced by proper fertilization of the soil, namely supplying nutrients in the right amount as determined by soil tests.

Our objective is to remove compaction so that roots can not only grow in the topsoil, but also penetrate subsoil layers as deep as required to pick up water and any available nutrients. In a non-productive soil, roots simply cannot get through any of several barriers. The best ripper in the world will not cause hardpans to melt away unless a correct mineral balance has been constructed first. A proper mineral balance, therefore, is the precursor to lasting success, whatever the hands-on approach.

For an ideal soil, humus would be a big key. Also, humus is the big key to water holding capacity as well as fertilizer holding capacity in terms of the amount that is in the soil. But to help illustrate the value of humus, the soil's capacity for water retention is proportionally relative to the humus content. Soils with relatively high amounts of humate material show better resistance to droughts and produce better yields where rainfall or irrigation may be lacking. A soil with a good humus content, say 4 to 5%, can hold more

than double the amount of moisture the 1.5 to 2% humus soil can hold. We live with a 0.5 to 1.5 inch rainfall reservoir in our area because most of our soils are below 2.5% humus. Below 2.5% humus, nutrient elements leach out because it is easier to lose nutrients from a soil with low humus. Also, microbiologists point out that a soil with 2.5% or less humus keeps microbes on a starvation diet.

Most people think they would like to have high humus in the soil, but William A. Albrecht's work in this area revealed that even humus cannot completely annihilate all the problems. With soils that are high in humus always expect copper deficiency problems. Peat and muck-type soils generally mean production problems because of copper deficiency.

The term humus is not used on most soil audits, but there is the designation, organic matter percent. Humus and organic matter are often used interchangeably. **Humus is made up of decomposed residues that have been completely broken down in the soil by microorganisms.** The organic matter or humus terms notwithstanding, when talking about a long-term reservoir for nitrogen, phosphorous, sulfur, boron and zinc, I am not talking about undecomposed residues. This is referring to the humus (that is, completely decomposed organic residues) — without it, the reservoir function wouldn't happen.

Why does humus hold nitrogen, phosphorus, sulfur and boron while clay does not? Because humus is "stronger" than clay. If you could take a handful of clay in one hand and a handful of humus in the other hand, and measure the nutrients, humus has three times the nutrient holding ability of the clay.

Organic matter contributes to soil productivity in many ways. It improves the physical structure of the soil. It increases water infiltration. It improves tilth, decreases erosion, and supplies plant nutrients.

Originally published in Hands-On Agronomy.

PACIFIC GRO

Seafood for the Soil®

Builds Humus and Healthy Soil

... and grows gorgeous produce

Pacific Gro provides chitin, amino nitrogen and plant-available calcium.

Chitin and fish oil promote beneficial fungi and a healthier crop.

Used in many crops at large scale, organic and also complementing conventional inputs.

Applied by drip, pivot irrigation, in-row planting, and also foliar spray.

Growers usually notice more vigorous foliage and other benefits well before harvest.



Organic strawberries grown in Oregon

Table grapes grown in central valley, California



Pacific Gro

503-867-4849

www.pacificgro.com



PROBLEM: WATER RETENTION

Solution by PACIFIC GRO | WWW.PACIFICGRO.COM or (503) 867-4849



How does water retention affect soil health?

Microbes and plants need water to grow. Water retention is highly correlated with soil organic matter and a higher fungal-to-bacterial ratio, indicators of healthy soil that better supports the crop. The U.S. Department of Agriculture estimates that each 1% of organic matter in the top 6 inches of soil can hold 27,000 gallons of water per acre.

How can I tell if I have a water retention issue?

Obvious signs are: frequent wilting, and fields that pond instead of absorb water. Good soil tilth, with aggregates and sponginess, indicates good water holding capacity. This also provides for aerobic conditions and transfer of air (oxygen, nitrogen and carbon dioxide). Roots will penetrate deeper into the soil profile, which increases access to water and nutrients.

When do I know I've solved this problem?

If soil organic matter is increasing, you're on the right path. Soil will have a spongier texture. Increased water holding capacity can be observed with moisture probes from Sentek, which will show roots drawing water at a deeper level and that water is available in the root zone for longer. Plants will show less signs of water stress. Soil probes will sink deeper with less effort.

What's the first step I should take?

