



GREENCOVER

Cover Crops 101

How you can start regenerating
your soil with cover crops



Keith Berns and Kate Smith



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your soil with cover crops

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Many of our customers who sent us photos of cover crops in use on their operations.

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*Helping people regenerate, steward and share
God's creation for future generations.*

A close-up photograph of several green corn leaves, showing their characteristic long, narrow shape and prominent veins. The leaves are layered, with some in sharp focus and others blurred in the background, creating a sense of depth. The lighting is natural, highlighting the vibrant green color of the foliage.

1.

Why Cover Crops?



Houston, we have a problem.

There's no doubt we've come a long way in agriculture in the last 75 years. Genetic improvements, integrated technology, and breakthrough research have all led to increased yields. However, in spite of these advances, American agriculture still faces many problems and obstacles—some old and some new. As producers of food, fiber and fuel, we must be aware of these problems in order to solve them.

Soil erosion

Driven by wind, water, and intensive monoculture farming, soil erosion annually removes about 1.7 billion tons of American farmland topsoil. That's an average of more than 5 tons per acre. This loss of nutrient-rich soil reduces crop yields by 30% or more in heavily eroded regions and causes many downstream problems. We see the devastating consequences in the massive gullies created after a single intense rain event. We see it in the brown-colored water running through our rivers. We see it in the massive dust storms, not unlike those of the Dust Bowl Era. The precious topsoil that humanity relies on for sustenance is flowing and blowing away at rates that cannot be sustained.

Poor water infiltration and water holding capacity

It does not matter how much rain falls on your land — it only matters how much moisture ends up in your soil. Far too many acres of American farmland have poor water infiltration often as a result of unprotected, compacted and poorly structured soils. Degraded soils can often have infiltration rates as low as half an inch per hour, which means that much of a moderate to heavy rainfall event will not be captured by the soil and utilized by the crops. Healthy and functioning soils can have infiltration rates 10X to 20X higher. Rarely is blessed precipitation lost or wasted on these lands. Dysfunctional soils also often have low carbon content, as measured by soil organic matter (SOM) levels, leading to much lower water holding capacity. This is critical to the agricultural water cycle because plants can only use the water that is infiltrated AND stored in the soil system. Each percent of soil organic matter can hold up to an acre inch (27,000 gallons) of water per foot, so increasing SOM will directly increase the soil's ability to store water, making the system much more resilient to drought conditions.





Herbicide resistant weeds

The modern era of herbicides began during World War II, with the development of 2,4-D which was introduced commercially in 1946. As one of the first selective herbicides, 2,4-D revolutionized weed control by targeting broadleaf weeds without harming grasses, significantly boosting agricultural productivity in the U.S. and beyond. Herbicides have been a tool for farmers ever since. However, when any tool is misused and overused, it loses its effectiveness and efficiency. Such is the case with many herbicides. As of September 2023, the International Survey of Herbicide Resistant Weeds reports 513 unique cases of herbicide-resistant weeds globally, involving 267 weed species across 72 countries. In the U.S., 165 unique cases of herbicide resistance have been documented among 92 weed species. The data highlights this growing challenge in U.S. agriculture, particularly in crops like soybeans and corn, where resistant weeds like Palmer amaranth and waterhemp are economically significant.

Pollution from fertilizers and chemicals

Fertilizers and chemicals from both agriculture and municipalities (lawns, parks, golf courses) contribute to pollution in the U.S. Nitrogen and phosphorus fertilizers are applied to 90% of U.S. cropland and civic green areas. This fertilizer-rich runoff causes nutrient pollution leading to algal blooms in 50% of United States waterways, including the Gulf of Mexico's 6,000-square-mile dead zone. Herbicides, when misused or overused, can contaminate groundwater and surface water. Nitrates are a major water supply contaminant. Runoff from fields, exacerbated by soil erosion, carries nitrates into groundwater and surface water. The USDA reports that 20% of U.S. wells in agricultural areas exceed the EPA's nitrate limit of 10 mg/L, affecting over 40 million Americans. In the Midwest, where corn and soybean farming dominates, nitrate levels in 30% of streams regularly exceed safe thresholds.



Loss of biodiversity

The farming systems of our grandparents and great grandparents were very diverse, with mixed farming operations including varied crops, livestock, and smaller-scale operations. Farms often integrated crop rotation, cover crops, and natural pest control—practices which supported greater plant and animal diversity. Pollinator populations, like bees, were healthier, soil biodiversity was richer, and monoculture was less prevalent. Today, U.S. agriculture is dominated by monocultures, with 90% of cropland focused on corn, soybeans, and wheat. Our reliance on monocultures has reduced native plant diversity, disrupting habitats for pollinators and soil microbes. Pollinator population declines and the loss of 75% of global crop genetic diversity together dramatically heighten risks to food security.

Rising input costs

Despite U.S. crop yields increasing significantly since 1950—corn yields, for example, rose from 38 bushels per acre to over 170 today—farmers face shrinking profit margins and rising debt. Intensive farming and heavily reliance on costly inputs like fertilizers and pesticides drives higher yields, but escalates expenses. Meanwhile, commodity prices remain volatile, often below production costs, thus squeezing margins. USDA data shows farm debt reached \$535 billion in 2023, up 30% from the previous decade, while net farm income dropped 15%. In 1950, input costs were lower and debt was 10% of today's levels. But farmers today find themselves facing a treadmill of high output and financial strain, resulting in reliance on loans and great risk of consolidation.

What's the Solution?



The answer is in systems that build soil health.

A systems approach to agriculture tackles the economic, agronomic and environmental challenges while sustaining profitable crop yields. By viewing farms holistically and linking soil function, profitability, and biological interactions together, farmers can increase the resilience of their operations. Many of the issues we face can be mitigated by leveraging the power of biology and following the examples that we see in the way God designed these ecosystems to work. By focusing on profit and not yield, farmers can begin to move away from the high-input treadmill. By growing more nutrient-dense crops and livestock, and by accessing markets that reward and incentivize these types of crops, we will see farmers win, consumers win, and the environment win all at the same time.

The **Six Principles of Soil Health** provide the framework needed to see the soil as a living ecosystem. Following these principles encourages and allows producers to implement the practices that will improve the health of the soil and the economy of the operation. These principles are derived from countless observations of how natural systems work. While they seem relatively simple and straightforward, they can be difficult to implement at first. Thankfully, cover crops can provide practical solutions for each principle, making cover crop utilization a great way to start implementing soil health principles.



Principle #1 **Context is the key**

Each farming operation is as unique as the hardworking men and women that pour themselves into it on a daily basis. The context principle emphasizes understanding the unique circumstances—ecological, economic, community, and spiritual—that shape farming decisions. Context connects humans with natural systems, recognizing factors like rainfall, soil types, local cultural norms (e.g., tillage practices), economic constraints (e.g., farm debt), and spiritual beliefs about stewardship. By applying context, farmers make informed, holistic decisions, which enhances soil health, resilience, and sustainability, and ensures the other five soil health principles have purpose and impact.



Principle #2 **Living plants and roots as often as possible**

Green plants build black soil! This pithy little saying has been emphasized by many of our friends in the soil health movement, and it has proven true time after time. Only a green plant can photosynthesize and produce energy-rich carbon compounds that not only grow the plant, but also feed the teeming microbial populations of a healthy soil. This biological component of the system is responsible for soil structure, nutrient cycling, disease protection and so many other services, but they only function when they are being fed by the plants. Cover crops are a critical part in keeping the system alive and thriving between periods of cash crops.



Take a deep dive into the economy of the soil with ***Carbonomics***, a soil health talk by our co-founder and co-owner Keith Berns.

greencover.com/carbonomics



Principle #3 **Keep the soil covered**

“Don’t farm naked” is a little slogan that our friends from Practical Farmers of Iowa have adopted. While the initial thought might draw a smirk or make you cringe a bit, the meaning is that the soil should never be left uncovered or “naked.” Maintaining ground cover, whether it is green and growing or brown and protecting, helps to armor the soil. This armoring effect drastically reduces wind and water erosion, protects the soil from extreme heat or cold, and provides a habitat for the biological community. The cover also provides carbon and other nutrients for the next generation of plants as they grow. As the name suggests, cover crops are designed to cover and protect the soil both while they are alive and growing, and after they are terminated.



Principle #4 **Optimize disturbances**

This principle is often referred to as Minimize Disturbances, meaning anything that disrupts the natural ecological function of the soil. Examples are tillage, commercial fertilizers, pesticides, monoculture cropping, burning, and intensive animal impact. All of these disturbances are tools that can be used within the proper context of an operation, and they’re sometimes necessary. However, by using these tools only when truly needed, you can improve your soil and thereby increase your profitability. Efficient optimization of these disturbances helps maintain the microbial communities that are so important to a healthy soil system. Properly integrating and utilizing cover crops can help mitigate much of the damage caused by using tools which disturb the soil.



Principle #5 **Maximize diversity**

Diversity builds resilience. This is true in the context of human communities, but is especially true in natural ecosystems. Consider how a native prairie can have over 500 species of plants, or how the coral reef in the ocean hosts more than 25% of all marine life species. It’s clear by studying these natural systems that they were designed with maximum diversity in mind. Monocultures of plants or biology are not natural. In fact, these man-made systems lead to many agronomic issues. Dwayne Beck, from the Dakota Lakes Research Farm, says that weeds and disease are nature’s way of adding diversity to a monoculture system. The challenge for the farmer is how to grow monoculture cash crops, for ease of growing and harvesting, while still maintaining system diversity. Cover crops can really help bring plant diversity to the system as a dozen plant species can be grown all together in a diverse cover crop mix without needing any specialized knowledge, equipment or markets. This diversity of plants promotes diversity of soil biology which leads to a very resilient system.



Principle #6

Properly incorporated livestock on the land

Livestock integration is a critical, yet underutilized, soil health principle for regenerative agriculture. By mimicking natural grazing patterns of historical prairie ecosystems, livestock enhance soil fertility and resilience. Grazing animals break down forage, cycling nutrients back into the soil through manure, which enriches microbial activity and reduces dependence on synthetic fertilizers, cutting costs for farmers. Managed grazing, using high stocking rates with frequent moves, ensures even manure distribution, minimizes soil compaction, fosters diverse soil biology, and promotes forage regrowth while maintaining soil cover. For farmers without livestock, custom grazing offers a practical solution to integrate animals without ownership. Properly managed grazing is one of the best ways to utilize cover crops and one of the fastest ways to build soil health.



Photo credit: Mark King

Cover crops are one piece of the puzzle

Cover crops are a very valuable tool to help put these principles into practice. They help keep the soil covered and a living root growing. They add a tremendous amount of diversity and help limit the amount of disturbance to the soil. Finally, they make great forage for integrating livestock into crop fields. It's safe to say that in almost all contexts, cover crops help farmers achieve the six principles of soil health.

One of the cover crop pioneers, our friend Steve Groff from Pennsylvania, likes to say, “Cover crops make a good farmer better and a bad farmer worse!” This is not a judgment, but rather a callout to the importance of management. The key to making cover crops work in the system is to use them as a highly managed tool, as one part of a bigger system that is constantly adapting to changing environmental and economic conditions. If cover crops are added to a system, but not managed within the context and goals of the operation, the system will likely not succeed. Just like any other crop, cover crops require water and nutrients, which means they can become competition to the cash crop if they are not terminated correctly. It may sound daunting at first, but with the proper management, cover crops can become an indispensable tool in your quest to regenerate your soil and your profitability.

Cover Crops are a key part of the solution, but how will they work in your operation?

Many of the problems that modern agriculture faces are solved by incorporating cover crops. The soil which we all rely on for our daily bread can be dramatically improved through cover crops. As you continue through this book, remember two things. First, that the soil is a living ecosystem. Second, remember that we need to think about our farms as a whole—taking into account how each management decision affects the entire system, not just the current cash crop. In the next chapter, we will take a deeper look at the benefits that cover crops can provide to your operation.

What is a cover crop?

A cover crop is a plant grown primarily to benefit soil health, ecosystem function, and agricultural sustainability rather than for direct harvest. Cover crops are planted between cash crop cycles to reduce erosion, enhance soil health, suppress weeds, cycle nutrients, support biodiversity, improve soil structure, increase organic matter, improve water management and provide livestock grazing. Cover crops are often planted in diverse mixes to confer multiple benefits to the soil.

In contrast with a cash crop that is planted for the primary goal of producing revenue, a cover crop is mainly planted for the overall improvement of soil over time. Cash crops are necessarily removed or exported from the system while cover crops are either left to decompose on their own or cycled through an animal to build the soil. In short, cover crops should add to the soil system, not be removed or taken away. Cash crops and cover crops work in tandem with each other, and when properly managed, contribute to the overall profitability and productivity of the entire operation.

A close-up photograph of a yellow flower cluster, likely a cover crop, with a ladybug perched on one of the buds. The background is a soft, out-of-focus green.

2. Cover Crop Benefits

In the small town of Ibach Switzerland in 1884, Karl Elsener began producing the first knives sold to the Swiss Army. The original model, called the Soldier Knife, was made for troops who needed a foldable tool that could open canned food and aid in disassembling a rifle. The Soldier Knife included a blade, a reamer, a can opener, a screwdriver, and oak handles. This multipurpose tool became known as the Swiss Army Knife and is synonymous with multiple functions from a single tool. It is no stretch of the imagination to call cover crops the Swiss Army Knife of agriculture as they perform multiple functions in our farming systems! We give a nod to Rob Myers with the University of Missouri for first drawing the comparison of cover crops to the multi-purpose Swiss Army Knife—we've taken his original concept and expanded it!

The following are some of the functional benefits that cover crops can perform.

The Swiss Army Knife of cover crop benefits





Erosion control

Cover crops are vital in preventing soil erosion by shielding the soil from the destructive forces of wind and water, particularly the high-impact energy of raindrops. A single raindrop can strike bare soil with enough force to dislodge particles, initiating erosion by breaking apart soil aggregates which then seal off infiltration paths and greatly increase runoff. Cover crops act as a protective barrier, absorbing this impact and reducing soil displacement. Cover crop root systems also anchor the soil, stabilizing it against runoff during heavy rainfall, while their foliage slows water flow, minimizing sediment loss. Growing plants also significantly reduce wind speed at the soil surface, mitigating erosion by acting as a physical barrier. This slowing effect prevents the detachment and transport of soil by wind. Studies suggest cover crops can reduce wind erosion rates by up to 80% compared to bare soil, preserving soil structure and fertility.

Improved infiltration

Cover crops significantly enhance water infiltration into soil, improving its ability to absorb and retain moisture while reducing runoff and erosion. Their root systems create channels and pore spaces, loosening compacted soil and facilitating water penetration. Additionally, the vast network of biological life that is supported by cover crops also contributes to significantly increased water infiltration rates. Earthworm burrows are perfect macropores for water to enter the soil and the biological glues that are produced by soil microbes build soil structure and stability and allow much greater infiltration. Also, the canopy of cover crops shields soil from the destructive impact of raindrops, which can dislodge particles and seal the surface, impeding infiltration. By intercepting rain, cover crops slow water flow, giving it more time to permeate the soil.

Improved water quality

Cover crops greatly improve water quality by reducing nutrient runoff, sediment loss, and pollutant contamination in waterways. Their dense root systems stabilize soil, preventing erosion caused by raindrop impact and runoff, which can carry sediment into streams and rivers. By anchoring soil, cover crops reduce turbidity in water bodies, improving clarity and supporting aquatic ecosystems. Studies indicate they can decrease sediment loads by up to 90% compared to bare fields. By slowing water flow across fields, cover crops allow more time for soil to filter water naturally, trapping contaminants. This sustainable practice protects watersheds, supports biodiversity, and ensures cleaner water for communities. Cover crops also mitigate nutrient leaching, particularly nitrogen and phosphorus, which contribute to water pollution and algal blooms. Species like rye, clover, or radishes absorb excess nutrients from the soil, acting as a “catch crop.” For example, cereal rye can reduce nitrate leaching by up to 70%, preventing contamination of groundwater and surface water.

