

Improve Your Post-Harvest Fertilization Program Results with Modern Biological Applications

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PREPARED BY ACRES U.S.A., THE VOICE OF ECO-AGRICULTURE



PACIFIC GRO

Seafood for the Soil™



SYNOPSIS: The time after we harvest our fruit trees, row crops or vegetables is often when soil is most disturbed, due to the use of heavy machinery, or in the case of root crops, due to large-scale physical soil disturbance. In recent decades, convention has taught us to use a defensive approach with our field management, including spraying herbicides and tilling heavily. In this white paper, we explore proven ways farmers inside the industry are rebuilding soil health after harvest to ensure:

- there is no net loss of vital nutrients for next year's crop;
- micronutrients are available in the right balance;
- weeds are not allowed to dominate;
- yield potential expands for fruits, vegetables and nuts; and
- your system is building yields and soil health congruently.

Moving to a more modern regenerative strategy first requires shifting to a more proactive, preventative approach. Farmers know at harvest that any type of annual crop or plant is carrying massive loads of minerals and sugars that require an abundance of energy to convert and store. At harvest, when the crop is removed from the field, we are starting the cycle all over again. Regenerative agriculturists are using these new post-harvest fertilization techniques to stimulate microbial communities during fertilization and create a healthy environment for whatever comes next.

Post harvest, it is also critical to manage residues leftover from harvesting broad-acre annual crops or fruit waste, which, when properly managed and treated, can lead to a recycling of nutrients into the soil. This could happen through shallow tilling, livestock grazing and waste management, composting, or advanced no-till methods.

Generally speaking, most farmers are not maximizing the potential of post-harvest applications, especially conventional farmers using post-harvest RoundUp or soluble nitrogen as their primary product for post-harvest. Regenerative and biological farmers have already proven that stimulating healthy nutrients to feed plants and soils is positive for their bottom lines.

Any type of boom-and-bust cycle is not good for farmers' cash flows and the long-term business sustainability. An abundant harvest in an orchard one year shouldn't lead to a sub-par harvest the next year, but that's often the way of thinking and the reality in conventional farming due to long-standing practices that strip energy from the soils. New, modern regenerative and biological tactics are emerging that show both the obvious ecological benefits, but also the economic benefits from a change in strategy.

The tactics are rooted in science and common sense. "A plant needs a tremendous amount of energy as it breaks dormancy. We should be building that plant up as much as we can so it comes out swinging strong next season," says August York, agronomist and owner of Intuit Ag Consulting, LLC, based in California. "Farmers need to give it more momentum so it goes into next year at a faster pace."

Farmers, including those who are growing perennials like many in California, are inundated with decisions to make all day around harvest, which can lead to paralysis by analysis, York says. He likes to remind farmers, whether you grow corn, soybeans or walnuts, of a saying he heard

from his father, a fruit tree farmer: "Don't let the perfect be the enemy of the good."

Regenerative farming, often called biological farming, is a systems approach, a nontoxic set of practices that can reduce erosion, reduce disease and insect pressure, alter weed pressure and produce high-yielding crops. A complete biological farming program accomplishes these feats by feeding the soil and managing for a diverse and dynamic microbial community. With this system, you never really reach your destination — your goal is to continue to move a positive direction down the soil health spectrum.

"Farmers aren't in control; nature is. If you're not working with nature, you're working against it, and you can't win the battle," says Jim Ladlie, founder and president of ProfitProAg. Ladlie holds a PhD in Crop Science and has been in the agriculture industry more than 30 years.

When soils are fed well after harvest, the growth emerges sooner and more vigorously the next spring, leading to a robust start to the season, he said. For pasture or perennial managers, any type of grower who fertilizes with products that feed the microbes, soils and plants remain strong throughout the winter, proven by field studies by Rodale Institute, Ohio State

University and the U.S. Department of Agriculture. Conversely, synthetic formulas are often focused on prevention, and therefore use more energy from the soil, leading to moving a negative direction down the soil health spectrum.

