COLORADO SOIL HEALTH FUNDAMENTALS

PRIMER 3: COVER CROPPING

PRIMER 3 SUMMARY

The goal of the Colorado Soil Health Primer series is to demonstrate the core principles related to soil health management as practiced and researched within the boundaries of the State of Colorado. Colorado scientists studying the effects of management practices and the state's farmers and ranchers implementing and measuring the changes on the land participated in this project.

This series is not about instructing the exact tactics a farmer or rancher would need to improve soil health. The individual tactics and strategies must change from property to property — or even field to field — depending on the goals of the land manager, and the available natural and financial resources. This series of information will give readers the resources to understand and evaluate practical and proven ideas to explore and adapt into a new or existing operation.

In this primer, readers will learn about how cover crops can improve soil health when managed correctly, how some Colorado farmers are using cover crops, and what benefits they are seeing in their operations.

▲ A winter rye grass planted after corn harvest can help hold snow (re: moisture) in the fields, improve soil temperatures, and keep an active root system in place.

Cover crops are a tool for land and crop managers who want to follow the STAR program fundamentals of keeping the ground covered and keeping a living root in the ground. By introducing cover crops into a rotation in Colorado, farmers and ranchers are finding improved water storage capacity, less erosion, and increases in soil biology and plant resilience.

The key in introducing cover crops is ensuring the plant is digestable when terminated. The goal of terminating a cover crop can be to produce a cash crop, but most often, they are terminated mechanically or with an application, and then incorporated into the humus areas of the soil. At the correct stage, which depends on the cover crop, the plant becomes food for the microbial life in the soil, which in turn feed the cash crop when those are planted into the cover crop residue.

COMMON TERMS

Cover Crops: The act of keeping the ground covered and maintaining living roots are two principles of soil management, and cover crops are a key tool to help farmers transition and measure the gains.

Pasture: Fields for grazing, wildlife passage or soil remediation are common across the state of Colorado.

Soil Biology: The life in the soil, from the smallest microbes to earthworms and dung beetles. The biology is responsible for helping break down organic matter and turning it into available nutrients for your crops.

Soil Chemistry: The ratios of elements in the soil are important and go beyond N-P-K.

Soil Health: The concept of maximizing an ecosystem's ability to feed soil microorganisms, leading to efficient nutrient cycling and turnover, which creates more nutrient availability for plants, increases soil water storage, and improves ecosystem sustainability and resiliency.

Soil Testing: The process of quantifying certain attributes of soil, including macro- and micro-nutrients, soil organic matter, cation exchange capacity, soil biology, water and/or air.

NRCS: The Natural Resources Conservation Service.

Source: Jim Ippolito & Megan Machmuller, Colorado State University

USDA-NRCS
Soil Management Principles

1. Limit disturbance
2. Keep soil covered
3. Strive for biodiversity
4. Maintain living roots
5. Integrate animals

▲ Cover crops can help attract pollinators, just one of the many reasons some Colorado farmers are using them in their systems. *Source: thedrs/Pexels.com*

"This is probably one of the harder spots in the United States to make regenerative ag work," says farmer Curt Sayles. Sayles grows dryland grain crops and raises livestock in eastern Colorado, where he receives an average of 17 inches of rain a year.

"The principles are valid wherever you're at. But it's a matter of fine-tuning the principles for your environment."

Cover crops are one of the tools Sayles and other Colorado growers are using to make regenerative ag work. They are an indispensable tool in implementing the five principles of soil health (minimize disturbance, keep the soil covered, keep a living root in the ground, introduce diversity, integrate livestock). Some folks add a sixth principle: context, since as noted above, individual tactics and strategies must change from property to property — or even field to field – depending on the goals of the land manager, and the available natural and financial resources.

No-till practices on their own minimize disturbance and keep the soil covered, but only with cover crops can a living root remain in the ground for all — or most — times of the year. Cover crops also add diversity that isn't there with no-till by itself. And they can be grazed by livestock.