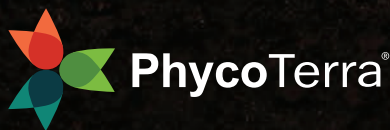
Increase the humus and fungal content. Adding biomass (cover crops, mulch, compost) can produce humus, which is stable SOM, when it's digested to grow fungal hyphae. Bacterial decomposition of plant matter produces nutrients but not much humus. Fungi play an essential role balancing the soil system. To shift the soil to favor fungi, stop damaging the fungi that are present (reduce tillage, don't use fungicide) and apply microbial products including beneficial fungi together with fungal food. Fish oil is an excellent fungal food.



WAKE UP YOUR SLEEPING GIANT

Around 75% of microbes found in soil are dormant.

PhycoTerra® is a superior soil microbial food sourced from nature and powered by microalgal technology. It improves your field and crop yield by feeding and waking up the native microbes in your soil, improving soil structure, nutrient availability, and water productivity – all important for healthy soil and healthy profits.



LEARN MORE AT PHYCOTERRA.COM

PROBLEM: SOIL MICROBIOME

Solution by PHYCOTERRA | WWW.PHYCOTERRA.COM



How do soil microbiomes affect my farm?

Growers who understand the impact of a healthy and active soil microbiome reap sustainable benefits in crop production.

Microbiomes are communities of organisms living in soil. A teaspoon of soil has roughly 1 billion microbes ranging in bacteria, archaea, protists, viruses, and fungi. Beneficial bacteria and fungi are essential for plant health as they consume carbon, and in the process, create nitrogen for crops to utilize.

About 75% of soil microbes are dormant or inactive due to starvation. When dormant, they don't support a thriving, healthy community within the soil, contributing to soil degradation and potentially less yield. But there is a way to wake up the dormant microbes to create an active microbiome.

When microbes are fed a nutrient-rich, balanced meal, microbes provide a long list of benefits to farms. A healthy soil microbiome supports crops through abiotic stress, like drought, wind and water erosion, and extreme temperatures. It improves soil structure and texture, impacting less runoff and leaching. And it creates a better environment for the crop to reach its full yield potential.

Waking up microbes puts them to work, improving your soil health and quality to optimize the potential yield on your farm.

What's the first step I should take?

To begin improving soil health on your farm today, incorporate practices such as reducing tillage or moving to a no-till system. Next, learn about your soil microbiome with a Certified Crop Adviser (CCA) to assess the biology and health of your soil. Working with a CCA can help determine the right solution for your soil, like Phycoterra®. Invest in a carbon-rich, superior microbial food to wake up and feed the soil microbes.



Sea-90[®]

OCEAN MINERALS

HEALTHIER SOIL, NATURALLY OCEAN-POWERED

Complete mineral and trace element support rejuvenates and supercharges soil and improves the nutrient-density of plants, pastures, and produce!



Supercharge your soil by multiplying and balancing your nutrient profile with Sea-90 Soil Mineralizer +. Increase organic matter and CEC levels for your best harvest ever. Plus, apply in the Fall for a head start on next season!



Enhance the nutrient density of your crops, pasture, and produce with Sea-90 Foliar Mineralizer. Micronized to dissolve instantly for quick and efficient field application. Excellent growing season option for when fertilizer was reduced at planting!

**RESTORE NATURE'S MINERAL BALANCE
AND ENJOY REDUCED FERTILIZER COSTS
AND INCREASED FARM PRODUCTIVITY!**

LEARN MORE AT Sea-90.com

OR CALL (770) 361-6092



For Organic Use

PROBLEM: UNBALANCED CHEMISTRY

Solution by SEA-90 OCEAN MINERALS | SEA-90.com or (770) 361-6092

How does unbalanced chemistry affect soil health?

Soil chemistry and health is directly related to mineral and trace element balance and availability. When an imbalance occurs, excesses of one element can become toxic to microbial populations, block uptake of other elements, and negatively impact soil porosity, humus, and organic matter. When soil chemistry is in balance, all elements known to be essential for plant and microbial health are present and available. Science has identified 17 elements as essential but current research suggests over 60 minerals and trace elements may be necessary for balanced soil health.

How can I tell if I have a unbalanced chemistry issue?