“Many synthetic fertilizers are byproducts of other industries and include things that are toxic to certain bacteria in plants, so the plants have to use excess energy to convert these forms of nutrients into forms they can use,” says Trent Graybill, an agronomist in Washington whose company, Soilcraft, helps growers and farmers grow regeneratively across all cropping systems. “Our passion is to see healthy people, so the way we’re going to accomplish that is to teach people about the ‘why.’”

FEED MICROBES TO MAKE IT WORK

If you want to increase soil health and productivity, and lower production costs, you need a program that will feed the microbes, which drives the nutrient digestion and conversion process.

“The problem with industrial agriculture is that 99 percent of how crops are raised are based on the theory that we are in control; that we can determine the input that we think determines the output,” Ladlie says. “The industry doesn’t want you to have healthy soils because then you’re not spending all this money to combat it. It just gets worse and worse, because nature becomes resistant to these insecticides and herbicides, so they come out with stronger ones, and the farmer becomes a drug addict.”

When Graybill works with farmers to transition to a more regenerative and biological approach to combat

issues they’re having on the farm, he tries to help them understand why they have the issues they do, which almost always comes back to how they’re treating the soil.

“Do they understand the biological component? We’ll show them that when you use this conventional product or type of fertilizer, here’s what happens and these are the types of results that you’re getting, and you’re potentially causing some of these problems with your management. Then it’s an automatic switch of the conversation to soil health, plant health, organics and biology.”

SOIL HEALTH GOAL IS BALANCE

Feeding the soils to strike the necessary, healthy nutritional structure that leads to successful regenerative farming is all about balance. Do you have too much nutrition or not enough?

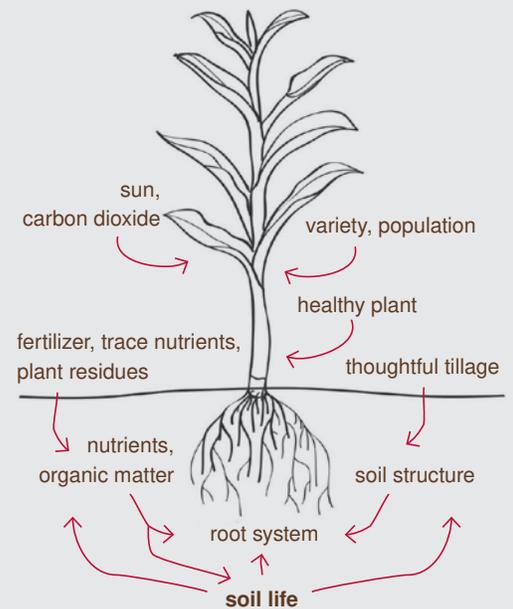
“Balance and ratios are more important than total numbers,” said Brad Forkner, owner of Nutrient Management Specialists, an Illinois-based soil structure and nutrient manager. In other words, it’s not about more is always better. Hardly is that the case in nature. And just because an element exists in nature doesn’t mean it is available to be used by the plant. Instead, we have to figure out how to ensure the system can move the nutrient from the soil to inside the roots, or from the atmosphere to inside the leaf.

You have to understand the mechanisms that can transverse a root or leaf structure, Forkner said. You have to understand the whole system.

“Think about a cake. Do you want me to send you the eggs on Monday, then sugar on Tuesday, flour on Wednesday and chocolate on Thursday? Or, did you want

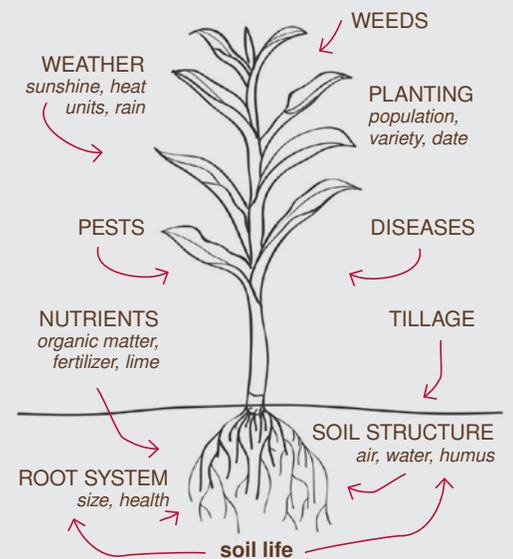
WHAT DOES IT TAKE TO GROW A GOOD CROP?