In short, there is widespread consensus that these soil health principles are valid. This primer will present examples of how Colorado farmers are using cover crops to improve their soil and — more importantly — to make their operations more profitable and resilient.

One always challenging question for Colorado farmers is context, the sixth principle of soil health. Are cover crops a prudent practice in a part of the country that is dry, sunny, windy, hot, and cold throughout the year? Should growers attempt to integrate cover crops in a place where water availability is a primary concern?

This primer will present evidence that the answer to these questions is yes: a well-planned, well-managed growing strategy can implement cover crops to a positive effect — even in Colorado.

The Benefits of Cover Crops

Cover crops are a relatively new practice within American agriculture.

Fundamentally, a cover crop is a plant that is grown not to be harvested for its grain or fruit or leaf, but simply to improve the quality of the soil and to aid in the production of other crops — cash crops — that will be planted and grown at a later point on that same land. This can strike growers as an odd idea; why apportion any percentage of land to something that is not going to directly produce a marketable yield and, thus, a financial profit?

This is a fair objection. Acreage, moisture, and time (not to mention money) are not unlimited resources. A grower who devotes space to a cover crop is not growing something that they'll be able to sell. Rain that falls on a cover crop is not falling on a cash crop. And how can a grower fit a cover crop into a growing schedule when they feel like most of their season needs to be focused on cash crops? On top of that, buying and planting cover crop seed isn't free.

The short answer is that growers who are using cover crops — several of whom will be profiled below — have discovered that when properly managed, the benefits of cover crops outweigh these concerns.

So what are the benefits of cover crops? This of course depends on which cover crops are used and many other elements in different farming circumstances. Yet, while proponents of any idea may tend to oversell their point, the experiences of farmers over the past several decades have shown that those who use covers can expect to see some — or many — of the following benefits:

Reduced soil erosion. This is perhaps the original — and some might say the most important — benefit of cover crops. Colorado farmers retain

institutional memory of the Dust Bowl — the most obvious example of what happens when nothing covers the soil and a wind comes along.

Cover crops can help prevent soil erosion in a number of ways:

- Their presence blocks bare soil from the wind, which otherwise can blow soil away.
- They slow down rain drops, which can dislodge surface soil and be swept away by water — or later by wind.
- Their roots bind soil together and hold it more firmly in place.

The roots of cover crops send exudates (sugars and other compounds) to microbes in the soil, and these microbes — particularly fungi — produce glomalin, which binds soil together.

Eroding soil often carries with it nutrients, such as nitrogen and phosphorus, that go on to pollute waterways and aquifers; cover crops can thus also help improve water quality.

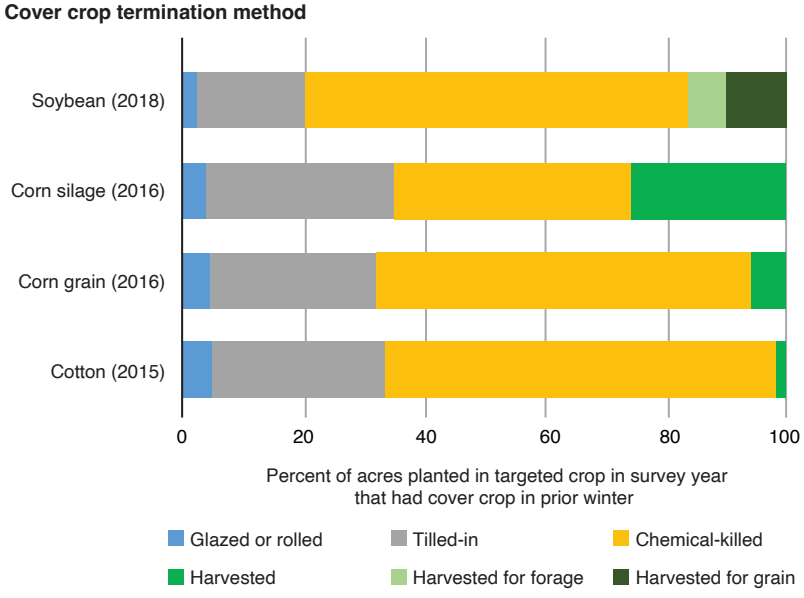
Increased infiltration of rainwater and reduced evaporation. We will touch on this more below — since utilization of water by cover crops is perhaps the key concern of Colorado growers — but cover crops can actually improve the water situation by preventing a crust from forming on the soil, by maintaining soil porosity, and by slowing down the runoff of water and thus enabling it to soak in. Because a cover crop acts as a mulch, it also reduces soil temperature and protects the soil surface from wind; higher surface temperatures and more wind leads to evaporation, so a cover crop helps prevent this.