Unbalanced soil chemistry can be easily determined through visual inspection. Poorly drained, compacted soil with minimal humus and organic matter is representative of unbalanced soil chemistry. Additional signs include excessive weed growth, accumulation of soil born pests, plant pathogens, and slow plant growth and production. Conducting a soil pH test can also help confirm if soil chemistry is unbalanced. Soil pH is considered a master variable as it affects many chemical processes, including nutrient availability. A more complete understanding of soil chemistry can be gained through tests of specific element availability and ratios (ex; nitrogen, phosphorus, potassium, magnesium, and calcium), EC (electro conductivity), and CEC (cation exchange capacity).

When do I know I've solved this problem?

The most obvious sign that soil chemistry has been corrected is superior crop/pasture health and productivity. A reduction in pest, disease, and weed pressure will also be apparent through visual inspection. The return of earthworms (represented by the presence of worm castings on the soil surface) and beneficial insects will also be observed. The soil will become more porous and standing water will disappear. Lastly, re-testing pH levels, element levels, and factors like EC and CEC and comparing vs. prior results should provide confirmation that soil chemistry has returned to balance.

What's the first step I should take?

If unbalanced soil chemistry is confirmed, test results will inform optimal solution(s). For low pH results (below 5.5, indicating acidic soil), broadcast and till lime into the soil. For high pH results (above 7, indicating alkaline soil), broadcast elemental sulfur and/or composted manure/organic matter, and till into the soil. In addition to adjusting pH, it is important to restore micronutrients and microbial populations by incorporating minerals and trace elements in the form of ocean minerals, humic/fulvic acids, and compost tea, or liquid microbials. To build soil humus and organic matter, a program of complex crop rotations or rotational mob grazing is recommended. All techniques should be coupled with a planned reduction of agro-chemicals.



Looking for a different
approach to nitrogen?

Use AEA's Nitrogen Efficiency
Program to get more out of
your expensive nitrogen inputs.

Increasing input costs and availability are top of mind this year. Growers using **AEA's Nitrogen Efficiency Program** are reducing their nitrogen usage, saving money and reducing their dependency.



Scan to learn more

Advancing Eco Agriculture

(800) 495-6603 • www.advancingecoag.com

PROBLEM: NITROGEN EFFICIENCY

Solution by Advancing Eco Agriculture | WWW.ADVANCINGECOAG.COM or (800) 495-6603



What are the **4Rs** of Nitrogen?

Right Form

Protein nitrogen is the most efficient source of nitrogen. Compost, plant-based fermented amino acid products, fish hydrolysates, and corn steep liquor are examples of protein nitrogen.

Urea comes in second. Much less plant energy and water is required to convert urea into complete plant proteins than other synthetic forms. Urea is relatively gentle on soil microbes.

Ammonium is the third most efficient form of N as dry ammonium sulfate and UAN 28% or 32%. Where there is an excess of soluble ammonium beyond what a crop can immediately use, add molybdenum and humic substances to extend plant N availability and buffer negative results to soil biology.

Nitrate is the fastest to absorb but the least efficient N for crops to metabolize. Plants use a significant amount of their energy to convert nitrate into amino acids and proteins, so it is crucial to maximize nitrogen efficiency practices.

Right Rate & Right Time Run Together

Don't apply more nitrogen than soils and plants can use before it is volatilized, compounded, or washed away. Excess N is highly undesirable for seedlings or senescing plants. Apply nitrogen during the most demanding vegetative growth phases.

Right Place

The right place for nitrogen is in the crop itself. While soil applications are convenient, it may make little sense to apply all needed nitrogen to the soil. Typical side-dressing, streaming, or drip-line fertigation placement at the root zone supplies N during the greatest time of need.

The best temporary home for soil-applied nitrogen is in living microbial biomass. Diverse populations of microbes can mop up excess nitrogen, preventing atmospheric loss, and store it for release to roots later. Nitrogen compounding products can help with slow and steady release of early applications.

What's the first step I should take?

To start, take Haney soil tests to assess current nitrogen availability. Continually build nitrogen capacity with biology and cover crops, and use humic substances, carbohydrates, and micronutrient additives with applied nitrogen to support optimal efficiency.

When do I know I've solved this problem?

Nitrogen efficiency success looks like a balance sheet that shows reduced amounts of inputs, while maintaining quality yield with less insect and disease pressure.



Healthy Crops Start With Soil Biology



TAINIO
BIOLOGICALS, INC.