More than just fertilizer!



Note in this chart how nutrient uptake in the plant changes with each cycle in a corn plant. Do you know what nutrients your crops are pulling from the soil and when they will want them most available? (from The Biological Farmer, Acres U.S.A., 2018)

WHAT AFFECTS A CROP?



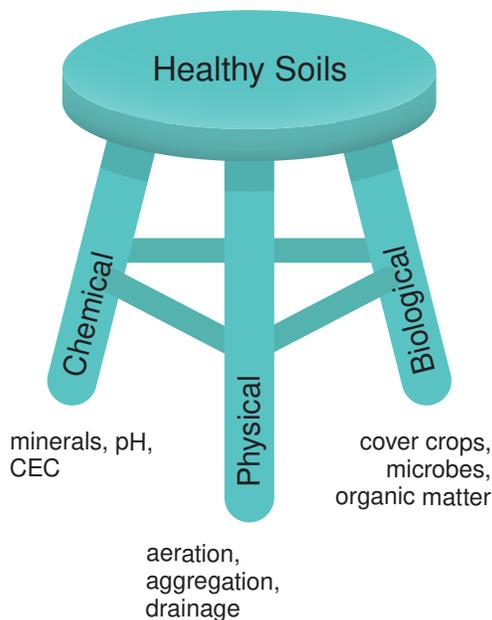
Note the different variables in this chart. Post-harvest fertilization is just one part of the overall system. (from The Biological Farmer, Acres U.S.A., 2018)





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THREE-LEGGED STOOL



Another way to look at soil health. The goal is to balance the chemistry, the physical properties and the biology together, like a three-legged stool. (from The Biological Farmer, Acres U.S.A., 2018)

the cake? If everything isn't there at the same time, then we don't get the end product.”

Some of the best measurements of crop health are strong, consistent yields and low pest and disease pressure. This indicates strong plant nutrition and health, as well as ecosystem health, York says.

Energy is produced by plants through photosynthesis — the more a plant can trap sunlight and produce glucose, the more energy it has. The digestion process, however, is driven by microbes.

Profit Pro put together a program where it applies microbes with a stimulant, along with Pacific Gro fertilizer, which adds nutrients, nitrogen, oils and protein that stimulate the fungi, aiding in the digestion of the plant post-harvest.

“It's key if you want to increase soil health and productivity, and lower production costs, a product like Pacific Gro is a food source for the microbes,” Ladlie says. “It's all about building soil health.”

In photosynthesis, about one-third of the energy and sugars a plant creates are sent down into the ground, feeding microbes and delivering nutrients to plants. When a fruit tree drops its leaves or vine, it's not photosynthesizing anymore so the energy stops. If you fertilize with something that feeds the microbes, the microbes will continue to grow, remaining strong and vigorous long into the winter.

Without proper crop residue management, however, vital nutrients that could be feeding future crops go to waste. This is true of both perennials and annuals — whether the plant is

still there and living, or you're trying to decompose everything you can to get ready for the next crop — the more you decompose, the more energy and nutrition you'll provide for the soil.

“You want that residue broken down by microbes and pulled back down into the soil through carbon sequestration,” Ladlie says. “The best way to get carbon retained on the land is to sequester it by digestion with microbes. The other part of it is you retain more carbon, energy and nutrients on the land by bringing that carbon base down into the soil — there are a lot of nutrients tied up in that residue that can interfere with planting and herbicide applications.”

GROW FUNGAL AND BACTERIAL ACTIVITY

When growers are trying to get plant and root residues to break down, everything needs to be biologically active, Forkner says. Products like Pacific Grow, which uses seafood byproducts that balance fungus with bacteria, are essential in that process. It also takes the right amount of water and oxygen available in the soil.