Reduced evaporation

By forming a dense canopy and covering the soil, cover crops play a crucial role in reducing soil evaporation, conserving moisture, and enhancing soil water retention. These plants act as a living mulch, shading the soil surface and reducing direct exposure to sunlight and wind. This shading effect can significantly decrease soil evaporation rates compared to bare soil, preserving moisture for subsequent crops, especially in arid or drought-prone regions. The plant canopy also intercepts solar radiation, lowering soil temperatures, which further slows evaporation. Studies show cover crops can reduce surface temperatures of the soil by 30-50 degrees, which make a huge difference in the evaporation of moisture from the soil. Also, by slowing wind speed at the soil surface by up to 60%, they minimize drying effects of air movement. These combined actions of shading, improved infiltration, and wind reduction ensures more water remains available for crops.

Reduced compaction and improved soil trafficability

If a farmer is out planting and gets caught out in the middle of a field in a big rain storm, he will always drive back on a grassy area if possible rather than the uncovered field. The turf effect of a living root system will help carry the weight and impact of the vehicle. This same effect can be accomplished with cover crops as they can be used to enhance soil trafficability (the ability of soil to support agricultural machinery without excessive compaction or rutting) by improving soil structure and stability. Extensive root systems create a network of channels and pores, increasing soil porosity and reducing bulk density. This enhances soil's load-bearing capacity, allowing it to withstand the weight of heavy equipment, especially during wet conditions when

bare soils are prone to compaction. By adding organic matter through the liquid carbon exudates of growing plants and the decomposing roots and residue of terminated plants, cover crops boost soil aggregate stability, which helps maintain soil structure under mechanical stress.

Increased soil organic matter

Soil organic matter (SOM) is one of the most important components of any soil and the more you have, the more productive and resilient that soil will be. Since SOM is made up of 58% carbon, we cannot increase it without significant infusions of carbon into the system. The best way to increase carbon in the soil is to have a diverse mixture of plants growing for long periods of time. As the plants photosynthesize, they take carbon (CO_2) from the atmosphere and convert it to liquid carbon compounds which consist of sugars, carbohydrates, fats, lipids, proteins and phenolic compounds. Plants add carbon, and thus SOM, to the soil in two ways. First, as the plant grows it accumulates carbon in its biomass. When the plant dies and decomposes, some of the carbon is cycled into the soil, but much of it is lost back to the atmosphere as CO_2 as part of the natural decomposition process. Secondly, when a plant is growing in a biologically rich soil, as much as 50% of the carbon produced through photosynthesis is leaked out through the root system as energy-rich exudates and is consumed by the soil microbial community. Dr. Christine Jones tells us that the carbon produced through this liquid carbon pathway is 10-50 times more likely to become part of the stable SOM than carbon that comes from the decomposition pathway. Growing more plants through the integration of cover crops means more carbon in the soil which leads to increased SOM.

Photo credit: Mark Misar





Photo credit: John Rutherford

Increased soil microbial activity

Cover crops foster a vibrant underground ecosystem that is critical for soil health and agricultural sustainability. By exuding liquid carbon in the form of sugars, amino acids, and organic acids through their roots, cover crops can feed and support diverse biological communities. This nutritional buffet stimulates microbial growth, particularly beneficial fungi like mycorrhizae, which enhance nutrient uptake for plants. This increased microbial activity improves nutrient cycling, making essential elements like phosphorus and potassium more available to crops. Cover crops also create a favorable environment for microbes by improving soil structure, increasing water infiltration, and reducing temperature fluctuations through canopy cover. These conditions promote microbial diversity, which strengthens soil resilience against pathogens and environmental stress.

Increased soil aggregation

Cover crops promote the formation of stable soil aggregates—clumps of soil particles bound together—by contributing organic carbon to the system and fostering microbes which produce biotic glues. This process increases soil porosity, water infiltration, and resistance to erosion.

A key biotic glue is glomalin, a glycoprotein produced by arbuscular mycorrhizal fungi, which form symbiotic relationships with cover crop roots. Glomalin acts as a sticky binding agent, coating soil particles and stabilizing aggregates. It can constitute up to 30% of soil organic carbon, significantly enhancing aggregate durability and carbon sequestration.

Other biotic glues, such as polysaccharides and organic acids are also excreted by cover crop roots and soil microbes, which bind soil particles further. These compounds, enriched by cover crop residues, create a glue-like matrix that holds aggregates together, reducing breakdown from raindrop impact or mechanical stress.

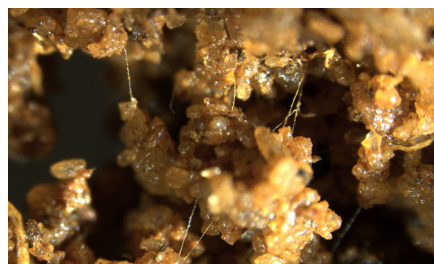


Photo credit: Phil Lee

Nitrogen fixation

Because 78% of our atmosphere is nitrogen, there are 30,000 tons of nitrogen above every acre of crop ground. However atmospheric nitrogen is held as di-nitrogen (N_2) with the two N molecules bound tightly to each other and is therefore inert to other interactions, including being accessed by plants. Leguminous cover crops, such as peas, beans, clover, and vetch, form symbiotic relationships with rhizobia bacteria in their root nodules. These bacteria convert atmospheric nitrogen (N_2) into ammonia, a form plants can use, through the enzyme nitrogenase. This can be a powerful process. Rhizobia associated with crops such as soybeans can fix as much as 350# of nitrogen in 60 days. Likewise, cover crops such as sunn hemp or hairy vetch can contribute as much as 200# of nitrogen through their microbial partners. Free-living nitrogen fixers, such as *Azospirillum* and *Azotobacter*, are soil bacteria that convert atmospheric nitrogen (N_2) into ammonia independently of plant root symbiosis, unlike rhizobia. While not as productive as rhizobia, these microorganisms play a vital role in enhancing soil fertility, particularly in nutrient-poor environments, by contributing fixed nitrogen to ecosystems without requiring legume hosts.

Nutrient cycling

Cover crops are integral to nutrient cycling, enhancing soil fertility, and reducing nutrient losses in agricultural systems. By capturing, storing, and releasing nutrients, they improve soil health and support regenerative crop production. Leguminous cover crops fix atmospheric nitrogen (N_2) through symbiosis with rhizobia bacteria, but the availability of many other nutrients can be enhanced through the use of cover crops. Deep-rooted crops such as rye and radish, excel at scavenging residual nutrients, particularly nitrogen and phosphorus, from the soil. Their root systems absorb excess nutrients, preventing leaching into groundwater or runoff into waterways. Additionally, cover crops like buckwheat can mobilize phosphorus through root exudates, making it more accessible to crops. By mixing legumes and non-legumes, farmers optimize both nitrogen fixation and nutrient retention, creating a balanced nutrient cycle. Finally, many of the nutrients that plants need from the soil can be made available through the soil microbial community. When they are properly fed and supported by diverse cover crop mixes, the natural nutrient cycle will be strong and efficient.

Pest and disease suppression

Cover crops play a significant role in disease suppression within agricultural systems by altering soil microbial dynamics, reducing pathogen populations, and enhancing plant resilience. Their ability to suppress soil-borne diseases stems from multiple mechanisms. Certain cover crops, like mustard and brassicas, release biofumigant compounds such as glucosinolates during decomposition. These compounds are toxic to pathogens like *Fusarium* and *Rhizoctonia*, reducing their prevalence in the soil. Similarly, sudangrass produces sorgoleone, a natural allelochemical that inhibits fungal pathogens. Cover crops also foster beneficial soil microbes that outcompete or antagonize pathogens. Diverse cover crop mixtures create a balanced microbial community, further limiting pathogen dominance. Physical mechanisms contribute as well. Dense cover crop canopies reduce soil splash, limiting the spread of foliar pathogens like *Phytophthora*. Their roots improve soil structure, reducing conditions like waterlogging that favor diseases. Additionally, cover crops break disease cycles by acting as non-hosts for crop-specific pathogens, disrupting their life cycles.

Effective disease suppression depends on proper cover crop selection, timing, and management. By integrating diverse cover crops, farmers can naturally reduce disease pressure, decrease pesticide use, and promote resilient, regenerative cropping systems.

Photo credit: Payton Ward



Weed suppression

Cover crops are a powerful tool for weed suppression in regenerative agriculture, reducing reliance on herbicides and promoting ecosystem health. By competing for resources and altering environmental conditions, cover crops effectively limit weed establishment and growth.

Cover crops like cereal rye, oats, and sorghum-sudangrass form dense canopies that block sunlight, inhibiting weed seed germination and growth. For example, rye can reduce weed biomass by up to 90% through shading and physical competition for space. Their extensive root systems also compete with weeds for water and nutrients, further suppressing weed vigor. Fast-growing cover crops, such as buckwheat, establish quickly, outpacing weeds and smothering them within weeks. Some cover crops employ allelopathy, releasing chemicals that inhibit weed growth. Rye, for instance, produces benzoxazinoids, which suppress weeds like pigweed and lambsquarter. Similarly, sorghum-sudangrass releases sorgoleone, a potent allelochemical that disrupts weed root development.

Cover crops also disrupt weed life cycles by altering soil conditions. Residue from terminated cover crops, left as mulch, creates a physical barrier that hinders weed emergence. Additionally, cover crops stimulate beneficial soil microbes that can reduce weed seed viability.

Effective weed suppression depends on strategic management, including choosing appropriate cover crop species, timely planting, and proper termination. Mixtures of grasses and legumes, like rye and hairy vetch, enhance suppression by combining rapid growth and allelopathic effects. By integrating cover crops into rotations, farmers can control weeds naturally, reduce herbicide costs, and support sustainable soil health, fostering resilient agricultural systems.

Wildlife benefits

Cover crops provide significant benefits to wildlife, enhancing biodiversity and supporting ecosystems in agricultural landscapes. By creating diverse habitats, they offer food, shelter, and breeding grounds for various species, contributing to ecological balance. Cover crops extend the growing season, providing year-round food and habitat structure. Their dense canopies and root systems offer cover for small mammals, ground-nesting birds, and beneficial insects like pollinators and predatory beetles. Planting cover crop species such as sunflower or millet, produces seeds that serve as a food source for birds, such as sparrows and quail, especially during winter when resources are scarce. Leguminous cover crops enrich soil nitrogen, indirectly supporting herbivores by improving forage quality in subsequent grazing systems. Cover crops also foster earthworm and microbial populations that benefit insectivorous species like bats and amphibians. By reducing erosion and runoff, they maintain cleaner waterways, supporting aquatic wildlife.



Beneficial insects and pollinators

By providing food, habitat, and shelter, cover crops create environments that support bees, butterflies, predatory insects, and other beneficial species. Flowering cover crops, such as buckwheat, crimson clover, and phacelia, produce nectar and pollen, serving as vital food sources for pollinators. Studies indicate that fields with flowering cover crops can boost pollinator abundance by 30–50%, enhancing crop yields by up to 20% in pollinator-dependent systems.

Cover crops also support beneficial insects, such as ladybugs, lacewings, and parasitic wasps, which prey on pests like aphids and caterpillars. Diverse mixtures create varied habitats that harbor these natural enemies of pests, reducing the need for pesticides. The structural diversity of cover crops provides overwintering sites and refuges from tillage or spraying, ensuring insect survival. Their roots and residues improve soil health, supporting soil-dwelling beneficials like predatory mites. Effective management, such as planting early-flowering species and avoiding premature termination, maximizes benefits. By integrating diverse cover crops, farmers foster resilient ecosystems, enhance natural pest control, and improve pollination, supporting regenerative agriculture and biodiversity.

Livestock feed

Last but surely not least, cover crops provide excellent livestock feed. Whether it's a spring crop of triticale and peas, a super diverse grazing mix for the summer, or a silage crop of sorghum sudan, cover crops fit the bill for quick and easy livestock feed in any season. Generally annual plants, cover crops are quick to establish and many provide high quality nutrition with excellent palatability. For people with livestock, cover crops are virtually a no-brainer when it comes to profitability. For those who don't currently own livestock but are planting cover crops, you probably have a few neighbors who would love to let their cows graze your land. It's another way to bring in revenue from a cover crop.

Cover crops enhance livestock production by providing nutritious forage, improving pasture quality, and supporting sustainable grazing systems. They offer a dual benefit: feeding livestock while enriching soil health, making them a valuable tool for integrated crop-livestock operations.

Leguminous cover crops like clover, peas, and vetch are high in protein, offering nutritious grazing or hay for cattle, sheep, and goats. Non-leguminous cover crops, such as rye, oats, or sorghum-sudangrass, provide high-fiber forage, extending grazing seasons, especially in fall or winter. Mixtures of species, like rye and hairy vetch, ensure balanced nutrition and consistent biomass. Grazing cover crops reduces feed costs and improves pasture resilience by reducing erosion and enhancing soil fertility through nitrogen fixation and organic matter addition. Properly managed rotational grazing of cover crops prevents overgrazing, maintains soil cover, and promotes regrowth.

Photo credit: Diane Hesterberg





Photo credit: Julie Birky

Rediscover the joy of farming

We have many customers tell us that using cover crops makes farming fun again. Cover crops can reinvigorate farming, transforming it into a dynamic, engaging, and rewarding practice. By diversifying field management, they break the monotony of conventional monoculture, making farming fun while boosting sustainability. Planting cover crops adds visual and ecological diversity to fields. Farmers experiment with colorful mixtures, turning their land into a living canvas that changes with the seasons. This creative aspect—choosing species, timing planting, and observing growth—sparks curiosity and hands-on learning. Cover crops also make farming interactive by fostering problem-solving. Farmers tailor mixes to address specific challenges, like weed suppression or nitrogen fixation, turning fields into experiments. Successes, like seeing rye choke out weeds or vetch enrich soil, deliver tangible rewards, boosting morale. Cover crops invite wildlife—birds, bees, and beneficial insects—making fields lively ecosystems and making farmers the stewards of biodiversity.



3.

Choosing Your Cover Crop

Selecting the Right Cover Crop

Choosing the right cover crop species is one of the most challenging yet rewarding tasks in cover cropping. With over 100 cover crop species available from Green Cover, the options can feel overwhelming. Fortunately, our team works with farmers across the country to simplify this process. To select the best cover crop for your operation, we ask a series of key questions to align your goals with the right species. Here's how we guide the decision-making process:

1. *Why?* Why are you planting this cover crop? What are your goals?

The first step in selecting a cover crop is understanding your objectives. Without clear goals, choosing the right seeds becomes nearly impossible. Cover crops are like a Swiss Army knife, offering a range of benefits depending on your needs (as illustrated in on page 12). Potential goals include improving soil health, enhancing fertility, suppressing weeds, controlling erosion, or providing grazing opportunities. Identifying your priorities helps us match the cover crop's benefits to your specific needs. We'll explore these goals in greater detail later in this chapter.

2. *When?* When will you plant and terminate your cover crop?

Timing is critical to cover crop success. The planting and termination dates significantly influence which species will best suit your goals. The length of your growing season — determined by factors like frost dates and climate — narrows down the list of suitable cover crops. The reproductive cycle of a plant should also be considered to avoid any unwanted volunteer seed. Choosing species that align with your planting window ensures optimal growth and performance.

3. *How?* How will you plant your cover crop?

The planting method also plays a role in species selection. Will you use a drill for precise seeding, or will you broadcast the seed? The choice of method affects seeding rates and species suitability. For instance, some species perform better when drilled into the soil, while others can tolerate broadcasting. Understanding your equipment and approach helps us recommend seeds that will establish successfully.

4. *What?* What is the next cash crop?

A fundamental rule of cover cropping is to ensure the cover crop does no harm to the following cash crop. The cover crop should enhance, not suppress, the next crop in your rotation. For example, certain cover crops may leave residues or allelopathic effects that could impact specific cash crops. By knowing your next crop, we can select cover crop species that complement your rotation and support long-term productivity.