Biological Inoculums | Foliar Fertilizers | Enzyme Support
Cellulose Digestion | Bioremediation | Custom Formulations

Natural Growing Through Biology™

www.tainio.com

PROBLEM: SOIL BIOLOGY

Solution by Tainio Biologicals, Inc. | WWW.TAINIO.COM



How does soil biology affect soil health?

Soil and soil health can be measured in many ways, but to a farmer, the most important aspect of a soil's health is how well it supports and maintains crops. Soil biology plays a critical role in the various plant nutrition cycles — carbon, water, nitrogen, phosphorus, and more. Aggregate formation and soil structure are created through digestion and deposition of carbon that has been fixed by a plant and been processed/digested by microorganisms. As we increase organic matter, we increase moisture-holding capacity and gas exchange, which are critical to soil nutrient processing.

How can I tell if I have a soil biology problem?

Depending upon the approach of the farmer, biological issues can be evaluated in many ways. Understanding that soil biology is the primary means of supplying nutrients to the plant, allows us to directly correlate some excesses and deficiencies with soil biology, or lack thereof. Issues like soil crusting, poor structure and water cycling, buildup of field debris, and others can all be traced back to soil biology.

When do I know I've solved this problem?

We are often asked, “If I’m feeding the biology and using good farming practices, why do I need to regularly reinoculate my fields?” The answer is generally that farming does not happen in a vacuum. The diversity of soil biology is impacted greatly by environmental factors such as drought, freezes, floods, etc. The very nature of farming itself disturbs the soil and utilizes its resources, thus disrupting the balance of the microbial communities within the soil environment. Just as you wouldn’t take probiotics one time and consider your gut health “fixed,” soil inoculation should not be considered a one-and-done solution. It is a long-term farming practice that, if done properly, will result in long-term benefits.

What’s the first step I should take?

The first step to solving pretty much every problem is understanding and knowledge. At Tainio Biologicals, our motto has always been “test don’t guess.” By continually monitoring our crops and soils, we can better understand the cause of any issues, so that we can improve upon our previous successes (or failures). It is also critically important to develop an understanding of how current practices can affect soil biology, and how to incorporate good biological practices into your current growing program.

Get your free BeCrop Advisor Certification and become a leading expert in **soil health.**

By becoming a certified BCA, you can use the power of soil biology to match the right solution to some of the most pressing challenges in agriculture.



Farmers

Have a reliable way to know and work with their soils' natural biological functions.



Advisors

Have a diagnostic tool to make recommendations based on the existing biological pathways in soils.



Retailers

Have a comprehensive report to demonstrate the performance of inputs on soil biology over time.

With the BeCrop® Report, you will be able to assess biological soil health based on microbiome insights on:

- Management Sustainability Rating
- Early disease risk detection
- Input Performance
- Nutrient Cycling

Benefits of Becoming a BCA:

- ✓ Optimizing input costs
- ✓ Free soil health education
- ✓ Science-based recommendations
- ✓ Sustainable management verification
- ✓ Proprietary tools
- ✓ Connecting to local farmers

Secure Your Free Certification Today and Join the BCA Community!



Now offering CEUs!

By completing the course and passing the exam with a 70% or higher, you will receive your BCA Certification.



Agriculture's Missing Puzzle Piece

BeCrop® connects soil needs to inputs and illuminates the path towards regenerating soils.

“BeCrop® Test has a disease component to their report which shows potential pathways for pathogens. It's almost like if you've had a genetic test as a human and you find out through your family history that you're predisposed to some kind of condition. If you know that predisposition, you can manage it. Biome Makers gives that ability to know before you grow.”

Matt Rasmussen,
Farm Manager at Rasmussen Farms, NE

Your soil test says you have a reservoir of nutrients, but your crops are not responding. Here's Why.

We sat down with 5th generation corn and soybean farmer, Matt Rasmussen, from Fremont, Nebraska. Last year, he completed a chemical soil test and a plant tissue test, **but the results did not match up.**

He took tissue samples every week from the beginning to the mature stages of plant growth. He was not seeing responses from the crops based on the nutritional elements that were identified in the chemical soil test. He wanted to determine why the crops were not receiving the K and Mg that tested high in the soil. He saw a **big gap in soil digestion and nutrient uptake.** He searched for ways to **improve his fields before the growing season and discovered the BeCrop® Test.**

Matt completed BeCrop® Test to **identify nutrient pathway improvements, understand his disease risks, and predict the effectiveness of fertilizer practices.**