“You've got the minerals, biology and food sources in there, then we get an explosion of fungal growth, and then we start breaking things down faster,” Forkner says. “If we can keep corn healthy, for example, and take a fairly mature ear off and there's some green left in the plant, we can use those natural sugars to help feed the biology under the soil.”

The problem with today's agriculture

is that soil life and biodiversity has been severely compromised. It limits the ability to retain moisture and nutrients, and as a result leads to low energy, low nutritionally-dense fruit, nuts and vegetables, Ladlie says. But they can be grown back and restored.

“You spend all this money on herbicides and fungicides, to try to control the pests that are there to try to balance the system — it’s a circle to nowhere,” he says. Microbes drive everything in life, even in the human body. Our gut health contributes to clarity, energy and longevity, and it’s all driven by what we eat and put into our mouths.

“Eat natural vegetables and fruits, no processed foods — you’d be surprised what it’ll do to you,” Ladlie says.

MANAGE NUTRIENT EXCESSES AND DEFICIENCIES

An excess of some nutrients can be as limiting as deficiencies of others.

“Most of agriculture’s limiting factors, as far as nutrition goes, come from the excesses we put in the crop rather than deficiencies,” York says. “Addressing the excesses in crops is the best way to balance that plant to perform at its optimum level.”

Practicing farmers like York agree that getting out of the N-P-K conversation,

BALANCE:
Chemical - Physical - Biological

Out of Balance

In Balance

<u>SYMPTOMS</u>	<u>RESULTS</u>
<p><i>Soil harder, compacted</i></p> <p><i>Soil doesn't dry out, muddy.</i></p> <p><i>Small root systems.</i></p> <p><i>Crops can't tolerate drought.</i></p> <p><i>Plant not healthy; cannot provide health to livestock.</i></p> <p><i>Weed and pest problems.</i></p> <p><i>More chemicals & fertilizers required.</i></p> <p><i>Bigger tractors, more horsepower need to farm.</i></p> <p><i>Less profit.</i></p>	<p><i>Soil easier to work.</i></p> <p><i>Improved crop quality.</i></p> <p><i>More efficient use of fertilizers.</i></p> <p><i>More profit (the bottom line:) lower inputs, few weed and insect problems.</i></p>

Your system should be addressing these major points that affect a crop health. (from The Biological Farmer, Acres U.S.A., 2018)

and into a conversation a balanced supply of a whole lot of nutrients, is one of the first steps. When working with specific crops or a specific grower or orchard manager, there’s always something that’s needed more than others.

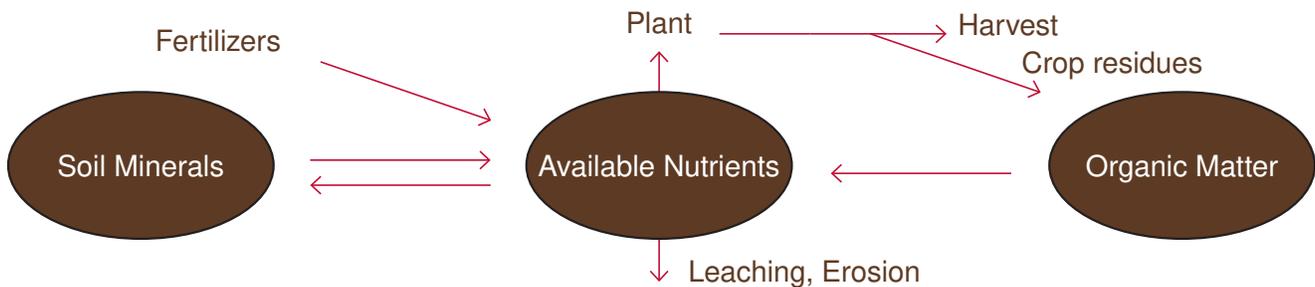
Stimulating the microbiology will feed plants and soil a diverse range of nutrients, which provide for better balance within the ecosystem. The more nutrient density that exists, the less risk for pest and disease problems, which leads to more consistent and stable yields.

