

Why Are Farmers Adding Rocks to Their Fields?

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✓ Fact Checked

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STORY AT-A-GLANCE

- › The pH of soil influences the growth and productivity of crops grown on the land. Soil pH regulates the availability of nutrients to the plant, so, even if the soil is fertile, unless the pH is appropriate, the plants cannot absorb the nutrients
- › Lab data show that adding crushed volcanic rock called basalt or olivine can help sequester carbon dioxide, balance the soil pH, and improve crop yield
- › Several startup companies have developed programs so farmers are not charged for the rock, delivery or spread across the land since large corporations purchase the rock for "carbon credits"
- › Crop productivity, soil health and protecting the environment are also functions of regenerative farming and livestock practices. To protect the environment and your health seek out foods from small farmers using regenerative agricultural practices

Would you add rock to your garden soil and expect a better harvest? That's exactly what farmers across the country are hoping to see this season.¹ Of course, there is a little more to the story than adding rocks to the soil and watching plants grow. It has to do with altering the pH of the soil.

Importance of Soil pH to Crop Productivity

The pH is a measurement of acidity. The measurement ranges from 0 to 14, where 7 is neutral. pH measurements less than 7 are acidic and those greater than 7 indicate a

base. Both acids and bases are corrosive and the greater the distance from neutral, the more corrosive the substance.

To put this in perspective,² blood has a pH of 7.4, and milk, urine and saliva have a pH that ranges from 6.3 to 6.6. More acidic compounds you might find in your home include grapefruit juice and tomato juice, which have a pH of 2.5 to 3.5, or battery acid and hydrochloric acid, which have a pH near zero. On the other side of the scale, baking soda has a pH of 9.5; bleach and oven cleaner have a pH of 13.5; and liquid drain cleaner has a pH of 14.

It turns out that soil pH also makes a difference in the growth and productivity of plants.³ Soil pH might not be the most exciting topic, but having a basic understanding can help improve your gardening efforts. When you consider garden soil, acidic soils generally have a pH that ranges from 4 to 6.5, while alkaline soils have measurements that range from 7.5 to 9.

While pH is not a nutrient, it does regulate the availability of soil nutrients to the plant. In other words, just because your soil is fertile doesn't mean the plants will be able to absorb the nutrients and thrive. Plants either prefer a soil pH that ranges from 7 to slightly alkaline or ranges from 7 to slightly acidic.

When the soil is too acidic, gardeners and farmers can apply lime to help raise the soil pH. And that's what farmers have been doing in areas of the country that commonly have acidic soil. According to a map from The Biota of North America Program republished in The Modern Farmer,⁴ acidic soils, or those with a pH less than 6, occur along the East Coast, through part of the Midwest and along the West Coast of Oregon, California and Washington.

The soil pH is referred to as the "master soil variable"⁵ since it influences a variety of factors important to plant growth. Soil pH is linked to the chemical environment, biology and geological factors.

Volcanic Basalt Rock May Help Balance Soil pH

A 2018 paper⁶ published in Nature Plants proposed that crop production and climate change could be positively influenced by adding crushed silicate rock to croplands. The paper theorized that crushed volcanic rock could lower the amount of CO₂ that enters the atmosphere and increase crop production and pest and disease protection, as well as restore fertility and structure to the soil.

Silicate is the most important mineral found in igneous rock, which crystallizes from volcanic magma.⁷ A 2023 paper⁸ used computer modeling to estimate the total carbon sequestration of enhanced rock weathering (ERW) on croplands. The researchers found that applying 10 tons of basalt dust per hectare (2.47 acres) could sequester 64 gigatons of CO₂ over 75 years.

When this was extrapolated to all agricultural land, the mathematical model suggests that ERW could sequester 217 gigatons over 75 years with a few caveats. There is a fraction of the basalt that does not weather, which indicates a need to optimize application and ERW payback in hot and humid environments is significantly shorter.

Application of ERW has been the focus of several startup companies in the past year after lab research demonstrated the potential to improve soil health and reduce carbon emissions.⁹ The process begins when slightly acidic rain contacts the volcanic rock and converts carbon dioxide to bicarbonate.¹⁰ The bicarbonate raises the soil pH and releases minerals into the soil.

Adding pulverized rock to the soil “turbocharges” this natural process, releasing minerals faster within several years, instead of over thousands of years.¹¹ One area where farmers are trying this is the Columbia Basin in Oregon.

Francisco Calderon, director of the Columbia Basin Agricultural Research Center, says that over the years the pH of the topsoil in the area has dropped to 5 and below.¹² Chris Rauch is one of those farmers. He grows dryland wheat in the area surrounding Pendleton, Oregon, along the Columbia Plateau that was formed by ancient basalt lava flows.

He first learned about the process during an annual agricultural show in Spokane and was initially doubtful of the process. However, when the latest pH soil results came in at 5.3, he reconsidered his decision.

Farmers Getting Help at No Charge

Not only was he doubtful of the process, but there was no charge to the farmers for the rock, the delivery or distribution across the land. It seemed too good to be true.

However, because enhanced rock weathering is a form of permanent sequestration or carbon dioxide removal, the startup companies supplying the basalt rock can sell “carbon credits” to large corporations.¹³

It's a win-win situation for the farmers and the corporations. Farmers receive soil amendments that they hope will help raise the soil pH and improve crop productivity at no charge, while large corporations can demonstrate they are taking some action against climate change.