+33 Bushels per acre



+1.5 lbs

Test weight in corn



Reduced Input Costs

BeCrop® Test provided a full digestion and nutrient availability report and recommended switching to biological input practices to unlock his nutrient potential like inoculants and plant growth promoters to supplement plant nutrient uptake. The results shined a huge light on how **important it is to manage the livestock of the soil biology for the farm to thrive.**



Grower's Secret
Innovative Organic Solutions™

Steeped in Science

Third-Party Tested

**Amino Acids for Organic
Crop Production**

Scan here to read our white paper on Amino Acids,
written by Dr. Wesley Chun



Call us to talk about your unique farming needs

(888) 467-4769

www.growerssecret.com

PROBLEM: NUTRIENT POLLUTION

Written by Chief Science Officer DR. WES CHUN | WWW.GROWERSECRET.COM



What is nutrient pollution?

Nutrient pollution occurs when excess water-soluble chemical fertilizers reach lakes and oceans due to leaching and run-off events. It is estimated that up to 50% of applied fertilizers are normally lost from fields. This causes **eutrophication**, the situation where excessive nutrients in a lake or other body of water causes dense growth of plant life and death of aquatic animal life from lack of oxygen.

How can we reduce eutrophication?

There are two major ways to manage nutrient losses from the field. The first is good management practices (precision agriculture, sediment ponds, erosion management) of chemical fertilizers. The second is to use organic or regenerative farm management practices such as organic fertilizers, increasing soil organic content, and increasing soil microbial levels. Organic farming practices can lead to better water and nutrient holding capacity.

Why is less organic N needed than synthetic N for a crop?

Nitrogen in the form of amino acids is used more efficiently by plants than nitrates and ammonium. The organic N that is in our GSN is supplied as amino acids. Amino acids are quickly taken up by plant roots and leaves. They are immediately used for making enzymes and proteins. Any excess amino acids not taken up by the plant are used by microbes, which in turn release amino acids when they die. Lastly, the plant uses less energy to manufacture enzymes and proteins from amino acids compared to synthetic nitrogen in the form of ammonium and nitrate.

Do organic fertilizers cost more?

Many organic fertilizers deliver more bang for the buck. If you look at the cost of applying an organic fertilizer vs. a synthetic fertilizer, the difference is small, especially today where current events have drastically raised the cost of synthetic nitrogen. Organic nitrogen does not suffer from leaching and run-off compared to synthetic nitrogen. Certain organic nitrogen fertilizers such as amino acid fertilizers are more efficiently used by plants. For these two reasons, less organic nitrogen is needed by plants than nitrogen supplied by synthetic fertilizers.



Feed the soil natural, nutrient-rich fertilizer



Making good growing better

Nature Safe Organic Fertilizers feed the soil with highly concentrated nutrition derived from feed grade animal and plant proteins.

- ✓ Application flexibility at planting and during growing season
- ✓ Nutrient release curves support plant and soil needs
- ✓ Use alone or to enhance your current fertilizer program
- ✓ Safety and quality tested
- ✓ Increase yield, quality and ROI

Visit naturesafe.com to view our full line of Ag and Turf products.

Liquid, Dry Flowable and Pelleted Formulations

Manufacturing and Distribution Plants in Central CA, NE, KY

A Brand of Darling Ingredients, the Global Leader in Sustainable, Feed Ingredients

For More Information, Call 800-743-7413



LGMA Compliant Products
Available on Request

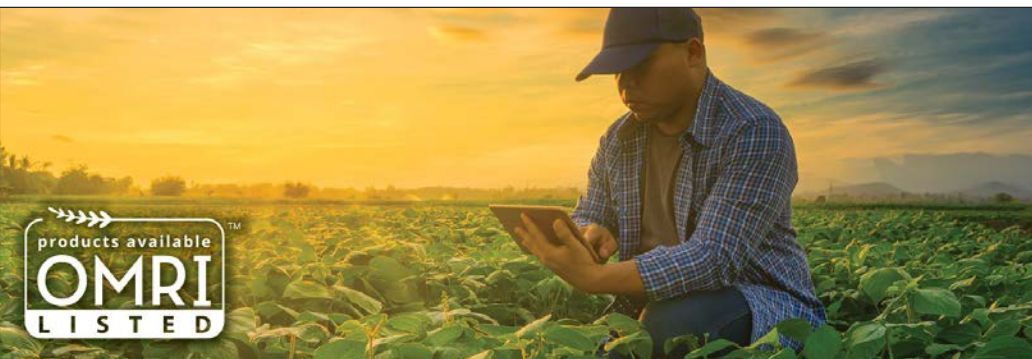


NUTRIENTS

DARLING
INGREDIENTS

PROBLEM: ORGANIC COMPLIANCE

Solution by NATURE SAFE FERTILIZERS | WWW.NATURESAFE.COM or jmiller@naturesafe.com



What is OMRI?

