

# How to Use Regenerative Farming Principles to Grow Healthier Food in Your Own Garden

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## STORY AT-A-GLANCE

- › The challenge facing most farmers today is that conventional agriculture has decimated the topsoil with tilling and synthetic fertilizers, which disrupt and destroy the microbial life necessary to grow nutrient-dense food
- › Few agricultural areas have a deficiency in phosphorus and most farmers do not need to apply this synthetic fertilizer
- › A significant amount of the phosphorus applied ends up running off. Only minute amounts actually go into the plants the year it's applied. The rest leaches into the watershed and feed algae blooms
- › Mycorrhizal fungi grow in healthy soils and are responsible for nutrient transfers between plants and soil biology. The most critical thing in a plant's life is its relationship with mycorrhizal fungi, which is why tillage and synthetic chemicals should be avoided
- › The five basic principles for building a healthy soil ecosystem are: not disturbing the soil microbiome, protecting the soil surface with cover crops, diversification, maintaining living roots in the ground as long as possible and integrating livestock and insects

***Editor's Note: This article is a reprint. It was originally published November 19, 2017.***

Gabe Brown is a pioneer in regenerative land management, which helps restore soil health. I had the opportunity to visit his farm in Bismarck, North Dakota, in 2017. Brown

travels widely to teach people how to build soil, without which you cannot grow nutrient-dense food.

The challenge facing most farmers today is that conventional agriculture has really decimated the topsoil with tilling and the use of **synthetic fertilizers**, both of which disrupt and destroy microbial life. Maria Helena Semedo of the Food and Agriculture Organization of the United Nations has warned that at the current rate of topsoil degradation, all the world's topsoil will be gone in less than 60 years.<sup>1</sup>

Brown's farm was founded by his in-laws in 1956. They farmed it conventionally, using tillage, synthetic fertilizers, pesticides and other chemicals until 1991, when Brown and his wife purchased the farm. Brown continued farming conventionally until 1993, when a good friend and no-till farmer convinced him to make that transition. Two years later, in 1995, he began diversifying his crops.

*"There's approximately 32,000 tons of atmospheric nitrogen above every acre," Brown says. "All we have to do as producers is to plant legumes and inoculate it with the rhizobia, and it'll take that nitrogen and convert it. In other words, make it available to the plant. I started growing peas, some clovers and alfalfa in order to do that.*

*We still had 1,200 acres of spring wheat in '95. The day before I was going to start combining, I lost 100% of that crop to hail. I had no insurance, because it just didn't hail here very often. Well, that was pretty devastating. 1996 came along and I started planting corn. I started planting species like triticale and vetch and trying to diversify the rotation a little bit. Unfortunately, we lost 100% of our crop to hail again. That was two years in a row."*

## **The Silver Lining**

While devastating, two seasons of crop residue left on the ground had a remarkably beneficial effect. He began noticing more earthworms. The soil felt moister. In 1991, the soil on the farm could only infiltrate a half-inch of rainfall per hour. In other words, if it

rained 1 inch, half of it ran off. Organic matter levels were only about 1.8%. Historically speaking, soil scientists tell us the organic matter in healthy soil should be in the 7% to 8% range.

What this meant was that three-quarters of the carbon in the soil had been lost due to improper farming methods. When 1997 brought a major drought, again, for the third time in a row, he was unable to harvest any cash crops.

He still needed feed for his livestock, though, so he began planting cowpeas and Sorghum-Sudangrass, which he let the livestock graze on. He simply couldn't afford hay. The following year, 1998, 80% of his crops were again lost to hail, for the fourth year in a row.

*"It was hell to go through, but I tell people it was the best thing that could have happened to me, because that got me moved down the path of regenerative agriculture," Brown says. "Due to the changes we saw on the soil, we started growing more cover crops. Back then, I just thought of it as livestock feed. But we realized that we truly can grow topsoil.*

*Those same soils that back in '91 were 1.7% to 1.9% organic matter today are in the 5.5% to 7% range. Infiltration rates, where I used to only infiltrate a half of an inch per hour, we can now infiltrate an inch in nine seconds, and the second inch in 16 seconds. We're in a 15-inch moisture environment here in Bismarck, North Dakota. Whatever moisture falls, it's going to be able to infiltrate and be used.*

*It's been a learning process over the past 20 years. How do healthy ecosystems function? We've really studied that and learned that it's all these components together. We're at the place now in our operation where we no longer use any synthetic fertilizers. We don't use pesticides. We don't use any fungicides. We do occasionally, in certain circumstances, use an herbicide, but it's very selective.*

*It's never while the crop is growing. It's always before it's growing. We do not use glyphosate. It's only in a select situation because I refuse to till, because*

*tillage is so detrimental to the mycorrhiza, fungi and soil biology.*

*Now, we're at the point where we have a healthy functioning soil ecosystem. It's able to provide the nutrients that those plants need. In turn then, it provides those nutrients, not only to the plants, but to the animals and, hopefully, to us as people."*

## **Synthetic Phosphorus Is Unnecessary**

Brown has been fortunate enough to be visited by many of the top scientists in the world. One of the important lessons he's learned from them is that very few agricultural areas have a deficiency in phosphorus. Farmers have for a long time been told they need to apply **phosphorus**, yet Rick Haney, with the Texas Agricultural Research Service (ARS), claims there's not a single peer-reviewed research paper demonstrating it has a positive effect on plants.