The Power of Diversity

To achieve multiple goals and advance soil health, diversity in cover crop mixes is essential. Plants naturally thrive in diverse ecosystems, and well-designed mixes promote cooperation rather than competition among species. Diversity enhances resilience against weather extremes, diseases, and pests while providing a balanced diet for soil microbes and, when applicable, livestock. A diverse cover crop mix creates a robust system that supports both immediate objectives and long-term soil health.

By answering these four key questions—*Why*, *When*, *How*, and *What*—we can tailor a cover crop mix that meets your unique needs, maximizes benefits, and sets your operation up for success.

Diversity of Plant Families in Cover Crop Mixes

Incorporating a variety of plant families into cover crop mixes is a cornerstone of building resilient, healthy soils. Each cover crop species belongs to a specific plant family—such as legumes (Fabaceae), grasses (Poaceae), brassicas (Brassicaceae), or broadleaves like sunflowers (Asteraceae)—and each interacts uniquely with soil microbes like fungi and bacteria. By including diverse plant families in a cover crop mix, farmers can significantly enhance soil microbial diversity, which drives biological activity and supports long-term soil health. Aiming for 4–6 plant families in a mix maximizes these benefits, fostering a robust ecosystem that promotes soil restoration, nutrient cycling, and farm resilience.

Common Cover Crop Plant Families

Poaceae – Grasses

Cereal rye, triticale, oats, sorghum, millet, annual ryegrass, grazing corn, teff grass, wheat, etc.

Fabaceae – Legumes

Clovers, hairy vetch, peas, lentils, cowpeas, mung beans, faba beans, sunn hemp, fenugreek, etc.

Brassicaceae – Brassicas

Turnip, radish, collards, rapeseed, kale, mustard, african cabbage, camelina, arugula, etc.

Polygonaceae – Buckwheat

Linaceae – Flax

Malvaceae – Okra

Boraginaceae – Phacelia

Plantaginaceae – Plantain

Asteraceae – Safflower, Sunflower, Chicory

Cucurbitaceae – Pumpkins, Gourds, etc.

Chenopodiaceae – Sugar Beets

Rosaceae – Small Burnet

Pedaliaceae – Sesame

Why Plant Family Diversity Matters

Plant family diversity is critical because different families contribute distinct ecological functions to the soil ecosystem. For example, legumes fix nitrogen through symbiotic relationships with rhizobia bacteria, while brassicas, with their deep taproots, scavenge nutrients and reduce soil compaction. Grasses provide dense root systems that stabilize soil and add organic matter, and broadleaves like buckwheat attract pollinators and suppress weeds. These complementary roles ensure that a diverse mix addresses multiple soil health goals simultaneously, such as improving structure, enhancing fertility, and controlling erosion.

Deep taproots access nutrients far below the surface.



Fibrous roots stabilize soil and prevent erosion.



Large tuberous roots create pores to reduce compaction and enhance water infiltration.



Diverse plant families also support a thriving microbial community. Soil microbes, including mycorrhizal fungi and bacteria, form symbiotic relationships with plant roots, exchanging nutrients for carbon-rich root exudates. Each plant family releases unique compounds that attract specific microbial partners, creating a varied and dynamic soil microbiome. As Dr. Christine Jones, a leading soil ecologist, explains, “The diversity of plants in a cover crop mix is critical because it drives microbial diversity, which is the engine of soil health. A diverse microbial population enhances nutrient cycling, improves soil structure, and increases resilience to environmental stresses.” This microbial diversity translates into healthier crops, as a robust soil microbiome can suppress pathogens and improve nutrient availability.

Practical Considerations for Maximizing Diversity

To achieve these benefits, aim for a cover crop mix that includes 4–6 plant families, tailored to your specific goals, climate, and planting window. For example, a mix might combine legumes (e.g., cowpeas or vetch), grasses (e.g., oats or rye), brassicas (e.g., radishes or turnips), and broadleaves (e.g., buckwheat or phacelia). This diversity ensures that the mix addresses multiple objectives, such as nitrogen fixation, weed suppression, and erosion control, while fostering a balanced soil ecosystem.

However, diversity must be balanced with practicality. The mix should align with your planting method, the next cash crop, and environmental conditions like rainfall and soil type. Dr. Christine Jones underscores the importance of thoughtful design: “It’s not just about throwing in as many species as possible. The key is selecting a complementary mix of plant families that work together to enhance soil function and meet the farmer’s goals.” Using tools like the SmartMix® Calculator can help farmers select species from different families that suit their specific needs and conditions.

Seasonality in Cover Crop Selection

When choosing cover crops, seasonality is a key factor. Cover crops, like most plants, fall into two categories: warm season (C-4) and cool season (C-3) species, based on their photosynthetic pathways.

Warm season (C-4) plants, such as sorghum sudan, millet, cowpeas, and sunflowers, thrive in hot, dry conditions and perform best during summer months.

Cool season (C-3) plants, like cereals, brassicas, clovers, and peas, prefer cooler, wetter conditions and grow well in spring, fall, and sometimes winter.

Spring and fall cover crop mixes typically feature cool season species, while summer mixes favor warm season species. However, combining both types in a mix can enhance performance. When added to a diverse mix, cool season species thrive longer into warmer months. For example, in test plots in south central Nebraska, monocrop brassicas show stress by August. However, when mixed with warm and cool season species, these brassicas thrive under the canopy of taller plants, benefiting from the cooler, moister microclimate near the soil surface. This diversity fosters resilience and extends the growing period for all species in the mix.

Making it simple — the SmartMix Calculator

The SmartMix® Calculator, developed by Green Cover, is an innovative online tool designed to help you create custom cover crop mixes tailored to your specific needs, fields, and goals. Accessible for free at smartmix.greencover.com, it simplifies the complex process of selecting from over 120 cover crop species by guiding users through a series of questions about their objectives, planting methods, location, planting and termination dates, and the next cash crop. By inputting details like ZIP code, the tool pulls climate data—such as average rainfall, frost dates, and USDA Plant Hardiness Zones—to recommend species suited to the user’s environment. This ensures that the selected mix aligns with local conditions, enhancing growth and effectiveness.

The calculator’s value lies in its ability to customize mixes to achieve up to three specific goals. You can choose from any of the goals below:

Cover Crop Goals in SmartMix®

- Increase Soil Organic Matter

Erosion Reduction

Nutrient Cycling

Nitrogen Fixation

Provide Lasting Residue

Weed Suppression

Compaction Breaking

Supplemental Grazing

Diversify Introduced Perennial Pasture

Attract Beneficial Insects
- Salinity Tolerance

Mycorrhizal Fungi Growth

Nematode Control

Winter Stockpiling

Interseed into Corn (V3-V6)

Introduce Annuals into WS Perennial Pasture

Introduce Annuals into CS Perennial Pasture

Grazing with Regrowth

Establish New Introduced Perennial Pasture

Please fill in all details to initiate your mix.

Name your mix

Summer Grazing Mix

Acres to Plant

80

Irrigated inches

0

Zipcode

68928

Seeding Method

☒ Drilled

☐ Broadcast

☐ Broadcast with Incorp

Next Cash Crop

Rye

Bagging Option

☐ 50 lb. bags

☒ Tote

☐ Bulk

Seeding Date

06/30/2025

Termination Date

09/30/2025

Is this a certified organic field?

☐ Yes

☒ No

Your selected growing period will last 92 days. It will also contain 2052 base 50 growing degree days and 2952 base 40 growing degree days.

Goals

Highest Priority

Supplemental Grazing

High Priority

Increase Soil Organic Matter

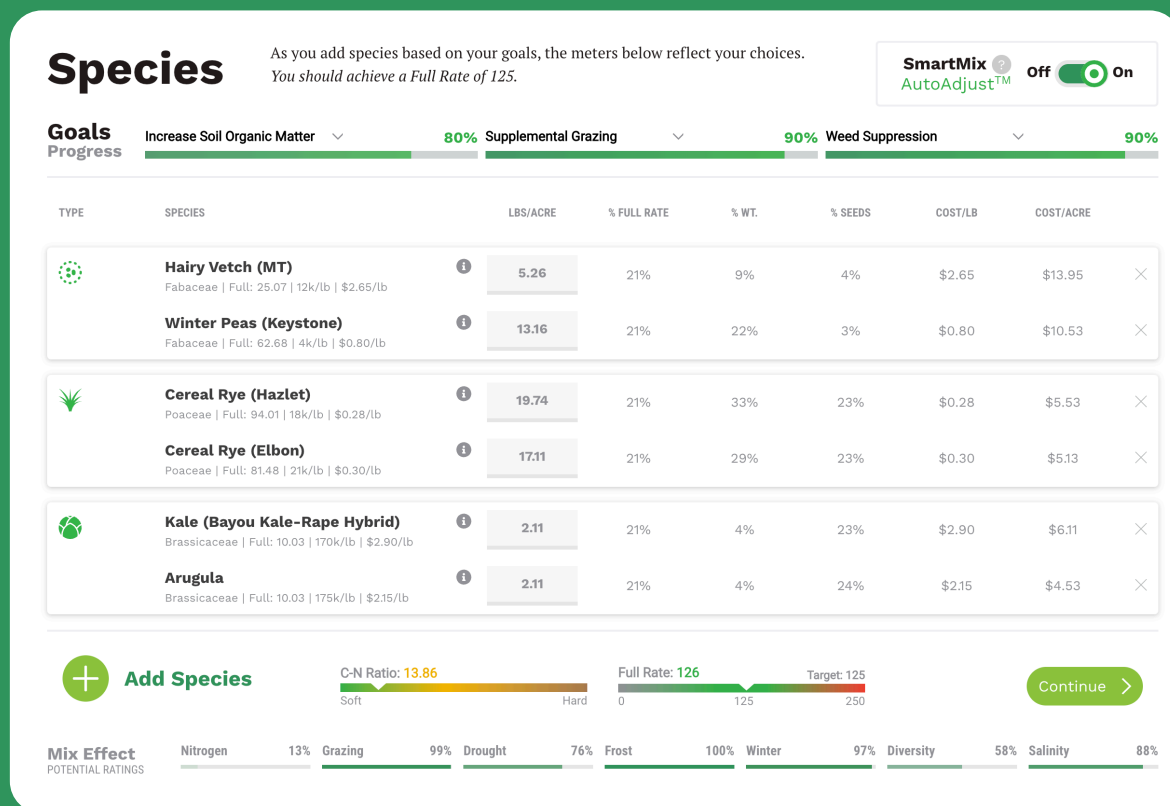
Priority

Weed Suppression



SMARTMIX[®]

Build your own SmartMix
SmartMix.greencover.com



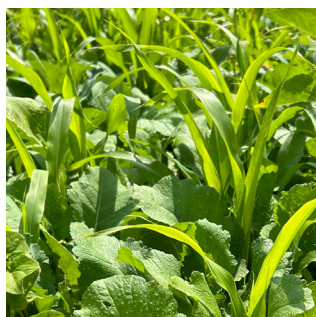
SmartMix[®] scores each species based on your goals, planting timing, and compatibility with your next crop, while calculating real-time costs for seed, inoculant, mixing, and bagging. Want to stay within budget? You can tweak seeding rates or swap collards for a more economical option like rapeseed without sacrificing results. Plus, you'll get metrics like carbon-to-nitrogen ratios and grazing suitability to make confident, informed choices.

More than just a calculator, SmartMix[®] is your learning partner. With species info, videos, and tech sheets, SmartMix will help you understand each plant's strengths, enabling you to build your expertise. Feel free to experiment—save your mix, tweak it later, or reach out to our Green Cover experts for personalized advice.

The value of pre-made mixes

While the SmartMix® calculator is a great tool for many people, there are times when a standard diverse mix is going to be a great solution for you. If you are planting a small area or have pretty general soil health goals, one of our many pre-made diverse cover crop mixes will likely save you time, money and the hassle of designing your own custom mix. Even with these pre-made mixes, identifying your main goals is crucial to making the right choice for your cover crop mix. We've compiled some general categories that capture many common cover cropping goals and scenarios and created mixes designed to address those needs specifically.

Feeding Livestock



Warm Season Grazing Mix

Featuring 12 of the most palatable and fastest growing warm season cover crops, this mix will be a hit for your livestock - both above the ground and below. Plant this mix when your soil temperatures reach 65 degrees and you can be grazing in 6 weeks. With proper grazing management, multiple grazings can be achieved.



Cool Season Grazing Mix

Plant this grazing mix in the spring when soil temperatures hit 45 degrees or in the late summer 45 days before your first frost date. Use a rotational grazing system to maximize your usable forage and promote a longer vegetative growth period.



Stockpile Grazing Mix

This mix is designed to be planted in the summer but grazed in the late fall through mid winter. Ideally planted 8-10 weeks before your first frost, this diverse combination of warm and cool season plants is designed to balance forage production and nutrient retention. This is a great way to increase the number of days your livestock are grazing instead of eating hay.



Building and Protecting Soil

Building soil requires growing plants, lots of biomass, and wide diversity. We've designed three mixes each containing at least four different plant family groups with the primary goal of building soil and preventing erosion.



Warm Season Soil Builder

This mix features 14 species from 7 plant families and can be planted once soil temperatures are at 60 degrees and on the way up. Summer plantings can occur all the way up to 6 weeks prior to your first frost date. You can expect quick ground coverage and lots of soil building from this mix.



Cool Season Soil Builder

This mix features 11 species from 6 different plant families to protect and build your soil in the spring or the fall. Spring plant as soon as your soil temperatures hit 45 degrees and are on the way up or fall plant 4-6 weeks ahead of your first frost date. This mix will have very few plants survive the winter in zones 6A or north.



Overwintering Mix

This mix features the most winter hardy species and can be planted after an early to mid-fall harvested cash crop and will grow into the following spring. Herbicide or tillage will likely be the best way to terminate this mix as multiple different species will make it through the winter and trying to terminate them all with a roller crimper can be challenging.

Cover Crops For Row Crop Rotations



Corn Interseeding

Adding diversity in a corn and soybean rotation is often difficult due to the short season left after harvest. To help with this, many producers are considering interseeding their corn at V3-V5 stage. At this stage, the corn gets the head start it needs but still allows light to bring up the cover crop before the canopy closes. This corn interseeding blend introduces all four functional groups — legumes, grasses, brassicas, and broadleaves — to add diversity to the soil. With more root exudates, beneficial insect attraction, and nutrient cycling, this blend helps build soil alongside the corn.



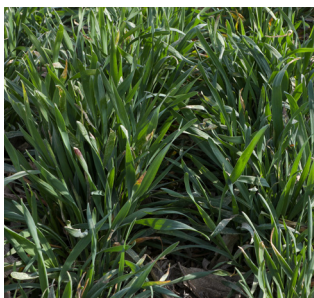
Brassi-Cast™

This brassica mix is designed to be broadcast into standing crops prior to harvest. This very low seeding rate mix works well broadcast into seed corn acres or into hail damaged commercial corn. This mix is a great addition if you are planning to graze crop residue later in the year.



Pre-Corn

This blend is specifically designed to be planted right after fall soybean harvest and to prepare your soil for a corn crop. Barley provides weed suppression, while hairy vetch fixes nitrogen for the cash crop. Camelina provides another layer of diversity, coming from the brassica family, and can also help with weed suppression.



Pre-Bean Mix

Planted into harvested corn stalks, cereal rye is the backbone of this mix with rapeseed and flax bringing microbial diversity to the soil. This is especially helpful on corn and bean rotations where grasses and legumes dominate the landscape.



Summer Nitrogen Fixer

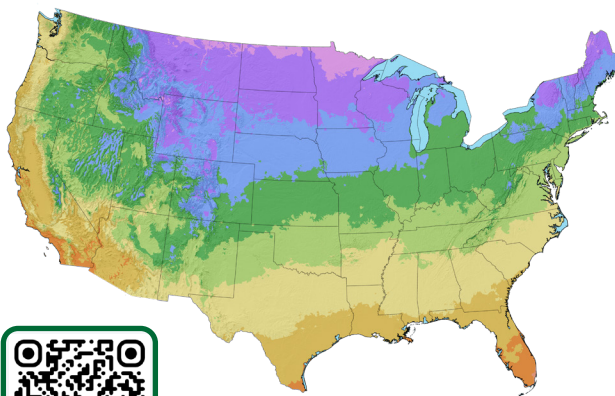
Somewhat similar to Warm Season Soil Builder, this mix has extra helpings of nitrogen fixing legumes complete with the proper inoculants to ensure your plants are fixing the maximum amount of nitrogen during the peak growing season. This is an excellent mix after wheat harvest or in preparation for a grass crop the following year.