The Organic Materials Review Institute began in 1997 to ensure quality, chemical-free products are used in organic agriculture and that external inputs for organic farms are following the USDA's National Organic Program standards. The USDA requires a third-party assessment for producers to be certified organic. However, OMRI doesn't participate in certification. It only assesses the inputs (fertilizers and feed) that qualify producers to be certified.

Why tested quality inputs are needed and who is impacted by it?

OMRI validates organic inputs as dictated by USDA's NOP program, the Canadian Organic Regime, and the Mexican Organic Products Law. The animal- and plant-based products in Nature Safe Fertilizers are sustainably sourced from our parent company, Darling Ingredients established in 1882. Extensive control measures ensure product safety and quality of each ingredient as well as Nature Safe's line of organic fertilizers.

How do I know products are compliant?

As an organic producer, OMRI listed products help organic certifiers effectively reconcile a grower's inputs, ensuring NOP compliance for the property and related crops produced. The peace-of-mind afforded to growers making their purchasing decisions for fertilizer, seed, and other related inputs is enhanced significantly by OMRI's due diligence in guaranteeing that the USDA's organic guidelines are met.

How does OMRI's application and review process work?

OMRI clearly defines the process of getting on their list. First, a company must order an application kit that includes OMRI's Resources and Policy Manuals. From there, once the company creates an account, it can apply to have a product listed, as well as renew products that are already listed. Once the review process starts, applicants are required to pay a company fee based on gross sales, as well as some smaller fees for each product and category (defines various input groups). The review and approval process generally takes several months. A critical factor to minimizing review times is ensuring all paperwork is submitted properly and that fees are paid as outlined.

ALGAENERGY

Delivering the soil solutions
you've been searching for

Discover the benefits of our solutions
for your crops and let AlgaEnergy help you
do your part to give back to the soil

Increase
nutrient
content

Enhance the
biodiversity of
the soil
microbiome

Stimulates
rhizospheric
growth and
activity



Want to know more
about our products?



PROBLEM: SOIL DEGRADATION

Solution by ALGAENERGY | ALGAENERGY-INTL.COM/NA or info@algaenergy-intl.com



How is soil degradation an issue?

Soil is the foundation of the food chain; it hosts more than 25% of all biodiversity on the planet while supporting humanity. This vulnerable layer is expected to feed and provide potable drinking water to a global population of 10 billion by 2050. Currently, a third of the world's soil has degraded — increasing carbon emissions and threatening global food supplies. With rates of soil erosion increasing, humanity faces an unprecedented crisis.

How can I tell if I have a soil degradation problem?

You will notice plants losing vitality, lesser yields, smaller crop size, plants succumbing to stressors, and an increase in weed species and pests. Additionally, soil color, composition, and permeability will deteriorate.



When do I know I've solved this problem?

Healthy soil is crumbly — you will notice increased organic matter and better moisture retention, but it can still drain effectively. Plant quality will improve, increasing the quantity of crops harvested, and produce better quality fruits and veggies that hold more moisture, are bigger in size, taste better, and have improved nutrient properties — from vitamins to proteins to antioxidants.

What's the first step I should take?

Do your research! Find innovative and sustainable solutions that assist environmental recovery from the ground up. Solutions like ours are based on the unique properties of microalgae and backed by high-quality scientific studies that demonstrate how natural products help regenerate degraded soils, leading to better crop efficiency and happier plants. Growers worldwide have partnered with us and reported an average yield increase of 7.6% on various crops, including legumes, fruits, grasses, and more.

Apical Crop Science

The New Paradigm of Crop Nutrition

Apical Crop Science LLC is an agricultural technology company that provides farmers with critical resources to achieve exceptional crop performance in organic and regenerative agriculture systems.