The current production model is based on yields. The entire farm program, and the payments farmers receive from the government are all based on yield. Revenue insurance is also obtained based on past yields. But yields have nothing to do with nutrition. Synthetic phosphorus may increase yield somewhat, but does nothing to improve the nutrient content of the food.

*"Big business, the chemical and fertilizer companies, tell [farmers], 'The only way to get this yield is with our improved stacked trait genetic hybrids, and then the fertilizer – that's needed; all these inputs, which is a total fallacy, because that's not how ecosystems function,'" Brown says.*

## **Phosphorus Runoff Causes Environmental Harm**

A significant amount of the phosphorus applied ends up running off. It's not incorporated into the plants. In fact, research shows only minute amounts actually go into the plants the year it's applied. The rest leaches through groundwater into the watershed, where it poses significant problems. While it may not feed the plants very

well, phosphorus and **nitrogen fertilizers** do feed algae in water, causing overgrowth that kills off other marine life.

*"It's causing the major catastrophe to our ecosystems. It's a large cost to the environment and small benefit to the producer," Brown says. "One of the things I try and teach and educate producers on is how to hold those nutrients on your land. That's where cover crops come into play.*

*You grow cover crops for a variety of reasons. One of them is to capture the nutrients that are there and hold them on your landscape. That's what's needed. The other thing those cover crops do is they convert that organic form of these nutrients into inorganic, and make it available to the plants via biology.*

*Cover crops are a win-win. We're taking CO<sub>2</sub> out of the atmosphere through photosynthesis. We're pumping out that carbon – liquid carbon, I'd like to call it – [into the soil] where it exudates into the soil to feed biology. It starts the whole nutrient cycling process."*

## **Five Principles to Growing Topsoil**

There are five basic principles to growing topsoil and building a healthy soil ecosystem:

- 1. Avoid disturbing the soil microbiome** with tillage, herbicides, pesticides and fungicides. The less mechanical disturbance the better. The same applies in your home garden.
- 2. Protect the soil's surface** with cover crops and cover crop residue. In your home garden, use mulch, wood chips or lawn clippings. You never want to leave soil bare, as bare soil will have a negative effect on soil biology and the water cycle. Cover crops and other forms of "soil armor," such as wood chips, effectively prevent water evaporation and lowers the soil temperature.

There is easily a 20-degree F difference or more between soil that is bare and soil that is covered. When air temperatures reach 90 degrees or so, soil temperatures

will rise well above 100 degrees, which will dry everything out and fry the plants' roots. "If you have good armor or residue on the soil surface, the temperature there can be in the 80-degree range. Those plants are growing. It's a huge difference in production for the producer," Brown says.

3. **Diversify** – Having a diverse array of plant life is essential, and cover crops fulfill this requirement as well. Home gardens will also benefit from cover crops, helping to improve the soil, attract beneficial insects and capture more sunlight (energy).
4. **Maintain living roots in the ground as long as possible** – In conventional farming, once a cash crop is harvested, there's nothing left in the field to capture sunlight and keep growing. Maintaining some kind of growth at all times is key. If you have a small vegetable garden, don't leave it bare once you've harvested your veggies. Plant a cover crop in anticipation for the next season.
5. **Integrate livestock and other animals, including insects** – Flowering plants that attract pollinators and predator insects will naturally help ward off pests that might otherwise decimate your main crop. "Here in the Northern Plains, obviously, hundreds of years ago, we had large herds of bison and elk moving across the landscape, being pushed by the wolves, the predators. We're mimicking that today with our livestock on our operation," Brown says.

"The [grass-finished beef](#), the grass-finished lambs, the pastured pork, the free-range hens, they're all moving across the landscape, mimicking what was done hundreds of years ago. In so doing, they're [not only] benefiting the resource, but they're benefiting the people who consume them as well, because it's a highly nutrient-dense product." In the playlist below, you'll find two videos showing how Gabe has integrated cows and chickens on his farm.

## The Importance of Prairie Strips

Gabe recommends all growers keep a pollinator strip or so-called prairie strip along their property, no matter how small. Prairie strips refers to small patches of land around the

edges of crop fields where native, perennial grasses and flowers are allowed to grow wild. Urban homeowners could simply plant some flowering plants on their property.