Sometimes less is more—when to use a single species

You’ve heard us rave about the benefits of diverse cover crop mixes, and we stand by their value for boosting soil health and resilience. But sometimes, a low-diversity mix or even a single-species (monoculture) cover crop is the best choice for your farm. Here are a few scenarios where planting just one cover crop species makes sense for row crop farmers like you.

When you’re navigating a tight planting window

When planting late in the fall, your options may narrow. In Nebraska, for instance, November 15 is typically the cutoff for diverse cover crop mixes. After this date, cereal rye is often your only viable choice due to its cold tolerance and reliability. Depending on your location, this cutoff might shift earlier or later. Check the U.S. fall planting date map to find the best timing for your region, ensuring your cover crop establishes successfully.



planthardiness.ars.usda.gov

When you’re targeting a very specific goal

If you have a precise objective, a low diversity or monoculture cover crop can be your best ally. For example, planting hairy vetch alone is a great way to fix nitrogen for your next crop, especially on certified organic land. While you may sacrifice some of the broader benefits that come with diverse mixes, focusing on a single species allows you to hone in on a specific goal—like nitrogen fixation—while keeping management simple.

When you're meeting specific termination needs

Similarly, some situations demand precise termination timing and methods to protect your next crop. With just one species to manage, you can time roller crimping perfectly, ensuring effective termination without harming your cash crop. For organic farmers who rely on mechanical methods like roller crimping without herbicide backups, managing one species is easier than juggling multiple growth stages in a diverse mix. For example, terminating a single crop like rye at the right maturity stage ensures your cash crop isn't compromised, streamlining your operation.

Seed quality and performance

Not all cover crop seeds are created equal—quality matters, and you typically get what you pay for. Research increasingly emphasizes the importance of seed source and growing conditions. High-quality seeds grown in healthy, biologically active soils carry beneficial microbes that enhance soil health in your fields. These seeds are rich in nutrients like minerals, carbohydrates, proteins, and fats, have fewer seeds per pound, and exhibit higher test weights, leading to faster germination and vigorous seedling growth.

Seeds from plants grown in harsher climates than your own often perform better due to the resilience of the parent plant. At Green Cover, about 60% of our seeds come from a network of growers who follow the principles of soil health, often in challenging environments like dry or cold climates. These conditions test the strength of crops such as cereals, clovers, and brassicas, resulting in robust seeds that thrive under stress.

Well designed seed treatments can significantly boost seed performance. According to regenerative agriculture expert John Kempf, applying a combination of trace minerals act like “colostrum” for seedlings, providing essential nutrition that parent plants may not have supplied. Additionally, microbial inoculants—containing beneficial bacteria, mycorrhizal fungi, and bio-stimulants—form “synergistic stacks” that promote rapid germination and root development. This early microbial colonization enhances resistance to root diseases and reduces the energy seedlings need to recruit microbes from the soil, leading to healthier crops and better yields.

By choosing high-quality seeds and enhancing them with targeted treatments, you can maximize germination speed, seedling vigor, and soil health, setting the stage for a resilient and productive cover crop system.

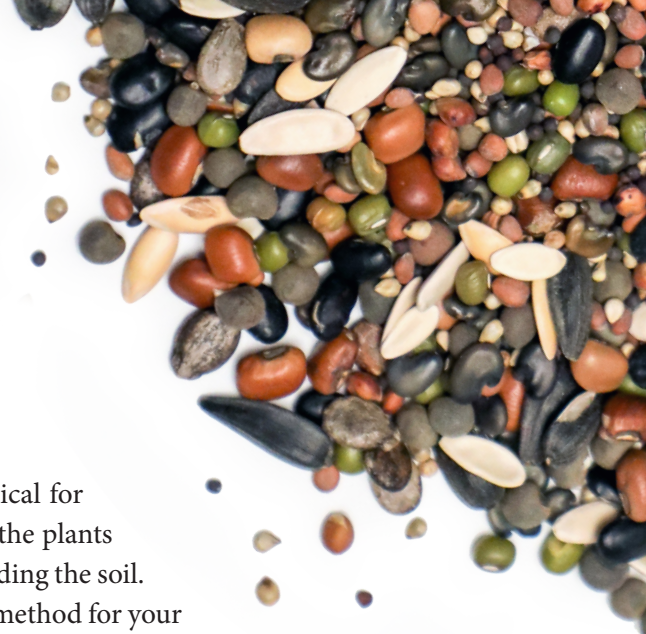
Learn more in John Kempf's article *Seeds and Seedlings with Speed*

greencover.com/seeds-with-speed





4. Seeding Cover Crops



Seeds are pretty amazing. A tiny little seed is a living organism that contains an embryo and all of the resources needed to allow that plant to begin its life cycle.

Just as with cash crops, a successful planting process is critical for the success of a cover crop. Without proper establishment, the plants will never have the chance to do their job of healing and building the soil. There are a variety of ways to plant cover crops and the best method for your situation will depend on the context of your operation.

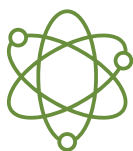
What does a seed need?

Before unpacking the different methods of seeding cover crops, it is helpful to understand what a seed needs to germinate.



Water

Water is needed to begin and sustain all forms of life. Moisture must be imbibed into the seed to initiate the germination process. Seeds will vary in the amount needed, with small seeds needing far less moisture than large seeds. Some cover crop species have a percentage of dormant seeds that will not allow moisture through the hard seed coat until a weathering or scarification process has occurred.



Energy

Like all metabolic processes, seed germination requires energy. The seed endosperm and the cotyledons have stored energy in the form of carbohydrates, fats, and proteins that fuel germination when environmental conditions are favorable for growth. This stored energy is what makes seeds valuable as energy for humans as well! Stored energy in the seed is very limited, with small seeds having less than large seeds. Planting depth becomes critical for small seeds as the energy required to push up from depth will not be found in small seeds. Plants must be able to generate their own energy shortly after emergence through photosynthesis and through the absorption of soil nutrients, so it is difficult for seedlings to survive in a shaded environment or in extremely poor soils.



Protection

It's a jungle out there in your soil. Seeds and seedlings must be protected from multiple things in order to survive and thrive. Bugs, rodents, birds, wind, water, heat, and cold can all be terminal for the seedling if not protected. Proper timing (based on soil temperature), proper seed placement and depth, proper seeding rates, and proper soil conditions will all give the seed the best chance for survival.



On-board biology

While not a requirement for germination, seeds were created to germinate and grow with diverse microbes helping out at every step along the way. Think of it as a microbial midwife that assists the germination and early growth processes. Most seeds come with their own microbial partners both in and on the seed that are inherited from their parents. When plants are grown in healthy, biologically rich and diverse environments, this diversity is passed on to future generations as a part of the seed formation process. Diverse biological seed treatments are also inexpensive and easy to apply to seed and are always highly recommended.

How deep should I plant my cover crop seed?

This is a common question once people are ready to plant their cover crop. A general rule of thumb is to plant a seed at a depth of 1-3 times the diameter of the seed—so very small seeds need to be planted shallow and bigger seeds can be planted deeper. The reason for this is that the smaller the seed, the less stored energy the seed has to push up through the soil.

When planting a diverse cover crop mix with a wide range of seed sizes this can be confusing. Many people ask about keeping the small seeds separate from the large seeds in a mix and planting them in different drill boxes. While this is certainly an option, it is extra work and most people do not have the equipment setup to do a split planting. What we find, however, is that a single seeding depth for a diverse cover crop mix is sufficient and all the seeds still have a chance to germinate and establish themselves.

That magic number is around ¾"-1" deep. At that depth, the large seeds (even the ones that would prefer to be planted 1½"-2" deep) can access the water they need and germinate and push out to the soil surface quickly. These larger seedlings form the pathways that the smaller seeds can use to grow to the soil surface. Many of the small seeded species such as brassica and clovers would prefer to be planted ¼" deep in a monoculture, but they tend to follow the larger seeded seedlings up and out of the ground with less of an energy expenditure. Of course, if you are planting a monocrop or all one seed size, it is best to use the planting depth recommended to that crop specifically.

How many pounds should I plant per acre?

When deciding what your seeding rate should be, it's important to factor in a few things. First of all, the recommended seeding rate of the species you are using is crucial. For monocrops you can follow the recommendations pretty closely, however many people will be using diverse mixes with lots of different seeds and lots of different seeding rate recommendations. In this case, we follow a percentage of full rate method. For each species in the mix, take the recommended seeding rate as monoculture planting and divide by the amount in the mix and that will get you your percentage of a full rate for that component of the mix. For example, if buckwheat is recommended to be planted at 30 lbs per acre for a full stand and you have 3 lbs in your mix, that is 10% of a full rate. When you add up all of the percentages for all the mix components, the mix should be around 125% total and as high as 150% for a mix that will be grazed heavily. The reason we aim for more than 100% is that in diverse mixes, plants tend to cooperate more than compete and the plant density can be pushed a little bit higher.

Mixes with cool season species and cereals generally are seeded at 60-120 lbs per acre. Warm season mixes can be seeded at a lighter rate, somewhere between 20 and 40 lbs per acre. The SmartMix® Calculator is based on this principle of percentage of a full rate and makes it very easy to see where you are at as you build a mix. We highly recommend using this tool when beginning to build a diverse cover crop mix for the first time.

If you are broadcasting your seed and not drilling it, the rates need to be increased 30-50%, as broadcasting seed usually means a lower germination rate because the seed-to-soil contact is less reliable. To compensate, increase the seeding rate to ensure you see a full stand of growth. The SmartMix calculator will take this into consideration if you tell it that your seeding method is broadcasting.

Let SmartMix® do the math for you.

By building your mix in the SmartMix Calculator, your seeding rate will be automatically calculated, plus you have the freedom to adjust the rates and percentages of individual species in your mix.



Build your own SmartMix
smartmix.greencover.com



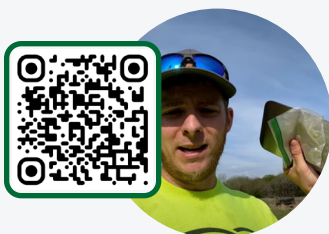


Photo credit: Tony Richards

Equipment considerations

The best way to achieve seeding success is to get the seed in the ground at the proper depth. This gives the best access to moisture for the imbibition process (especially for larger seeds), provides the best access to soil nutrients and give the seedling a protective environment. Both planters and drills will get the seed in the ground with good seed-to-soil contact and proper planting depth. No-till drills and planters are preferred because they can cut the residue, create a proper seed trench, place the seed, and cover the seed while leaving the majority of the residue in place to armor the soil against erosion.

Typically, a drill or an air seeder with disc openers is used for seeding cover crops rather than a planter that would be used for corn. One reason for this is that drills have narrower row spacing (7.5" or 10" vs. 30" typically) than planters which allow the cover crops to cover the soil and fill the root zone more quickly. Drills are also less expensive to purchase, operate, and maintain, require a less experienced operator, and are able to meter a much more diverse mixture of seeds than most planters will.



Not sure how to calibrate your drill?

Green Cover sales representative and Kansas farmer Zach Louk filmed this helpful demonstration of how to calibrate a grain drill using household items.

greencover.com/drill-calibration-demo

If a drill is not available, planters can be used. The best planters for cover crops are narrow row planters (15" or 20"), used with a special designed planter plate for cover crop seed mixes that most equipment manufacturers now offer. While planters are more expensive to own and operate, they do have some advantages over drills. Planters will give a much more precise and consistent seeding depth as well as more accurate seed metering. Parallel linkage, better down pressure, seed firming attachments, and better electronic monitoring of the planting process are also advantages of the typical planter over the typical drill.

How late can I plant cover crops?

Often, cover crops are planted after fall harvest, which means a tight window for planting. We recommend increasing the seeding rate as the planting date moves later into the fall season because there is less time for the plant to grow and tiller out in the fall. Some late plantings may not emerge until spring but for very cold tolerant crops like cereal rye or triticale, this is still better than not planting a cover crop. Earlier is always better, but later is better than not planting at all!





Photo credit: Kyle Psulkowski

Broadcasting

If no planting equipment can be found, if labor to plant or drill is a limiting factor, or if the seeding needs to be done into a standing unharvested crop, broadcasting the seed is an option. There are many types of broadcasting equipment available — drones, airplanes, large row crop broadcasters, and hand broadcasting equipment for small plots. This planting method will often have lower germination and emergence rates since it is more difficult for the seed to achieve seed-to-soil contact for proper water absorption. To maximize broadcasting success, follow these guidelines:

- Select mostly smaller seeds (clovers, brassicas, millets, ryegrass, cereal rye, etc.) as they require less water for germination than larger seeds. Small seeds can also more easily achieve seed-to-soil contact when broadcast.
- Watch the weather forecast closely and try to broadcast seed right before a rain event, or irrigate the field if that is an option. The rain drop impacts will help the seed get into contact with the soil as well as provide the moisture required for germination. Timing ahead of a rain can be difficult, especially in more arid environments, and thus broadcasting is generally used in higher rainfall areas or in fields that can be irrigated.
- Increase the seeding rate by 30-50% over a drilled rate. Some of the exposed seed on the soil surface will get eaten by insects, birds, and rodents, and some seed will never reach the soil surface where it can germinate. Increasing the rate of seed will increase your chances of success.

If you are able to lightly incorporate the seed into the soil, you will increase the seed-to-soil contact and thus, germination. This can be accomplished by dragging a harrow or shallow disc through the field both before and after broadcasting. On a smaller scale, broadcasting plant clippings, straw, mulch, manure, etc., over the top of the broadcast seed can also improve seed-to-soil contact. Livestock owners may use the hoof action of their cattle or sheep to work the seed into the ground also. With some incorporation, the increased seeding rate can be closer to 30%, while without incorporation, a 50% increase is more appropriate.

Treat your cover crop like a cash crop

Treating your cover crop like your cash crop means managing your cover crop with the same level of care, attention, and management as you would your primary revenue-generating crop. This approach emphasizes the importance of cover crops in improving soil health, reducing erosion, enhancing biodiversity, and contributing to the overall success of the farming system. Here's what it entails:



Prioritizing establishment

Plant cover crops at the right time, with proper seedbed preparation, optimal seeding rates, and appropriate planting methods to ensure good germination and growth, just as you would for a cash crop.



Selecting the right species

Choose cover crop species or mixes that align with your farm's goals (e.g., nitrogen fixation, weed suppression, or soil structure improvement) and suit your climate and soil conditions, similar to how you select high-yielding cash crop varieties.



Active management

Monitor and manage cover crops throughout their growth cycle to maximize their benefits, rather than treating them as an afterthought.



Timely termination

Plan and execute cover crop termination (e.g., mowing, rolling, or herbicide application) with precision to ensure it integrates smoothly with cash crop planting, avoiding competition or delays.



Investing resources

Allocate time, equipment, and financial resources to cover crops, recognizing their long-term value in improving soil fertility, reducing input costs, and enhancing cash crop yields.

By treating cover crops with the same diligence as cash crops, farmers can maximize their agroeconomic and environmental benefits, leading to a more sustainable and productive farming system.

Observing your cover crop

Once your cover crop is selected and planted, it's time to start observing. Equip yourself with simple tools like a spade, refractometer, garlic press, and a notebook to track changes. Regular observation motivates you to stay aligned with your goals and reveals subtle shifts in your soil and plants. While a field-wide view can obscure details, digging in and examining closely provides valuable insights.



Tools for observing

Your mind and discipline

Consistent observation requires commitment. Keep a spade handy, set phone reminders, take photos, and make notes. Build a habit of checking soil and plants every time you're in the field or pasture. These small observations inform decisions about your cover crop and cash crops.