Our innovative process of optimizing soil and plant health delivers customized solutions that help growers improve the health of soils, farms, and consumers.

Learn to implement regenerative and organic cropping systems with success and consistency by using our innovative laboratory methods, online data portal, and cutting edge crop inputs.

Precision
Laboratory Analysis

Regenerative
Agronomy

Organic Crop Inputs


Know more.

www.apical-ag.com • 503-479-8407

PROBLEM: SOIL INPUT TIMING

Solution by APICAL | WWW.APICAL-AG.COM or (503) 479-8407



How does soil input timing affect soil health?

If the proper type, amount, placement, and timing of crop inputs are applied, the plant-soil system usually functions in a way that achieves grower goals. If inputs are applied in excess of the plant's desired uptake, soil microbiology may be harmed. If inputs are supplied below the plant's desired uptake, soil depletion may occur, resulting in declining plant health and yield.

How can I tell if I have a soil input timing issue?

Plants have nutrient requirements that change throughout their lifecycles. If your plants display visual symptoms at a specific growth stage, your input timing may be a factor. Some possible symptoms include insects, disease, pests, weeds, and diminished or weak growth. Plants can naturally develop solutions to these problems when they have access to proper nutrition at critical moments of growth.

When do I know I've solved this problem?

A properly designed corrective nutritional action should provide quantitative and qualitative plant response within 7 to 14 days. Spectral imaging for plant stress or precision laboratory analysis of the plant/soil environment may show the grower quantitative improvement. The qualitative response may include increased plant vigor, decreased susceptibility to disease or insects, and overall progress toward grower goals.

What's the first step I should take?

Performing soil, plant, and water analysis can provide insight into optimizing plant nutrition and reveal which nutrients should be applied at which time and in what amounts. From that analysis, growers should be able to perform corrective action in the form of nutritional applications to the soil, plant, and water supply, or all 3.

The applications may be applied directly to the soil, through the irrigation system, or to the plant's foliage. By receiving needed elements at the proper lifecycle stage, plants are better able to withstand the stresses of growing in a given environment. Removing those stresses creates health in the plant, manifesting higher productivity and better plant health.

A close-up photograph of a person's hands planting a small green seedling into dark, rich soil. The person is wearing a brown jacket and dark shoes. The background is a blurred field of crops under a warm, golden sunset sky. The overall mood is one of care and growth.

Live Earth[®]

PRODUCTS

BRINGING VITALITY TO LIFE

GIVE VITALITY TO YOUR SOIL WITH
PREMIUM HUMIC AND FULVIC ACIDS

ORDER ONLINE AT LIVEARTH.COM

OR CALL 435.286.2222

PROBLEM: SOIL HEALTH

Solution by LIVE EARTH PRODUCTS | WWW.LIVEEARTH.COM



How do humates and humic acid applications improve soil health?

Soil health starts with organic matter. All soil organic matter contains some stable carbon in the form of humic or fulvic acids. Adding more of these organic acids can improve soil conditions that may adversely affect plant growth and yield. For example, humates and humic acid can facilitate soil colloid formation, which enhances a soil's ability to absorb hold water and nutrients. Better soil structure will also impact microbial activity and oxygen in the rhizosphere around the plant roots.

How can I tell if I am getting the most out of my crop?

Adding stable carbon, like humate, has shown positive changes to soil conditions and the retention of nutrients in crops. Humic acids are not used by a plant but are instead used as storage space for inputs like water and nutrients. To get the most out of the genetic potential and subsequent yield of a potential crop, some consideration should be put into soil health.

How do I know I've solved the problem?

Improving soil organic matter takes time. The USDA NRCS Soil Health guidelines suggest that as part of a soil health management plan, a farmer can improve soil organic matter in three to 10 years. Adding humate along with cover cropping and tillage management will help shorten the time it takes to build stable organic matter in your soil.

What's the first step I should take?

Applying granular humates or liquid humic acid is best used with your normal soil fertility. Because granular humates contain organic acids that are insoluble, like humin, farmers will typically apply humates where they can be incorporated into the soil. Other farmers find that adding humates with manure or fertilizer is another easy way to get them out without added labor. For those farmers wanting to apply liquid humic acid, consider mixing with compost teas or applying with irrigation water.

corigin



**See the difference?
Add Coriphol to your toolkit!
Corigin Solutions, LLC.**

corigin.co | (949) 677-6230

PROBLEM: STRESS

Solution by CORIGIN SOLUTIONS, LLC. | WWW.CORIGIN.CO



Problem: Stress

Can it get any more stressful being a farmer? Unlikely. Farmers have very little water, if any at all. Fertilizer prices are out of control, if any can be found. Export channels are significantly constrained. And finally, crop waste burning is no longer allowed.