“We’re trying to move farms and farmers from this mindset that anything else out there growing that isn’t the plant you put in the ground is harming the plant you want to grow. I’m not suggesting that all plants are helping you, but done in the right way, nature is far more cooperative in its evolutionary design or biblical design than it is competitive.”

COVER CROP TO HOLD & RESTORE NUTRIENTS

Cover crops essentially help you capture energy into the system during the dormant months, and are becoming more common in orchards and row crop farms.

Why? If the currency in soil is carbon, and the cash-flow is sunlight, so as farmers you want to capture as much cash flow potential throughout the year, York says.



Balanced soil, once you are moving positively on the spectrum, should generate real benefits to your soil health, crop quality and business. (from The Biological Farmer, Acres U.S.A., 2018)



PACIFIC GRO



Seafood for the Soil[®]

Liquid Salmon, Shrimp and Crab with Fast-Acting Calcium and Shell Metabolites from the Ocean.

Proven on thousands of acres of orchards and berries as a foliar, soil treatment and a delicious defender of a healthy soil food web.

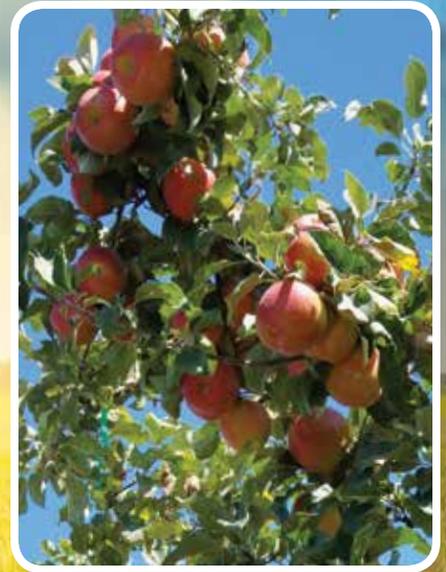
Pacific Gro Oceanic Hydrolysate 2-1-0.3 serves fish oil, amino acids, calcium and shell particles, for diverse soil biology and vigorous plants.

Post-Harvest Fertilization

After the produce is harvested, any plant intended to survive winter will bring in stores for next year. This protects against freeze damage and sets the table for another big yield. Before you take a break after harvest, your trees, bushes and soil will appreciate a good feeding.

Dealer inquiries welcome!

**Please visit us at
Acres USA - Booth #510**



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There are steps growers can take toward implementing cover crops, building upon the products, principles and practices that help capture energy into the system during the dormant months.

“Cover crops are a really important and foundational piece, in my mind, of regenerative agriculture,” York says. “You want to photosynthesize at the highest level possible throughout as much of the year as possible.”

In commercial agriculture, photosynthesis is pumping carbon into the soil for about three to five months out of the year. The rest of the year, the bare ground is losing carbon and other nutrients, becoming bankrupt in its flow of cash and energy into the system.

“Cover crops help you bridge that gap, like a bridge loan, so you can capture more energy into the system and keep that flywheel moving as fast as possible,” York says, “so when your crops do break dormancy or when you’re planting into that cover crop, you have high level of soluble carbon in the system. ... There’s a really strong case to be made that cover crops are going to be a foundational piece of 21st Century agriculture.”

It’s also essential that a new cover crop doesn’t compete with the residue from the harvested crop. Everything in the

ecosystem must promote diversity in the biology of the soil.

“Every piece of that cover crop has to have a purpose,” Forkner says. “Why is it in there?”

CUSTOMIZE TO YOUR OPERATION AND GOALS

When it comes to soil health, there’s no one-size-fits-all program. Custom solutions are needed across the board, says David Knaus, an Oregon Agronomist and CEO of Apical Crop Science.

“Plant and soil analysis is crucial,” he says. “We spend probably 70% of our time dealing with plant excesses. Once that’s done, we focus on what the plant needs. The excesses are what kills plants and makes them perform not up to capabilities. Plants in nature generally grow pretty healthy without a lot of influence.”

Apical solves all kinds of farm problems, the biggest of which are related to management. You have to develop custom solutions to address everything from changes in soil type, crop variety, mineral

balancing and fruit-crop techniques.