Spade

Your spade is your most useful tool when it comes to monitoring soil. Yes, soil tests are great, but training your eye to see patterns and shifts in your soil is second to none. Keep your spade with you all the time. The more you use it the more you know about your land.



Refractometer plus a garlic press

A refractometer (available online for under \$100) measures Brix, an indicator of plant health based on dissolved solids in plant sap. Use a garlic press to extract sap for testing. Higher Brix readings (above 12) suggest healthier plants, while lower read-

ings indicate vulnerability to pests and diseases. Brix levels vary with time of day and photosynthesis, so take multiple readings for a clearer picture. (Note: If borrowing a garlic press from the kitchen, replace it first!)

Notebook

Memory fades, so record observations consistently. Whether using pen and paper or a phone app, note key details like soil conditions, plant health, and Brix readings.

Example: July 14, 2025 - found two earthworms in one shovelful of soil, WS cover crop showing a brix reading of 13.5, very dry conditions.



What to Observe

If you're new to cover cropping, challenge yourself to monitor and document throughout the crop's growth cycle. Key questions to consider:

- How long did seeds take to germinate?
- What was the soil moisture like?
- Did the soil change as the cover crop grew?
- How much biomass was produced?
- Were any species absent or dominant?
- When and how was the cover crop terminated, and was the method effective?
- How did the cover crop impact the following cash crop?

Reflect on whether the cover crop met your initial goals. These observations help you evaluate success and guide your future decisions.



5.

Terminating Cover Crops

Photo credit: Mac Kincaid

The first commandment of cover cropping is... “Do No Harm To Thy Cash Crops.”



With this in mind, your cover crop needs to be terminated before or shortly after the cash crop is planted. If termination is incomplete or unsuccessful, the cover crops can compete with your cash crops for moisture, sunlight and important nutrients.



Planning cover crop termination starts when designing your mix, as your operation's goals, restrictions, and subsequent crops shape the best approach. For example, organic farmers cannot use chemical termination, requiring species selection that aligns with mechanical or natural methods. Planting a cash crop immediately after a cover crop differs from planting a forage crop for grazing. Align your termination strategy with your goals and context, prioritizing the soil health principle of minimizing disturbance. Effective termination requires intentional planning, a primary method, and a backup plan.

Termination methods and strategies

Freeze kill termination

Perhaps the simplest way to terminate a cover crop is to let the weather take care of it. Most cover crops will freeze kill at some point, though what temperature it takes depends on the plant. To help estimate cold kill temps for each species, you can refer to the species information tables in just a few pages. If you want to avoid using herbicides and you don't want to till or crimp, freeze kill may be the best termination method. Plan ahead to make sure the cover crop is planted at a time where it can accumulate enough growth to accomplish your soil health goals before the cold weather sets in.

Works best for:

- Summer or fall-planted cover crops
- Situations where spring regrowth is undesirable

Avoid if:

- You need spring growth
- You need weed suppression
- You're planting a spring cover crop



Tillage termination

Tillage, traditionally used for weed control, terminates cover crops by cutting roots and incorporating biomass into the soil. Less invasive implements like undercutters or high-speed discs will reduce soil disturbance compared to chisels or plows, though tillage still impacts soil structure and microbial life. Tillage should be done as shallow as possible to get the job done and ideally should always leave well-aggregated soil undisturbed below so that a more rapid biological recovery can occur. Tillage can reduce soil organic matter and increase erosion risk, so we only recommend it when other methods are impractical.

Works best for:

- Organic operations
- Fields that need accelerated residue breakdown

Avoid if:

- Erosion is a concern on sloped fields
- Maximum weed suppression is a priority



Chemical termination

The most common method for non-organic farmers, chemical termination uses herbicides, often combined with a weed burndown pass. You should always consult your agronomist or chemical salesman for herbicide recommendations tailored to species and field conditions, always following label directions.

Works best for:

- Terminating before a cash crop
- Avoiding tillage
- Diverse cover crops

Avoid if:

- You're certified organic



For best results when using herbicides:

- Terminate before the boot stage as later stages require higher rates.
- Use proper herbicide rates, adequate surfactants and gallons-per-acre for thorough coverage. Often using citric acid to lower water pH makes the chemicals more effective.
- Spray on warm, sunny days when plants are actively growing.



Photo credit: Matt Griggs

Roller crimp termination

Roller crimping kills cover crops by crushing stems to disrupt water and nutrient flow, preserving residue for soil cover. This is the best method for soil health benefits, as it avoids soil disturbance and maintains ground cover, but it does not work for everyone or in every situation. Timing is critical—crimping is most effective at anthesis (flowering and pollen shedding) through milk or dough stage. Plants like cereal rye are harder to terminate after the boot stage, requiring precise timing or a follow-up herbicide in non-organic systems.



Cereal rye shedding its pollen at anthesis.

We love diversity in a cover crop mix, but for the most effective crimper termination, we recommend simple mixes (e.g., cereal rye/hairy vetch or oats/peas), as diverse mixes are less suitable because different species in the mix will mature at different times.

Roller crimping works best for:

- Organic growers
- Simple or monocrop cover crops
- Cash crop systems

Avoid roller crimping if:

- You have a diverse mix with staggered maturity
- You don't have access to a roller crimper



High-quality roller crimpers are available commercially, or you can build your own using free blueprints from the Rodale Institute

rodaleinstitute.org/education/resources/roller-crimper-blueprints

Grazing or mowing termination

Grazing and mowing are less reliable for complete termination but suit specific scenarios. Grazing with high-density stocking and frequent moves, especially at reproductive stages can limit regrowth of most plants. Grazing enhances soil biology via manure and trampling but may require a secondary method like herbicide for full termination. Mowing can certainly set the cover crop back but may not completely terminate it. Mowing also chops residue into small pieces, causing rapid decomposition and uneven soil cover, which complicates planting.

Works best for:

- Forage crop systems
- When it's combined with another termination method

Avoid grazing or mowing if:

- You're planting a cash crop immediately
- You don't want to graze crops in the reproductive stage

Photo credit: Jim Elizondo



Timely termination ensures cover crops achieve objectives like nutrient cycling, weed suppression, and organic matter buildup without competing with cash crops.

Plan ahead, monitor growth stages, and maintain a backup plan to ensure your cover crop terminates successfully, enhancing soil health and supporting future crops.



Concept:

Planting green into a living cover crop and terminating after planting



“Planting green” refers to the practice of planting a cash crop directly into a living cover crop without terminating the cover crop beforehand. Instead, the cover crop is terminated shortly after the cash crop is planted, typically using methods like roller crimping, chemical termination, or mowing. This high level management approach contrasts with traditional methods where cover crops are terminated well before cash crop planting to avoid competition. Planting green leverages the benefits of a living cover crop during early cash crop establishment, maximizing soil health, weed suppression, and moisture retention while managing risks through strategic termination timing. Planting green requires no-till planters or seeders equipped to handle living cover crops and residue.

Considerations for planting green

Benefits:

Enhanced soil health

Living cover crops maintain root activity, fostering microbial diversity and nutrient cycling. Undisturbed roots enhance soil biology.

Weed suppression

The living cover crop acts as a mulch, reducing weed pressure effectively during early cash crop growth.

Erosion control

Green cover crops prevent erosion, especially in highly erodible fields.

Soil moisture

In wet springs, a growing cover crop can pull enough water out of the top several inches of the soil to allow quicker planting. Additionally the living roots give much greater trafficability in the field. After the cover crop is terminated it mulches the field and begins to save moisture through reduced evaporation and increased infiltration.

Extended cover crop benefits

Delaying termination allows cover crops to maximize biomass production and nutrient uptake, improving soil fertility for the cash crop.

Challenges:

Competition risk

Living cover crops can compete with cash crops for water, nutrients, or light if not terminated promptly. Cash crop planting and emergence must be timed with effective termination.

Timing sensitivity

Termination must align with cover crop growth stages (e.g., Anthesis for crimping, pre-boot for most effective herbicide efficacy) to avoid regrowth or reduced effectiveness.

Equipment needs

Planting into living cover crops requires specialized no-till equipment to manage residue and ensure seed placement.



6.

Why Cover Crops Pay Off

Cover crops are a no-brainer for soil health. They keep living roots in the ground, add diversity, and can even feed your livestock, hitting all six soil health principles.

But the big question we hear all the time is: “Will cover crops make me money?”

The answer is a resounding yes—if you manage them right. Cover crops deliver both quick wins and long-term gains. Some benefits, like grazing, nitrogen fixation, and nutrient cycling, show up in your bank account within a year. Others, like building organic matter, stopping erosion, and improving soil structure, take a bit longer but set your farm up for resilience against drought, floods, and rising input costs. Let’s walk through how cover crops can work for you, with a focus on the dollars-and-cents impact.

Grazing: turning cover crops into cash

Livestock feed is a huge expense—about 80% of total costs for most operations. Cover crops can slash those costs by letting your animals do the harvesting. Mechanically harvested feed, like hay or silage, racks up expenses for cutting, storing, and feeding. But when your livestock graze cover crops directly, you’re saving big. In the northern U.S., winter hay feeding is common, while southern farmers may need forage in summer. Cover crops bridge those gaps.

Stockpile forage

Plant a diverse summer cover crop mix to grow tons of biomass for winter grazing. Think of it like grazing corn stalks, but instead of leftover stubble, you’ve got lush, nutrient-rich cover crops designed for livestock. This cuts down on hay costs—sometimes by thousands of dollars. In northern regions with shorter growing season, people will do this as their only crop for the year, and they often find it to be more profitable than most grain crops. Where growing season allows, the stockpile can be planted after a summer harvested forage or grain crop.



Interseeding or post-harvest grazing

Interseed cover crops into corn at V3-V5 or in late summer, or plant them after small grain harvest. You get your grain crop and high-quality forage for fall, winter, or spring grazing. It's like growing two crops for the price of one! Diverse cover crops after wheat harvest can feed cattle through the fall and winter while rebuilding soil.

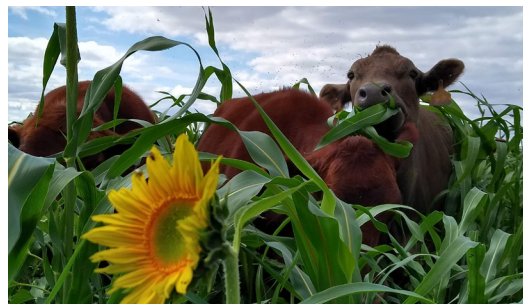


Photo credit: Diane Hesterberg



Want the nitty-gritty numbers and real-world data on grazing savings? Check out our articles *Making Cattle Your Cash Crop* and *Making Cattle Profitable With Year Round Grazing*:

greencover.com/cattle-profit

Nitrogen fixation: free fertilizer from the air

Since our atmosphere is 78% nitrogen, there are 30,000 tons of free nitrogen above every acre of ground in the world. But all that nitrogen is held in an inert form that plants cannot use. Legumes, like hairy vetch, clover, beans or peas will form partnerships with rhizobium bacteria to turn atmospheric nitrogen into plant-available forms. The legumes create carbon rich foods through photosynthesis which are used to feed and power trillions of bacteria that have formed nodule colonies on the plant roots where they convert the inert nitrogen to plant available forms. We have observed hairy vetch and winter peas produce over 200 pounds of nitrogen per acre for the next corn crop, but sometimes you have to wait late into the planting season before that is achieved!



Nitrogen-fixing nodule colonies on a cowpea plant.

Even a diverse mix with legumes can fix 60–120 pounds—enough to cut your fertilizer bill significantly. At today's nitrogen prices, that's real money saved.

Free-living nitrogen-fixing bacteria, like *Azospirillum*, *Azotobacter*, *Bacillus* and more are nature's little fertilizer factories that live independently in the soil, no host plant required. Unlike symbiotic bacteria like *Rhizobium*, which form big factories in legume root nodules, these guys work solo, turning atmospheric nitrogen (N_2) into ammonia (NH_3) that plants can use. This process, called biological nitrogen fixation (BNF), is powered by an enzyme called nitrogenase, which needs the carbon energy from plant root exudates to do its job. These free living bacteria are not as productive as *Rhizobium*, but can still contribute 30-50 pounds of nitrogen per acre and are a great natural way to boost nitrogen with less synthetic fertilizer expense. A cropping system that prioritizes soil health can produce a soil environment where these nitrogen-fixing free living bacteria can thrive.



Dive deeper with case studies in our article *Nitrogen by Nature* at greencover.com/nitrogen-by-nature

Nutrient cycling: unlocking your soil's hidden value

Your soil is a goldmine of nutrients, but plants often can't access these nutrients without help. Cover crops feed beneficial microbes that act like middlemen, unlocking nutrients like phosphorus, potassium, and micronutrients for your crops. A great way to see what you have available is to use the Total Nutrient Digest (TND) from your favorite soil lab. This test will show that most soils already have enough nutrients for healthy crops. For example, phosphorus is often abundant but locked up. Cover crops, especially diverse mixes, team up with microbes to make it available, reducing your need for synthetic fertilizers.



Dr. Christine Jones explains this beautifully in her video on the phosphorus paradox, showing how plant-microbe interactions cut input costs while boosting crop and soil health.

greencover.com/phosphorus-paradox

Herbicide savings with cover crops

Cover crops are a powerful tool for weed suppression, reducing herbicide use by outcompeting weeds, blocking sunlight, and sometimes releasing natural herbicidal compounds. Over time, these benefits compound, leading to significant cost savings, especially in systems like corn-soybean rotations where herbicide-resistant weeds are a growing problem.

According to the SARE bulletin *Cover Crop Economics* (2014), cover crops can reduce herbicide costs by suppressing weeds, particularly when used for grazing or managing herbicide-resistant weeds. While immediate savings may be modest, the payoff grows in years two and three as weed pressure decreases. A 2019–2020 SARE survey found farmers reported 39% savings on herbicide costs for corn and 41% for soybeans after adopting cover crops, with savings increasing over time as soil health improves and weed seedbanks shrink. A 2022 study from *Frontiers in Sustainable Food Systems* on cover crop-based system in Wisconsin showed that cereal rye cover crops suppressed early-season weeds in corn-soybean systems, reducing the need for postemergence herbicides. SARE's *Cover Crop Economics* warns that initial cover crop costs (seed, planting) may offset herbicide savings in year one, but savings grow in years two to three as weed pressure declines. Termination timing is critical—mistimed termination can increase herbicide use if cover crops survive and compete with cash crops.