Farmer stress and crop stress are perfectly correlated. Stress-free crops mean higher marketable yields and revenue, and lower stress on the farmer. Conversely, insufficient water, nutrient imbalances, pathogens, pests, heat and cold all stress crops, revenue and farmers.

Farmers and their advisors implement programs to minimize stress and maximize yields and then watch for any signs of stress. It's imperfect. A gamble. And here's the rub: when stress is observed, it's too late. The damage is done. By then the plant has shifted its energy from primary metabolism (growth mode) to secondary metabolism (survival mode). Secondary metabolites comprise the plant's natural defense arsenal. Phenols are well documented in published science as powerful antioxidants, antipathogenic, pest repellents, and growth stimulants. It takes energy to produce them, at the expense of crop growth.

Solution: Regenerative inputs refined from crop waste

Crop residues, like almond shells, are a viable source of phenols and other biomolecules that can be used to mitigate crop stress in advance.

Corigin bio-refines almond shells into Coriphol™, an organic liquid plant growth enhancer comprised of light molecular weight phenols and other biomolecules. The singular ingredient is almond shells — nothing more, nothing less. Applied with other crop nutrients, Coriphol has delivered double-digit paid yield increases, higher sugar production, increased nutrient uptake even at significantly reduced nitrogen loads — like half!

Corigin also produced a high-quality biochar for soil amendment applications, marketed as Corichar™. Biochar is well documented to increase soil moisture holding capacity, nutrient retention, support beneficial microbes, and sequester carbon in soils for centuries.

REGENERATIVE
FOOD SYSTEMS
INVESTMENT

**Catalyzing Connection & Capital
for Resilient Food Systems**



Explore how we can help you connect with the information and organizations that can finance and support your work in regenerative agriculture.

www.RFSI-Forum.com

For more information contact info@rfsi-forum.com

PROBLEM: CAPITAL FUNDING

Solution by REGENERATIVE FOOD SYSTEM INVESTMENTS | WWW.RFSI-FORUM.COM



Can soil health practices lead to greater profitability?

There is a misconception that adopting regenerative soil health practices necessarily leads to lower yields and therefore is not profitable. That, however, is an oversimplification and there is an increasing body of research showing that regenerative practices that build soil health can lead to higher profitability than those in conventional systems. A system that focuses on regeneration of soil can lead to lower input costs; the ability to grow higher value crops and access new markets and premiums; and as an additional benefit, increased resilience, reducing risks associated with volatile weather.

What are the financial barriers to adoption of soil health practices?

Despite the potential for greater profitability, the financial costs of transitioning to new practices can serve as a barrier to adoption, as can the potential for a loss in profitability during the transition from regenerative to conventional practices (which can be two to four years).

How is finance innovating to solve this?

A new crop of investors and funders is emerging. They seek more than just capital returns and want to build solutions for farmers, the environment, and the climate. As a result, there is increased innovation in designing new financial vehicles that address the barriers to regenerative adoption – including financial risk, capital expense, technical assistance, and new markets. These new vehicles, from organizations like Mad Agriculture, Steward, and Mission Driven Finance, are offering new forms of grant, debt, and equity funding that will help de-risk transition.

What's the first step I should take?

We aren't here to give investment advice, but we can encourage you to educate yourself about the funding opportunities that are available – both traditional and emerging. If you're seeking funding for your operation, it is helpful to first understand the different types of funding – grant, debt, equity, and blended capital – and how each might fit your specific needs. Then you can start to learn about what entities offer the funding you are looking for.

SOIL HEALTH ASSESSMENT

**DELIVERING THE
DATA YOU NEED
TO MEASURE
SOIL HEALTH**

The Soil Health Assessment (SHA)
goes beyond other soil tests
and measures the biological, chemical,
and physical properties of your soil.

What you get:

- Complete test results report, including your soil's unique health score
- Cover crop and nutrient recommendations
- Available nutrients, microbial activity and aggregate stability measurements



**How healthy
is your soil?**

WARD
Laboratories, Inc.