Not only will this nourish pollinators, research<sup>2</sup> confirms that adding native prairie strips to the rural landscape can actually help reduce water pollution from farm fields where synthetic chemicals are being used. The results show that converting as little as 10% of crop areas into prairie strips:<sup>3,4</sup>

- Reduces soil loss by 95%
- Reduces phosphorus runoff by 77% and lowers nitrogen loss through runoff by 70%
- Lowers nitrate concentrations in groundwater by 72%
- Improves water retention
- More than doubles the abundance of pollinators and birds

## **The Importance of Mycorrhizal Fungi**

Mycorrhizal fungi grow in healthy soils, where they serve several important functions. The fungus secretes a glue called glomalin – a sticky substance that starts the formation of soil particles and holds the soil together. Mycorrhizal fungi also transfer nutrients throughout the soil. It actually forms symbiotic relationships with the roots of multiple plants. The plants secrete exudates, which the mycorrhizal fungi take and distribute to feed the biology.

The fungi then take the nutrients produced by those soil microbes and transfer it back to the plants. Research by Dr. David Johnson at New Mexico State University shows the most critical thing in a plant's life is its relationship with mycorrhizal fungi. This is why tillage is so detrimental, as it destroys the mycorrhizal fungi and disrupts or inhibits this symbiotic relationship between plants and soil biology.

Synthetic chemicals also have a very destructive effect as they create massive pH changes in the soil that kill microbial life. To improve soil quality in your garden, you can actually buy mycorrhizal fungi spores. It's relatively inexpensive and they're very easy to

grow. They'll grow regardless, as long as you do not disturb the soil, but adding spores will help the fungi propagate faster.

## **How to Use Cover Crops in Your Garden**

So, you've harvested the veggies from your garden and planted a mixture of cover crops in their place in order to protect and nourish the soil. How do you make the transition back from cover crop to your chosen vegetables the following season? It might be tempting to till and turn those cover crops over into the soil, but this is the last thing you should do. You do need to terminate the cover crop somehow though. There are a number of different ways to do this. You could:

- Stomp the cover crop into the ground with your feet or a board (simply attach two rope handles to a 2x4 board and then use the board to step down the crop)
- If the cover crop has started to form seed heads, you can kill it off by rolling crop roller or small barrel over it
- Cut the growth down and leave the residue on top (although it works better if it's rolled or stepped down)

Once the cover crop has been killed off, you're ready to plant your vegetable seeds. For a small garden, Gabe recommends using a hoe to part the cover crop remains over to the side. Create a small slice in the soil, drop in your seeds and cover with a small amount of soil. If you're planting a transplant, simply move the cover crop aside, dig the hole and plant as normal.

## **Everyone Can Grow Their Own Food**

If you currently have a lot of lawn and ornamental plants, consider transitioning over to more edibles. When I moved into the house I live in now, the landscaping was 100% ornamental. It's probably 10% to 15% ornamentals now, which serve a purpose by attracting pollinators.

*"Homeowners should be producing their own food. Even if you just have a patio. It's amazing the amount of vegetables you can produce even in that setting," Gabe says. "Why not do that? I'm going to show you our small garden, which produces enough vegetables for four families for the entire year. It doesn't require a large area."*

Even college students living in a dormitory and those who rent can grow sunflower seed **sprouts** or microgreens, or participate in a community garden if there's one nearby. Growing your own food may seem daunting at first, but it's actually a really practical approach that creates a great deal of security. If you grow a large portion of the fresh food you eat, that's hard-earned dollars you won't have to spend at the grocery store. And you'll have better quality food.

*"In our household for instance, we have enough canned goods to easily last 18 months. I won't have to buy any vegetables for 18 months. It's there. It's either frozen or preserved through [Mason jar] canning," Gabe says.*

*"We've had visitors here from 21 foreign countries and all 50 states in the last five years. The No. 1 thing I hear from visitors from overseas is, 'I can't believe how poor the food is in the United States.' They say there's no flavor. What they really mean is there's no nutrient density.*

*They see that right away because many countries that I have visitors from, they're producing their own food in their own gardens. If you grow your own food, you will notice the difference in taste right away ...*

*Those five principles I've laid out work anywhere in the world where there's production agriculture, because I'm simply following a template that nature put forth. If you follow that template, you're going to succeed ... It all goes back to healthy functioning soil ecosystem. That's what we need. That's all about those principles. We can grow topsoil. In so doing, we can produce nutrient-dense food."*

## Sources and References

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- <sup>1</sup> Scientific American, December 5, 2014
- <sup>2, 3</sup> PNAS, October 2, 2017, 114 (42) 11247-11252
- <sup>4</sup> Iowa Public Radio, October 2, 2017