Photo credit: Allen Willmore

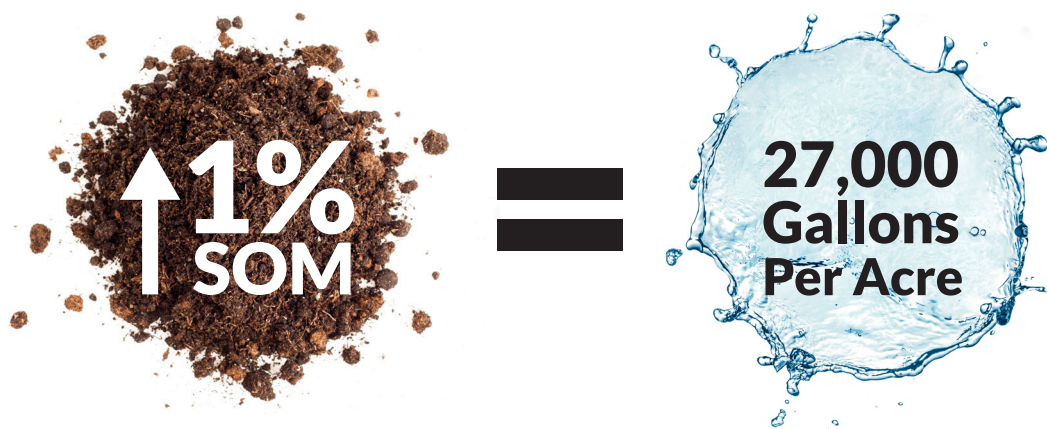


Long-term gains: building wealth in your soil

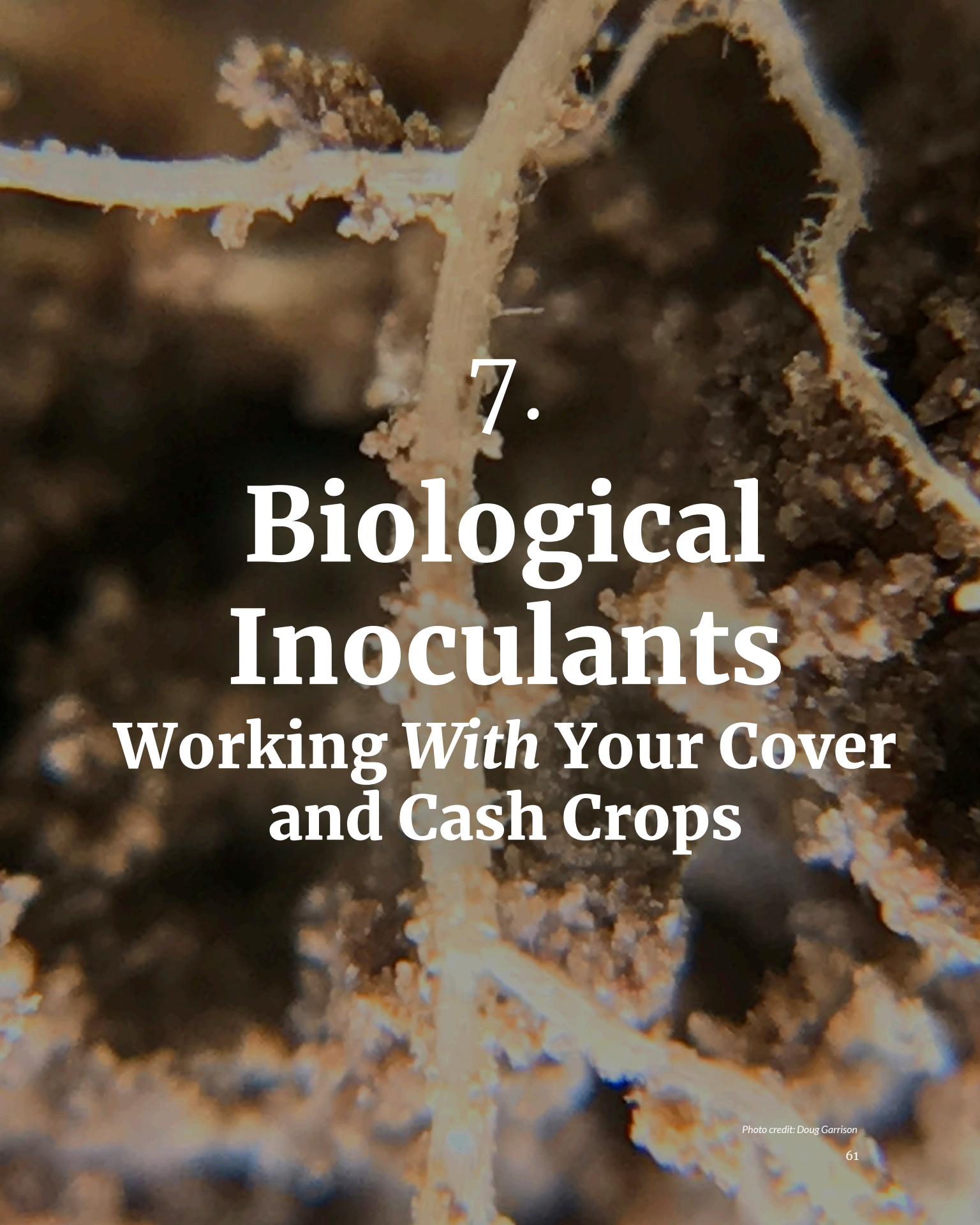
Some cover crop benefits take a few years to show up, but they're game-changers. Stopping erosion keeps your topsoil—packed with minerals and biology—on your farm. Many of our agricultural soils that are being farmed conventionally are losing 5-7 tons of soil per year. Cover crops can easily cut that loss in half and may even save up to 80% of the soil that would have otherwise been lost.

Building organic matter increases water-holding capacity, making your fields more resilient to drought and floods. Improved soil structure means better root growth, less compaction, and better water infiltration. These benefits compound over time, reducing input costs and stabilizing yields. NRCS testing has documented that a farm using cover crops can have infiltration rates 5-10 times as high as a conventionally farmed field with no cover crops. That makes a huge difference when a big intense rainfall event is the only moisture that we see for weeks.

Once we get the water into the soil with better infiltration, we have to be able to hold on to it. A 1% increase in soil organic matter (SOM) can hold an extra 27,000 gallons of water per acre, which is huge for dry years. Also the nutrient value of an extra 1% of soil organic matter is worth more than \$1,000 per acre, so even small increases in your soil are very valuable.



Cover crops aren't just a win for soil health—they're a win for your wallet, too! They deliver quick savings by slashing feed costs through grazing, fixing nitrogen with legumes and free-living bacteria, and cutting herbicide use. Over time, the benefits grow even bigger: cover crops can save up to 80% of your topsoil from erosion, boost water-holding capacity by 27,000 gallons per acre for every 1% increase in organic matter, and improve soil structure for stronger, more resilient yields. Use our SmartMix Calculator at [greencover.com](https://www.greencover.com) to design mixes that fit your farm, start small, and watch those savings stack up. Cover crops are an investment in healthier soil and a more profitable future.

A close-up photograph of plant roots, likely from a cover crop, growing in dark, rich soil. The roots are light-colored and fibrous, branching out across the frame. The soil is dark brown and appears moist.

7.

Biological Inoculants

**Working *With* Your Cover
and Cash Crops**

Photo credit: Doug Garrison

Biologicals aren't just another input—they're partners in your crop system.

Biologicals work hand in hand with cover crops and, really, with any plant that's rooted in the soil. For thousands of years, plants have relied on complex relationships with millions of soil microbes to access nutrients like nitrogen, phosphorus, calcium, and even water. But during the Green Revolution, we began “spoon-feeding” crops with synthetic fertilizers and as a result, many plants stopped forming these critical partnerships with microbes. When plants stopped needing microbes, the microbes lost their food source and their habitat—many either died off or went dormant.

Today, many soils are depleted of microbial life, which means plants have lost their natural pathways to absorb water and micronutrients. This leads to increased dependency on synthetic fertilizers and chemical pesticides just to keep crops alive and productive. That's why we strongly recommend incorporating biological inoculants into your system—especially alongside cover crops. These relatively inexpensive products can be applied directly to seed before planting, reintroducing beneficial microbes into your soil. And when paired with diverse cover crops, you're not just planting biomass—you're building microbial housing and creating jobs for soil life.



Roots growing in soils that are depleted of microbial life are bare. Because they have no protection from pests and disease from microbes, they are dependent on synthetic fertilizers and pesticides.

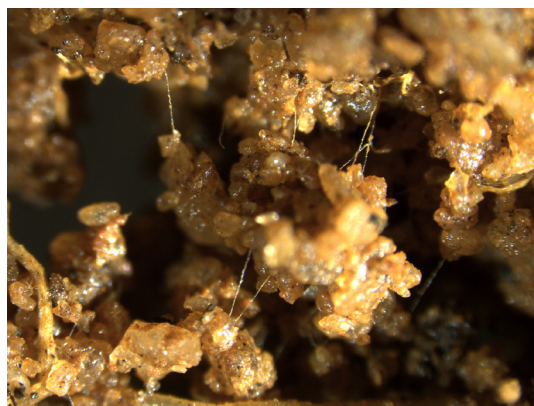


Photo credit: Phil Lee

Roots growing in soils with healthy microbial populations are protected by a quorum of microorganisms that give the plant access to water and nutrients that protect it from stress and disease.

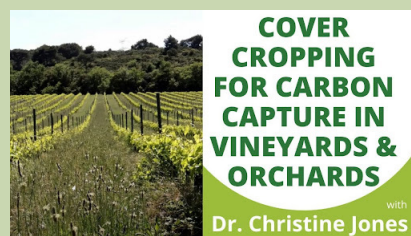
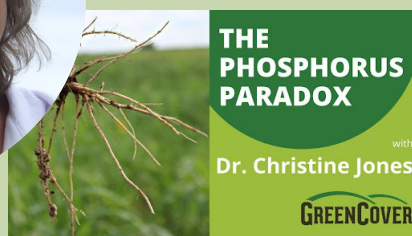


Read Dr. Christine Jones's article *Quorum Sensing and Auto-Inducers in the Soil Microbiome* for more on how plants and microbes interact.

greencover.com/quorum-sensing

Most soils can naturally recover their biological populations given time and the right conditions, however, adding beneficial microbes can significantly accelerate this process. Many row crop soils across the country are depleted of microbial life due to practices like tillage, synthetic fertilizers, pesticides, monocropping, and erosion. By inoculating seed with microbes and the signaling molecules that they produce, farmers can more quickly rebuild microbial populations, enhancing nutrient cycling, soil structure, and crop resilience. This approach helps reverse the damage caused by conventional farming, fostering healthier, more productive soils in less time.

Microbes, including bacteria and fungi, enhance nutrient uptake, improve plant resistance to pests, diseases, and environmental stresses like drought, and contribute to soil health. Our friend and renowned soil health specialist, Dr. Christine Jones, talks about the need for biological induction. This refers to microbes colonizing plant roots, stems, and seeds, fostering a robust plant microbiome. Diverse cover crops are critical, as their root exudates feed microbes, enhancing soil structure and nutrient cycling. Biostimulants, such as compost extract or seaweed applied to seeds, can amplify microbial activity. However, high-analysis fertilizers and pesticides can disrupt these microbial interactions, negatively impacting soil health. Diverse plant systems and reduced chemical inputs promote a thriving soil microbiome, leading to improved crop yields, lower input costs, and greater soil resilience. By leveraging these natural processes, farmers can build sustainable, productive agricultural systems.



Learn more about how microbe scan provide plants with the nutrients they need in our webinar series with Dr. Christine Jones.

greencover.com/dr-christine-jones-webinars

What are biological inoculants?

Imagine your gut after taking antibiotics: they target harmful pathogens but also wipe out beneficial microbes. To recover, you eat probiotic foods like yogurt or sauerkraut to restore healthy gut bacteria. Soil works similarly. Practices like tillage, herbicides, and pesticides not only control pests but also harm beneficial soil microbes and other life. Minimizing these disturbances is a key principle of soil health, but some damage is already done, and certain practices may still be necessary. Fortunately, biological products—like soil probiotics—can help.



Similar to how probiotic foods like sauerkraut and yogurt reintroduce good microbes to your gut, biological inoculants can reintroduce good microbes into your soil.

These products, such as microbial inoculants, reintroduce beneficial bacteria and fungi to the soil. They foster symbiotic relationships with plants, boosting nutrient uptake, plant resilience, and overall soil health. Just as yogurt repopulates your gut with good microbes, biological products restore the soil's microbial community, helping it recover faster and support healthier crops.

Biologicals are products made from natural, biological sources that enhance farming practices and outcomes. These include microbial inoculants, beneficial organisms, and other natural compounds that support crops, soil, and farm management. By reducing the need for synthetic chemicals, biologicals promote sustainable, eco-friendly farming. They improve soil health by boosting microbial activity, enhancing nutrient uptake, and increasing crop productivity. As a natural alternative to conventional inputs, biologicals contribute to a healthier, more sustainable farming system that benefits both the land and your bottom line.

Biological products include bio-pesticides and bio-fungicides, which control pests and diseases with minimal environmental impact; bio-fertilizers, like nitrogen-fixing (*Rhizobium*, *Azotobacter*) and phosphate-solubilizing bacteria, which boost nutrient availability; bio-stimulants, which improve plant growth and stress tolerance; and Plant Growth Promoting Rhizobacteria (PGPR), which enhance nutrient uptake and protect against pathogens in the root zone. By reducing reliance on synthetic chemicals, biologicals improve soil structure, nutrient cycling, and crop resilience, supporting eco-friendly farming and long-term productivity.



Learn about soil biology as well as compost extracts, biological seed inoculants, and more in our biologicals webinar series.

greencover.com/biologicals-webinars

What types of biological products are available?

Hundreds of biological products are on the market right now and many are good products. At Green Cover, we carry a number of high quality biological products that can be applied directly to cover crop seed, which is one of the most efficient and economical ways to introduce biology into your soil. All of these products meet the standards of the National Organic Protocol.

RhizoBac X-Tend Broad-Spectrum Seed Inoculant

RhizoBac X-Tend is a robust, broad-spectrum biological seed inoculant. It contains a high concentration of nitrogen-fixing rhizobia tailored for legumes like peas, vetch, cowpeas, sunn hemp, and soybeans, alongside free-living nitrogen fixers such as *Azotobacter* and *Azospirillum*. It also includes phosphorus-solubilizing bacteria *Bacillus megaterium* and *Pseudomonas fluorescens*.

MycoGreen NPK Diverse Biological Seed Inoculant

MycoGreen NPK is a dual inoculant designed to enhance soil health and crop performance through a blend of ten functionally diverse mycorrhizal fungi and eight beneficial bacterial species. The diverse blend of mycorrhizal fungi species form symbiotic relationships with plant roots, improving nutrient and water uptake, particularly phosphorus, while enhancing soil structure and plant resilience to stress. The bacterial species include free-living nitrogen fixers, phosphorus-solubilizing bacteria and even potassium-solubilizing bacteria. Additionally, four bacteria species known for enhancing plant growth and suppressing root diseases are included.

BioCoat Gold™

BioCoat Gold™, from Advancing Eco Agriculture (AEA), is a dry-blend seed treatment designed to enhance seed germination and early plant vigor in regenerative agriculture. It combines seaweed, calcium, humic substances, and multiple species of mycorrhizal fungi and 20 beneficial bacteria species to promote rapid, uniform germination and robust root development.

elevate'd Fungi

Elevate'd Fungi from Elevate Ag is a shelf-stable liquid microbial inoculant designed to enhance soil health and plant performance by introducing a diverse, fungal-dominant microbial population. It targets soils where bacterial populations have been restored through regenerative practices but lack essential fungi, even after decades of effort. Applied as a liquid seed treatment, it delivers a broad spectrum of beneficial fungi from a higher trophic level source than earthworms, complementing bacterial inoculants. These fungi improve soil aggregation, nutrient cycling, and plant nutrient uptake, particularly phosphorus, while enhancing root growth, soil structure, and moisture retention.

SeedFlare

SeedFlare, from AEA is a liquid mineral seed treatment designed to enhance germination and early plant health. It delivers essential trace minerals like magnesium, sulfur, cobalt, copper, molybdenum, manganese, and zinc directly to the seed, compensating for nutrient deficiencies in commercial seeds. This promotes rapid, uniform germination, early chlorophyll production, and robust root development, reducing insect susceptibility and boosting reproductive bud and leaf size for larger fruit and grain yields.

Remember: there's no magic bug in a jug.

With the surge of biological products on the market, it's easy to get swept up in promises, but microbial products work best as part of a whole-system approach—one that includes living plants, diverse biology, and long-term thinking. Trial them on your own farm to see what truly works in your soil. When you take a big-picture approach, combining cover crops with biologicals, you're not just growing plants—you're growing healthier soil and a more resilient farming system. A healthy soil system will eventually no longer need the addition of biology, but until you reach that point, a little bit of inoculation can go a long way!



8.

Where Do Cover Crops Fit in My Operation?

Most farmers already have an established crop rotation routine. The good news, is cover crops can fit into virtually any system.

But the truth is, a longer, more diverse rotation builds soil health faster and more effectively. We encourage you to evaluate your current rotation and consider extending it to maximize benefits. Below are examples of common U.S. crop rotations with timelines for integrating cover crops. These are just starting points—there’s endless room for creativity to tailor cover crops to your unique operation. Experiment to find what works best for your fields!