“Growers don’t always understand the depth and level of management it takes to get exceptional crops,” Knaus said. “If they’re not really aggressive continually, they’ll encounter ups and downs.”

If a crop’s limiting factor is below the surface, you can put water and food sources on it all day long, but that’s not what it needs, Forkner says.

“We need the most limiting factor — that’s where this whole soil health becomes a lot more intricate than throwing some extra plants out there for some roots,” he says.

This white paper was written in collaboration between Acres U.S.A. and Pacific Gro. The accuracy of the information herein has been verified and checked. It’s sole intent is to inform growers of all types of the advancing techniques used to grow healthy food and crops for consumers. Contact info@acresusa.com to learn more about this service. To learn more about Pacific Gro, [click here](#).

CORN NUTRIENT UPTAKE PER DAY BY GROWTH PERIOD

Nutrient uptake per day by growth period in corn				
Growth stage	Days after seeding	Pounds of uptake per acre per day		
		N	P	K
4 leaf	21	0.03	0.0006	0.04
9 leaf	34	1.14	0.1	1.4
Shoulder high	49	6.5	0.7	8.3
Tassel	71	3.8	0.7	4.0
Late silk	79	2.4	0.2	-1.1
Blister	93	0.2	0.4	-0.3
Dent	113	3.1	0.1	3.8

Nutrients are always moving in the soil based on what you are growing, the seasons and more. (from The Biological Farmer, Acres U.S.A., 2018)



THE CHANGING CONVENTIONS IN MODERN AGRICULTURE

Growers can make the switch to biological farming with the knowledge and tools to do so, but success is dependent upon switching their way of thinking. You can't switch to biological methods without thinking preventatively or nutritionally, soil consultant Trent Graybill says.

The thought of loading up the tractor again post-harvest is foreign to many conventional farmers. It's counter to traditional thinking and education, but it's time many farmers question this conventional wisdom.

Will your children and grandchildren have land fit to farm? Are you proud of the way you farm? Do you feel good about what you do?

Are expensive chemicals, weeds and pests, sick animals and poisoned water really worth it? Wouldn't you rather have good soil, healthy crops and animals, and freedom from worry about poisons?

"Sometimes growers want different results, but when you start to provide that framework for why they should change what they're doing, they get frustrated or even offended," says Graybill. "We're excited because there are a lot of growers, especially younger generation growers, who see some of the fallacies in what the former generation practiced.

Let's say you have an insect or a pathogen — conventional wisdom comes up with the drug or the Band-Aid to take it out, but it doesn't answer the questions, 'Why is this problem occurring? Where does it come from?'"

The traditional paradigm based on the model of competition instead of cooperation seems to be moving out, which August York, agronomist and owner of Intuit Ag Consulting, LLC, based in California, feels excited about.

"Regenerative agriculture is based on cooperation between nature, farm and farmer, and conventional ag, as practiced, is based on competition between farm, farmer and nature," he says.

	CONVENTIONAL	BIOLOGICAL
BASIC OUTLOOK	Control nature, maximize yield and profit. Short-term view.	Work within a natural system. Increase soil health and plant quality. Long-term view.
SOIL	Supports plant; supplies about a dozen elements.	A complex system; physical, chemical and biological factors.
FERTILIZERS	Synthetic, soluble salts, emphasis on N-P-K and pH.	Natural or low-salt, some available and some slow-release.
CROPS	Often monoculture. Grown for market and yield.	Soil-nudging rotations. Grown for quality.
WEEDS	Chemical control.	Manage soluble nutrients, mechanical control or spot herbicides; smoother crops.
PESTS/DISEASES	Chemical control, resistant varieties.	Natural control by good health, natural enemies and rotations.
ANIMALS	Antibiotics. Push for production.	Probiotics. High production from quality feed, good health.
ECONOMICS	High inputs. Moderate profitability.	Low inputs. High profitability.
ENVIRONMENT	Chemical pollution, degraded soil with high erosion.	Little pollution. Good soil with low erosion.

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