Initially, Rauch was concerned that the amendment would negatively impact seeding and increase soil compaction. But he found that the basalt blended in as if it were delivered by the wind.

It isn't only areas where soil pH is naturally acidic that can benefit from ERW. Jesse Vollmar is an agricultural consultant who lives in Michigan, where the natural soil pH is between 6.5 and 7, but years of heavy fertilizer and tilling has taken its toll on the soil.

Vollmar began working with a small ERW startup company in Seattle and has helped other farmers in his area. He told Modern Farmer “It's just a no-brainer for farmers. The hardest part is keeping up with demand.”¹⁴

Farmers in Virginia have also applied basalt to the farmland. Rick Bennett grows several crops on his old tobacco farm that has been heavily farmed for the last two centuries. Bennett tested a plot that had particularly acidic soil by creating test strips to determine if there was a difference in crop production.

Bennett reports he doesn't see a great deal of difference in the plants. However, he's waiting until after harvest to evaluate the data on the number of soybean pods and the number of beans in the pods before he decides.

Olivine Can Do More With Less

While basalt is the most common volcanic rock, it's not the only one. Another is olivine, which is a greenish-colored stone with a higher capacity to capture carbon dioxide.¹⁵ Another startup company, EION, uses olivine along the Mississippi River Delta Region where the soil is acidic. According to the CEO and founder of EION, Adam Wolf, the area is an ideal model for managing land.

“They have an appreciation for the natural world,” says Wolf. “It’s not as reductionist as in places like California, where you see vast landscapes dominated by one crop.”¹⁶ As Modern Farmer notes,¹⁷ the high humidity and heat also increase the reaction speed, allowing olivine to capture more CO₂ with less rock.

Instead of spreading 9 to 10 tons of basalt across each acre of land, 2 to 3 tons of olivine is spread per acre. However, olivine cannot be sourced in the U.S., so it is imported from Norway. Once it reaches the Mississippi, it is milled and distributed. A consultant for EION, Dan Prevost, rents patches of low-quality acidic land near his home in Mississippi and helps rebuild the soil using lands nobody else wants.

While the process sounds easy and cost-effective, Civil Eats points out that it hasn't been widely studied. Phil Renforth is a professor of engineering geology at Cardiff University. He was not involved in the 2018 research paper, but spoke with a reporter from Civil Eats, saying:¹⁸

“While enhanced weathering could make an enormous contribution to climate change mitigation, it remains one of the most poorly understood methods of removing CO₂ from the atmosphere. As the authors suggest, we need to do a lot more work to establish if these large carbon drawdowns can be achieved, and to assess the positive and negative impacts of this approach.”

Vollmar and Prevost started their journey in regenerative farming and understand the vital importance of soil pH to crop productivity and health, as well as protecting the environment.

Regenerative Farming Helps Protect the Soil and Livestock

Regenerative agriculture and holistic livestock management is a method of organic and food farming that not only avoids pesticides, fertilizers, GMO seeds and excessive greenhouse gas emissions, but **regenerates soil fertility**, water retention, carbon sequestration and rural livelihoods.

Regeneration has become a hot topic in the natural and organic food sector while climate activists discuss the role of organic and regenerative practices to help reduce greenhouse gas emissions and sequester excess atmospheric carbon dioxide. One regenerative farm example is White Oak Pastures in Bluffton, Georgia.

Run by Will Harris, the farm produces **high-quality, grass fed products** and has been an inspirational example of how to convert from conventional to regenerative agriculture while thriving financially.

In November 2022,¹⁹ Harris spoke with Joe Rogan about the transition from conventional farming practices to regenerative techniques, some of the pitfalls of industrialized farming and how using regenerative techniques has helped to restore the land.

Unfortunately, the majority of meat sold in the U.S. still comes from CAFOs, not grass fed farms. To protect the environment and your health, as well as support animal welfare, seek out food from small farmers using regenerative agricultural practices.

One useful option is to look for the American Grassfed Association (AGA) logo on meat and dairy, which ensures the animals were born and raised on American family farms, fed only grass and forage from weaning until harvest, and raised on pasture without confinement to feedlots.²⁰

Get to know local farmers using regenerative methods near you. Regeneration International, incorporated in 2014, has built a global network of regenerative farmers and ranchers across 60 countries. You can find a [map of regenerative farms](#) to secure a source of sustainable food near you.

Sources and References

- ^{1, 4, 9, 12, 13, 14, 15, 16, 17} [Modern Farmer, September 25, 2023](#)
- ² [U.S. Geological Survey, June 19, 2019](#)
- ³ [The Spruce, December 9, 2021](#)
- ⁵ [Applied and Environmental Soil Science, 2019;5794869](#)
- ⁶ [Nature Plants, 2018; 4](#)
- ⁷ [Open Geology, 6 Ignaeous Rocks and Silicate Material](#)
- ⁸ [AGU, 2023; doi: 10.1029/2023EF003698](#)
- ^{10, 11, 18} [Civil Eats, April 6, 2018](#)
- ¹⁹ [The Joe Rogan Experience, November 4, 2022](#)
- ²⁰ [American Grassfed Association, Our Standards](#)