Corn and soybean rotation with cover crops

The traditional corn and bean rotation that dominates much of the US agricultural landscape is simply not an avenue for building soil health. However, with a couple simple changes, you can start to see decreased weed pressure, fewer pests, increased soil carbon and more weather resiliency in your fields.

Year One:

Cash Crop: Corn	Fall-planted Cover Crop: Pre-Bean Mix* (Cereal Rye, Rapeseed, Flax)
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Year Two:

Cash Crop: Beans	Fall-planted Cover Crop: Pre-Corn Mix* (Winter Barley, Hairy Vetch, Camelina)
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**Terminate early in the spring if it’s dry, or if you’re concerned about moisture.*

Cover crops can fit into a corn-soybean rotation, boosting soil health and cutting costs. Cereal rye is a popular choice to start with, planted after corn and before soybeans. Rye keeps living roots in the soil during the off-season, reducing wind and water erosion. Its massive biomass suppresses weeds, potentially saving one herbicide pass in spring, while its deep roots break up compaction and improve water infiltration. Rye is versatile and can be terminated in various ways, making it a great entry point for farmers new to cover crops.

For added diversity and depending on the planting date, consider adding a brassica like rapeseed or a broadleaf plant like flax. Rapeseed, a cold-tolerant brassica, thrives when planted in mid-fall, enhancing soil structure. Flax, a cool-season crop, may produce less biomass but supports mycorrhizal fungi, which are vital for healthy, drought-resistant crops. Flax will winter-kill when you drop below 20 degrees, so pay attention to the planting timing.

A challenge with this rotation is the tight planting window—corn harvest often stretches into October or November, when many cover crops struggle to germinate or survive. Rye shines here, as it can be planted late and still grow vigorously in spring, outcompeting weeds and protecting soil. Rye is very unique in that it will germinate in soils as cold as 34 degrees and if the temperature is in the high 30's and the sun is shining, cereal rye will be photosynthetic. No other cover crop will do that, which is what makes rye such a popular choice—especially for late plantings.

After soybeans and before corn, earlier harvest allows options like winter barley, hairy vetch, or camelina. Winter barley, another cold-tolerant grass, avoids rye's allelopathic effects, making it ideal before corn. Hairy vetch can fix significant nitrogen (60–200 pounds per acre), but it requires growing into late spring for maximum benefit, delaying corn planting. Camelina adds diversity and soil health benefits.

While a corn-soybean rotation works, it limits soil health gains compared to longer rotations. Adding a small grain, like wheat, creates more opportunities for diverse cover crops and grazing, especially if you integrate livestock, taking soil health and profitability to the next level.



Corn, soybean, and wheat rotation with cover crops

Adding a small grain like wheat, rye, or oats to your corn-soybean rotation creates a prime opportunity to integrate diverse cover crops. Harvested in summer, small grains open a wide window for planting both warm- and cool-season cover crops, capturing sunlight to produce abundant biomass. This biomass feeds soil microbes, reduces erosion, breaks up compaction, boosts water-holding capacity, and suppresses weeds, building a healthier, more resilient soil system.

Year One:

Cash Crop: Corn	Fall-planted Cover Crop: Pre-Bean Mix* (Cereal Rye, Rapeseed, Flax)
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Year Two:

Cash Crop: Beans

Year Three:

Fall-planted Cash Crop: Wheat	Summer-planted Cover Crop: Post-Wheat Mix (Sunn Hemp, Forage Sorghum, Sorghum Sudan, Radish, Sunflower, Buckwheat)
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**Terminate early in the spring if it's dry, or if you're concerned about moisture.*



A post-wheat cover crop mix can include a variety of species—grasses, legumes, brassicas, and broadleaves. This diversity supports beneficial microbes, unlocking nutrients like phosphorus and potassium already present in the soil. Legumes in the mix, such as hairy vetch or cowpeas, can fix 60–120 pounds of nitrogen per acre, reducing fertilizer costs for the next crop. These mixes create a thriving environment for soil biology, enhancing nutrient cycling and soil structure.



Economically, small grains may yield less than corn or soybeans, but pairing them with a grazing cover crop can boost profitability.

If you have livestock, summer cover crops provide high-quality forage, cutting feed costs. Without livestock, you can lease grazing rights to neighbors or grow a stockpile mix for late fall or winter use. Summer is ideal for generating significant biomass, so seize this chance post-harvest to maximize both soil health and income.

Other scenarios for cover crops

Interseeding cover crops into corn

Interseeding cover crops into corn is gaining traction as a way to boost soil health and farm profitability in corn-soybean rotations, where tight planting windows often limit cover crop options. By planting cover crops before the corn is harvested, farmers can add diversity that enhances soil biology, suppresses weeds, and provides grazing opportunities. There are two main interseeding strategies, each with unique benefits and considerations.

Early interseeding (V3–V5 stage)

Planting cover crops at the V3–V5 corn growth stage allows corn to establish without competition while giving cover crops time to grow before the corn canopy closes. Research, including Green Cover's trials, shows cool-season species like annual ryegrass, hairy vetch, red clover, and brassicas do best in this system, especially in 30-inch rows, due to their shade tolerance. These mixes can produce decent biomass per acre by fall, especially in wider corn row spacings, reducing weeds, supporting soil biology and providing excellent supplemental grazing.





Late interseeding (Dry-down stage)

Broadcasting cover crops during corn dry-down, typically in late summer, is another option. Smaller-seeded species like brassicas (radish, turnip) or clovers work best due to their ability to germinate on the soil surface with adequate moisture. Aerial seeding or high-clearance spreaders are commonly used, though success depends on rainfall or irrigation. Winter-hardy species like cereal rye, annual ryegrass or hairy vetch can overwinter for added weed control, biological benefits and grazing.

Residual herbicides, such as atrazine, can hinder cover crop establishment in either an early or late planted scenario, so make sure your herbicide plan is conducive to the cover crop species you are wanting to grow. Always consult an agronomist, or an herbicide salesman, and the herbicide label for more information.



Photos courtesy of Jeey Luhniers



Interseeding cover crops into pasture

In addition to adding cover crops to your row crops you can also utilize them in pastures. There are two main scenarios that provide opportunities for additional forage production.

Interseeding summer annuals into cool-season grass sods

Interseeding summer annuals into cool-season grass pastures boosts summer grazing or stockpiles forage for fall, enhancing pasture productivity. To succeed, graze or hay the pasture low just before the summer slump to reduce competition, then interseed promptly. While less reliable than planting into a bare seedbed, interseeding still improves biomass and forage quality compared to unplanted sods. As always, including a control area is helpful for comparison.

For summer grazing, plant species like dwarf BMR sorghum-sudan, forage soybeans, cowpeas, mung beans, sunn hemp, buckwheat, pearl millet, teff, or crabgrass (teff and crabgrass can be broadcast; others should be drilled). For fall stockpiling, use photoperiod-sensitive BMR sorghum-sudan, sunflowers, safflower, and cowpeas. Interseeding also enhances wildlife habitat, attracting deer, birds, and insects. Legumes, like cowpeas or sunn hemp, often perform better in subsequent years due to improved nodulation when planted into soils that have had that legume family in the soil before.

Interseeding into perennial warm-season grasses

Interseeding into perennial warm-season grasses, like bermudagrass or native prairie species (big bluestem, switchgrass), extends grazing, boosts forage quality, and enhances soil health. Warm season pastures benefit from interseeding cool season annuals to provide a boost in the dormant season, increase protein and minerals, add nitrogen via legumes, and extend photosynthesis for soil-building root exudates. Interseeding can occur in late summer/early fall or winter/early spring. Winter annuals like cereal rye, triticale, annual ryegrass, crimson clover, balansa clover, vetch, peas, and forage collards can work very well in these situations. With proper timing and good fall and winter moisture, an additional 1-3 tons of forage can be achieved while building soil carbon and keeping your microbial population happy and fed.





Prevent plant

Rain is good — but sometimes you have too much and cannot get your cash crop planted, leading to fields that qualify for the “Prevent Plant” program. While missing a cash crop is a setback, it opens the door for innovative cover crop strategies and gives a unique opportunity to benefit soil health, break up traditional crop rotations, and add biodiversity to your system.

Prevent plant acres can be used to establish diverse, multi-species cover crop mixes that improve soil biology, suppress weeds, interrupt disease cycles, produce and cycle nutrients, and even provide valuable livestock forage when allowed (grazing is typically allowed after November 1, per program rules).

When choosing a cover crop mix, farmers should begin by asking: What is your goal? Options might include suppressing weeds, fixing nitrogen, building soil organic matter, or providing late-season grazing. Each of these goals will point to different species or mixes. Also herbicide carryover from prior applications must be considered, as it may affect cover crop viability and grazing safety. Be sure to consult chemical labels and do bioassay tests in the fields using seed samples (Green Cover is happy to send out seed samples for this purpose).



Cover crops after a hailed-out cash crop

Experiencing crop loss due to hail, wind, or flooding is difficult, but there are productive ways to recover value from damaged fields. One key strategy is using cover crops—especially when combined with livestock—for forage, soil health, and nutrient management.

If you have livestock, planting warm-season forage crops in mid-summer can provide valuable grazing or hay. Later in the season, cool-season options like ryegrass (planted after August to avoid heat dormancy) are effective. Even if you don't own livestock, partnering with neighboring cattle producers can turn a lost crop into a grazing opportunity. Before planting cover crops, always evaluate your herbicide history. Residual chemicals may prevent certain species—especially legumes—from germinating. To test safety, rake in a small “test plot” of various seeds to observe growth before committing to a full field planting. Often you may want to avoid legumes if you recently applied herbicides, as they're more sensitive. When seeding into damaged corn, which typically leaves excess nitrogen in the soil, nitrogen production from legumes is not needed. Excluding legumes also reduces seed cost while helping tie up nitrogen to prevent leaching. Whether your goal is to recoup lost revenue through forage production or simply protect soil health with living roots, planting a well-planned cover crop mix is a sound recovery strategy.

Companion cover crops

Companion Cover Crops (CCCs) are short-lived plants sown alongside cash crops to support soil health, biodiversity, nutrient cycling, and overall farm profitability. Rooted in ancient practices, companion cropping lost ground to monoculture systems but is regaining popularity due to its ecological and economic benefits. CCCs fill niches above and below ground, suppress weeds through canopy shading, reduce the need for herbicides, break pest and disease cycles, and support beneficial insects. They are not meant to compete with the main crop long-term; they either winter-kill or are terminated before critical growth stages. This strategy fosters a healthier, more resilient agroecosystem.

Farmers often use CCCs like rye, oats, radishes, clovers, peas, sunflowers, flax, and phacelia to improve soil aeration, water infiltration, and organic matter. Diverse mixes release a variety of root exudates, enhancing microbial activity and leading to more vigorous crop growth. These benefits support reduced inputs—such as fertilizers, seed treatments, herbicides, and insecticides—while improving yields. Real-world examples include planting radish or lentils with winter wheat, which improve yield and grain quality, or mixing oats with flax to deter mites without insecticides. Systems like BioStripTill use strips of radish and fava bean for early corn planting and nutrient concentration, while CCCs in canola support overwintering, resist pests, and improve moisture retention.



Photo courtesy of Iyadnyla Sharma

Frost-sensitive companions such as buckwheat and flax alongside winter canola.

Success with Companion Cover Crops depends on timing, seeding rates, moisture availability, and farm-specific variables. Adaptive management is essential. Used strategically, CCCs compost in place, recycle nutrients, and enhance ecosystem services while reducing synthetic input dependence—contributing to long-term sustainability and profitability.

Summer fallow replacement cover crops

Farming in the arid High Plains is extremely challenging due to limited rainfall, high evaporation, and unpredictable moisture. Many farmers assume the region is too dry for cover crops, however some innovative producers are proving otherwise.

Traditionally, the area relies on a wheat–fallow–corn–fallow rotation, which often leaves soil bare, hard, and vulnerable to weeds like kochia and Palmer amaranth. Innovators have been planting cover crops during the long fallow period before wheat—directly opposing conventional advice to keep fields bare to preserve moisture. The results have been promising. Instead of needing five herbicide passes during fallow periods, now only one or two are needed. Some weeds are even grazed by livestock, turning a nuisance into a resource. Grazing cover crops not only provides forage and supplemental income, but also helps rest perennial pastures and expand the cow herd without buying more land.

Though cover crops use some moisture, farmers have observed improved water infiltration and reduced evaporation thanks to cover residue. The key to success is receiving rainfall after terminating the cover crop—this allows the moisture to be stored more efficiently than on bare soil. Crop yields after cover crops have varied, depending on rainfall, but long-term improvements in soil health, increased organic matter, and better phosphorus availability are clear. When both grazing income and lower weed control costs are considered, the benefits outweigh the seed costs.





Cover crop benefits to wildlife

Cover crops provide significant benefits not only for soil and crops but also for surrounding wildlife. By keeping living roots in the soil and maintaining ground cover year-round, cover crops create habitat and food sources for a wide range of wildlife species. Birds, insects, pollinators, and small mammals all find refuge in the increased plant diversity and cover, especially during times when cash crops are not actively growing. Flowering species in cover crop mixes support pollinators like bees and butterflies, while the dense vegetation offers protection and nesting sites for birds and other creatures. Additionally, cover crops help build healthier soils that support more nutritious and diverse forage, indirectly benefiting larger wildlife like deer and turkeys. By minimizing soil disturbance and reducing chemical inputs, cover crops contribute to cleaner water and healthier ecosystems, making farmland a more welcoming and sustainable environment for wildlife of all kinds.



Photos courtesy of Grant Woods and GrowingDeer.TV



Cover crops for gardens

Cover crops are a powerful tool for improving soil and the size of the field or plot does not matter! Cover crops can improve the health of your garden soil health naturally and effectively. They suppress weeds, increase organic matter, enhance soil structure, and make nutrients more available to your plants—leading to healthier, more nutritious harvests. Unlike commercial farming, gardens offer the flexibility to use cover crops in a wide range of creative and beneficial ways.

Some practical applications include planting overwintering mixes in the fall to create mulch for spring transplants, using cool season mixes in early spring or fall, and filling empty beds between crops to keep soil covered and thriving. Cover crops can also be used to prepare new garden beds, attract pollinators and beneficial insects, or even be planted between garden paths as living walkways.

Planting is simple: broadcast seed over a clean seedbed, lightly rake it in, add straw mulch, and water until established. For termination, gardeners can crimp, mow, tarp, till, graze, or even use hand tools, depending on scale and context. Foot crimping—done with basic materials like wood and rope—is an effective DIY method that leaves a valuable mulch layer in place.



Crimped cover crops provide a dense mulch for garden vegetables.



9.

Soil Health and Regenerative Agriculture

Cover crops are essential for soil health and play a key role in applying all soil health principles.

Cover crops...

- **Keep the Ground Covered**, protecting the soil from erosion.
- **Maximize Diversity**, enriching ecosystems with varied plant life.
- **Minimize Disturbance**, preserving soil structure.
- **Maintain Living Roots**, promoting soil vitality year-round.
- **Support Livestock Integration**, enhancing land productivity.

Following these soil health principles is the first step toward restoring and rebuilding the land. However, for many farmers, soil health is not the end goal. The term Regenerative Agriculture is often used interchangeably with soil health, but they are distinct concepts. Soil health is a cornerstone of Regenerative Agriculture, as restoring life to the soil supports all life on Earth. However, Regenerative Agriculture extends beyond soil to encompass the broader environment and, crucially, people. It involves:

- Restoring the relationship between farmers and the soil.
- Strengthening farmer-to-farmer connections.
- Rebuilding communities.

By nurturing both the soil and human relationships, Regenerative Agriculture fosters a regenerative lifestyle, driving true healing and growth for the land and its communities.





Photo credit: Jodi Lathrop

Redefining environmentalism

What do you think of when you hear the term “environmentalism”? For many farmers, it conjures images of angry, militant activists chaining themselves to trees or protesting fossil fuels. That’s not who we are, and it’s not the vibe we want. But as farmers—whether we’re managing vast fields or a backyard lawn—we’re inherently tied to the environment. Our work shapes the land, water, and ecosystems. So how should we think about environmentalism? We believe that it is all about being caretakers of creation, a role that aligns with both farming and, for many, a biblical worldview.

We are writing this to farmers, ranchers, and anyone who grows something, but we frame much of the discussion from a Christian perspective, as that’s the foundation for Green Cover and for many of our customers. But even if you don’t share that faith, the same principles apply and we think they will make sense to you. Farmers should be the best environmentalists—not in the angry, destructive sense, but as stewards who actively improve the land.

The biblical call to dominion

An often misunderstood concept that often confuses us is “dominion,” drawn from Genesis 1:26-28, where God gives humanity dominion over creation—fish, birds, and every living thing. Historically, some farmers and Christians have misinterpreted this as a license to exploit the land, thinking, “God gave us this, so we can do whatever we want.” This mindset has led to environmental degradation, from soil erosion to nutrient depletion. We believe that the dominion God gave Adam does not mean domination but responsible authority.

Genesis 2:15 demonstrates this, where God places Adam in the Garden of Eden “to work it and keep it.” The Hebrew words here—*avad* (to work or serve) and *shamar* (to keep or protect)—suggest a role of serving and protecting creation, not exploiting it. This is a far cry from the “do whatever you want” attitude. Instead, dominion means caring for the land with intention, ensuring

it thrives for future generations. We acknowledge that many who are reading this likely already embrace this mindset, but we need to spread this perspective to other farmers who see dominion as a blank check for resource extraction.

Rethinking stewardship

The term “dominion” from Genesis 1:26-28 is often equated with stewardship, and many farmers proudly call themselves stewards of the land. This term captures the idea of responsibly overseeing and protecting something valuable, like our soils, water, and ecosystems. But we believe that stewardship alone is not enough. Stewardship focuses on preserving what’s there, much like sustainable farming maintains the status quo. The problem? Our resources—soil, water, biodiversity—are degraded. We’ve got eroded fields, depleted nutrients, and broken systems that need more than preservation; they need restoration.

Stewardship is a defensive strategy, protecting what we have. But dominion, the biblical term, implies action—exercising authority to improve and regenerate. It’s offensive, in the best sense, pushing us to fix what’s broken. Our soils shouldn’t just be sustained; they need to be rebuilt through practices like cover cropping.

“StewMinion”: A new mindset

To bridge the gap between passive stewardship and active dominion, our co-founder and co-owner, Keith Berns, coined the word “StewMinion.” It’s a playful blend of stewardship (care and protection) and dominion (authority and initiative). While it is not a biblical term, it does capture the dual responsibility of farmers. Stewardship alone, which focuses on preserving what’s there, isn’t enough when soils and ecosystems are degraded. We need to take action to restore and improve them, showing initiative to make things better.

Stewminion means exercising responsible authority—nurturing, protecting, managing, and regenerating creation. At Green Cover, our mission reflects this: to help people regenerate, steward, and share God’s creation for future generations.



Intrigued by the call to stewardship that rebuilds the land? Watch Keith’s ***StewMinion*** talk.

greencover.com/stewminion

The parable of the talents: A call to action

To illustrate this concept, we can turn to the New Testament parable of the talents (Matthew 25:14-30). Jesus tells of a master who entrusts three servants with bags of gold (talents) before a journey. The servant with five talents doubles his investment, earning five more. The servant with two talents doubles his to four. But the servant with one talent buries it, returning it unchanged. The master praises the first two, saying, “Well done, good and faithful servant,” and rewards them with more responsibility. The third servant, however, is called “wicked and lazy” for merely preserving the talent without growth. The master takes his talent and gives it to the servant with ten, casting the lazy servant out.



There is a strong parallel to regenerative farming. The third servant was a steward, protecting what was given, but he failed to improve it. God calls us to actively use, increase, and improve what we’ve been entrusted with—our land, resources, and talents. This requires risk and effort, not just preservation. At Green Cover Seed, we strive to practice this in our core value of “always growing.” It’s a play on words—keeping fields growing with cover crops and encouraging ourselves and our customers to grow in knowledge.

Understanding creation

To be good stewminions, we need a broader view of creation. It’s not just soil, though that’s a big focus for most of us. Creation includes water, animals, insects, microbes, families, and communities. We urge farmers to think beyond their fields, considering how their practices impact local ecosystems and human systems. For example, cover crops don’t just build soil—they improve water quality by reducing runoff and support biodiversity by attracting pollinators.

Creation is very complex, but we believe there are four key truths about creation:

It's All-Inclusive: Creation encompasses soils, water, livestock, wildlife, and communities. Our responsibility extends to all these elements.

It's Intelligently Designed: The powerful concept of irreducible complexity shows us that you and I and all of nature are not just the total of many mutations and happy accidents, but rather are intelligently designed. We can clearly see this in systems like soil microbiology that are so intricate that removing one part (e.g., microbes) causes dysfunction. Creation was designed to work, giving us confidence we can restore it.

It's Good and Very Good: Genesis 1:31 declares creation “very good.” Despite current degradation, our goal is to restore it to this state.

It's Fruitful and Abundant: Creation was designed to produce (Genesis 1:28). As farmers, we align with this by fostering systems that thrive naturally.

These truths guide regenerative farming, encouraging us to work with creation's design, not against it.

Creation's brokenness and restoration

We acknowledge that creation is broken—eroded soils, resistant weeds, and degraded human systems such as community disconnection. But the good news is that creation wants to be restored. We have seen farmers plant diverse cover crop mixes and integrate livestock, marveling at how quickly soil organic matter rebounds. These systems, when managed regeneratively, snap back to their designed state because they were built to thrive.

We draw comfort from the biblical promise that God will one day fully restore creation. Until then, we're called to restore our piece of it—our fields, families, and communities. This includes recognizing people as part of creation, fearfully and wonderfully made (Psalm 139:14). Even those we disagree with deserve respect, as they're part of God's design. This shifts how we interact and should encourage us to foster regenerative relationships.



Regenerative living: Giving more than you take

We like to think about the concept of “regenerative living,” applying regenerative agriculture’s principles—giving more than you take—to personal life. Just as cover crops add more carbon to soil than they remove, we should contribute more than we extract in these four areas:

Work: Be a regenerative worker, giving more value than your pay. If you earn \$15 an hour, deliver \$18 worth of effort. If you are making \$80,000 per year, bring \$100,000 worth of value to your company. This mindset leads to promotions and opportunities, as we have seen within Green Cover’s team and other businesses around us.

Finances: Just as you cannot increase soil organic matter without putting more carbon into the soil than what you are taking out, you cannot increase your savings if you spend more than you earn. Live below your means, saving more than you spend. Personal debt, like national debt, limits your ability to help others or seize opportunities. When you are financially sound, you have the ability to help others in so many ways, but when you are deep in debt, you are greatly restricted in being able to help others.



Photo credit: Tom Turner

Relationships: Invest more in relationships than you take. We can all picture someone who exemplifies this by always giving more to a relationship than they take. They build strong connections with other people by giving of themselves generously. Regenerative relationships create a support network for farmers, reducing stress and addressing issues like depression and suicide.

Community: Contribute to your local community, church, or even online groups by putting in more effort and value than what you are extracting. Communities thrive and grow when givers outnumber takers. Challenge yourself every day to help build community wherever you are and with whoever you are dealing with.

Regenerative living ensures you leave every sphere of your life—work, finances, relationships, community—better than you found it, just like regenerative farming improves soil and regenerative farmers leave the land better than they found it.

Share this mindset with family, friends and neighbors and challenge each other to embrace stewardship—actively nurturing and regenerating creation. Drop the term in conversations. It's a great way to spark discussion about responsible land care and regenerative living! By blending stewardship's care with dominion's initiative, we can restore degraded soils, rebuild communities, and live regeneratively—giving more than we take. Cover crops are a practical start, aligning with creation's intelligent, fruitful design. Let's be the best environmentalists, not through anger, but through action, leaving the land and our lives better for those who come after us.



10.

Embracing Cover Crops:

A Journey to
Regenerative Farming

Photo credit: Peyton Ward



If this resource sparked new questions while answering others, that's a good sign—you're on the path to mastering cover crops.

Like any new skill, learning to use cover crops takes time, observation, and an open mind. At Green Cover Seed, we aim to equip you with tools to start this journey, as outlined in our mission to help farmers regenerate soils and communities. The biggest hurdle? Overcoming the fear of starting or pushing past setbacks.

Start Small, Keep Moving Forward

Whether you're planting your first rye crop or experimenting with a diverse post-wheat grazing mix, the key is to start somewhere. We've worked with thousands of regenerative farmers across many diverse operations, and they share one trait: a commitment to regenerating soils, food systems, and communities. They may not chase the highest yields, but their focus on profitability pays off over time. These farmers embrace failures as learning opportunities, staying resilient and creative. Their legacy inspires the next generation—kids, grandkids, or young farmers eager to continue this work. To succeed, connect with other regenerative farmers, building a community to share knowledge and support.

Photo credit: Crystal Neuharth

Profit Over Yield

Regenerative farming requires a mindset shift: prioritize profitability over yield. Conventional agriculture often traps commodity farmers, like those growing corn or soybeans, in a cycle of high inputs and yields with no control over prices. Breaking free means becoming more autonomous. By focusing on profits, you open doors to new strategies—adding a small grain to your rotation, integrating livestock, or selling directly to consumers. These choices empower you to make decisions that enhance your farm’s ecological and financial health, putting you in the driver’s seat.

A Journey, Not a Race

Adopting the six soil health principles—minimizing disturbance, maximizing soil cover, keeping living roots, increasing diversity, integrating livestock, and maintaining context—is a process. You won’t transform your soil overnight, but working with nature’s design accelerates the progress. Cover crops, especially diverse mixes, align with these principles, fostering biologically active soils. At Green Cover Seed, we’re here to support you with high-quality seed, biological inoculants, educational content, and events. Start with your own test plots, observe results, and reach out to our team to customize mixes for your goals. We’re excited to walk alongside you, helping you regenerate your farm and community for future generations.



Where to go from here?

Dive into more soil health resources from Green Cover.

This book is designed to cover the basics of cover cropping—and only the basics. We hope that you’ve found topics and ideas that you’d like to explore further. The resources page on our website is designed to give you an in-depth soil health education across many different formats and media. We hope you’ll find it a valuable companion on your soil health journey.

- **Soil Health Resource Guides**
Get free access to our yearly publication featuring articles from soil health experts and practitioners.
- **SmartMix Calculator**
Build your own custom cover crop mix.
- **Keepin’ You Covered Email Newsletter**
Sign up for our email newsletter and get soil health articles, success stories, and learning opportunities delivered to your inbox every other week.
- **Green Cover Podcast**
Listen to Green Cover co-founder and co-owner Keith Berns have really interesting conversations with some of the best experts and farmers in regenerative agriculture.
- **Articles**
Browse or search our extensive catalog of soil health articles.
- **Presentations**
Can’t make it to every soil health event? Get the next best things by watching these recordings from our events.
- **Webinars**
From presentations by world-renowned scientist such as Dr. Christine Jones to interviews with farmers and ranchers, our webinar series offer a deep dive into soil health topics. Join us live or catch up on previous series.
- **Videos**
Watch video tours of our test plots and get cover crop tips in our extensive video archive.
- **Frequently Asked Questions**
Find answers to your cover crop and soil health questions.
- **Decision Guides**
Not sure which cover crop mix to choose? Get recommendations from our decision guides.
- **Recommended Resources**
A compilation of noteworthy soil health literature written by soil health experts.



Continue your soil health education at our resources page.

greencover.com/resources

About Green Cover

Green Cover sprouted in 2008, when brothers Keith and Brian Berns experimented with cover crops on their family farm in Bladen, Nebraska. They observed and experienced how diverse cover crop mixes leverage the biological processes that God designed into creation. Green Cover was launched to make cover crop seed available to other farmers.

Today, Green Cover is still family owned and operated. We grow, clean, mix, and deliver the highest quality cover crop seed directly to agricultural producers across the nation.

Our purpose is to help people regenerate, steward, and share God's creation for future generations.

(402) 469-6784 • greencover.com





Keith Berns

Co-Founder / Business Development at Green Cover

Keith Berns combines over 25 years of no-till farming with 10 years of teaching Agriculture and Computers. In addition to no-tilling 1,800 acres of irrigated and dryland corn, soybeans, rye, triticale, sunflowers, and buckwheat in South Central Nebraska, he also co-owns and operates Green Cover, one of the major cover crop seed providers and educators in the United States. Through Green Cover, Keith has experimented with over 120 different cover crop types and hundreds of mixes planted into various situations and has learned a great deal about cover crop growth, nitrogen fixation, moisture usage, and grazing utilization of cover crops.

Keith was honored by the White House as a 2016 Champion of Change for Sustainable and Climate-Smart Agriculture. Keith also developed the SmartMix® Calculator, one of the most widely used cover crop selection tools on the internet. Keith has a Masters Degree in Agricultural Education from the University of Nebraska and teaches on cover crops and soil health more than 30 times per year to various groups and audiences. Keith also was appointed by Nebraska Governor Pete Ricketts to be part of the Nebraska Healthy Soils Task Force and had the privilege of serving as the chairman.

He enjoys spending time with his beautiful wife Audrey and their 7 children and their families, including the 11 grandkids!



Kate Smith

Marketing at Green Cover

Kate's fascination with human health led to a fascination with soil health. Kate grew up in rural southern Wisconsin and spent most of her time outdoors and working on various farming operations. During this time she developed a deep appreciation for plants, animals, food, agriculture and natural resources and the way in which they all work together. Kate went to college at the University of Nebraska – Lincoln studying Animal Science and Grazing Livestock Systems. After college, Kate started working full time for Green Cover as a Sales Representative, gaining experience in the cover crop world. After a couple sales seasons, Kate transitioned to the marketing team helping write articles and organize processes. Kate and her husband, Ben now reside in Monroe, Wisconsin. Kate enjoys spending time outdoors, with her family, and seeks every opportunity to visit a lake during the summer. She enjoys learning about soil, plant, and animal health and how it relates to human health.

A note from our CEO

For years, Green Cover has published Soil Health Resource Guides that are packed full of articles from researchers, farmers and ranchers who are experts in soil health. But we've never before produced a resource that is written for the farmer who is just getting started cover cropping. Our hope is that this small book will help to jump start your journey into cover crops and regenerative agriculture.

Visit the Green Cover website (greencover.com) to take the next step in your learning journey. We have many videos and articles about soil health as well as links to some of our favorite regenerative agriculture resources. When you are ready to put some of your newfound knowledge to work in your own soil, our SmartMix® calculator can guide you through developing a custom cover crop mix formulated to meet the specific goals of your operation. If you prefer brainstorming solutions with a person over the phone, please call one of our cover crop experts. We'd love to show you how a diverse cover crop mix can move you toward your goals. We can quickly ship to anywhere in the USA and would love to support your soil legacy while helping you regenerate, steward, and share God's creation for future generations!



David Nelsen

Green Cover CEO

David Nelsen has been with Green Cover for more than eight years and serves as the CEO. His military and manufacturing background plus his ability to see the big picture allow him to integrate the many functions of Green Cover!

David lives with his wife Britny and their nine children on a small farm south of Red Cloud, Nebraska.

You've heard about cover crops... but where do you start?

Perhaps you heard that you should be using cover crops, that they can benefit your soil, and help prevent erosion. Or perhaps you heard a horror story about a farmer who tried cover crops, but used up all the moisture for his cash crop and experienced a yield drag. We want to be frank with you—cover crops can be challenging to manage. But with the right plan, and careful management, we know that cover crops can benefit your farm.

We've seen it over and over. Farmers have increased soil organic matter, decreased input costs, and increased profitability. Farms have become more resilient to adverse weather, pests, and weeds. And farmers have rediscovered the joy of farming—experimenting with new techniques, constantly learning, and watching their soil improve.

We wrote this book to help you get started on a journey, not just of implementing cover crops, but of regenerating your soil. At Green Cover, our purpose is to help people regenerate, steward, and share God's creation for future generations. We hope that this book will be a stepping stone to help you to regenerate your piece of God's creation.



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