Increased soil organic matter and microbial activity. Cover crops provide organic material that eventually decays into the soil. Additionally, growers usually terminate cover crops while they are in a vegetative state, which means that they are higher in protein than the residue of cash crops and provide excellent nutrition to soil microbes.

As already mentioned, the exudates cover crops pump into the soil feed soil microbes and increase their activity. And since cover crops shade the soil, the lower soil temperatures — and reduced soil temperature fluctuation (a significant factor in Colorado) — provide a more suitable environment for microbes than bare soil in the absence of a cover.

Improved soil aeration and aggregation. Like any plant, a cover crop has a root that eventually withers and dies, leaving behind a vacant channel in the soil. This helps reduce compaction and provides pathways for water and for soil organisms. And the increased microbial life associated with cover crops means more earthworms and other invertebrates that make their own channels. This reduced compaction can improve the root depth of the

▼ In a well-managed system, cover crops can prevent a lot of soil erosion and water evaporation.*Source: Colorado Department of Agriculture and Travis Harvey*



Note: The grazed and rolled categories are combined because, for some crops, the number of positive responses is too low to report individually. Soybeans (2018) was the first year the survey asked separately about harvesting for forage and harvesting for grain.

Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service, 2015 (cotton), 2016 (corn), and soybean (2018) Agricultural Resource Management Survey.

▲ This shows the results of a national survey of cover crop managers and the types of tools used to terminate the cover crops. When, and how, you terminate your cover crops depends on your goals, your rotations, and the cover you are using. *Source: USDA*

cash crops which follow the cover crop.

Soils that are too loose are also benefited by cover crops, since the glomalin produced by fungi helps keep soil in place.

Providing forage for livestock. Cover crops can be managed so as to enable the use of livestock on the farm — another of the key tenets of soil health. Several of the farmers profiled below successfully use cover crops to graze their (or someone else's) livestock. Their cattle and sheep trample the vegetative plants and leave manure and urine that further enrich the soil.

Suppressing plant disease. Because cover crops increase microbial life, they support increased populations of beneficial nematodes and protozoa, which can attack disease-causing organisms. They also produce natural antibiotics that can suppress pathogens. Cover crops can stimulate saprophytic organisms, which eat decomposing matter and thus reduce the risk from disease-causing organisms in decaying cash crops.

Suppressing weeds. Cover crops are often vigorous and can form a canopy ahead of weeds. Some cover crops leave behind a thick mulch that shades out weeds. Other covers produce allelopathic compounds that suppress weeds; rye is a notable example of this, being able to reduce the growth of some pigweeds and marestail. And some cover crops utilize a field's excess nitrate — a form many weeds feed on; this obviously only makes sense in certain situations, depending on the nutritional needs of the following cash crop.

Supporting pollinators and beneficial insects/arachnids. Growers can include flowering varieties of cover crops that feed and nurture insects and arachnids that pollinate their crops and that combat unwanted pests.

Termination methods

One of the challenges of using cover crops is terminating the cover so that the next cash crop can be grown.

Tilling-in the cover crop is one option, but this can result in soil erosion and degradation of organic matter. An alternative strategy, if the cover crop is fall planted, is to only sow covers that will winter kill. These vary depending on climate but generally include oats and some species of mustard and radish.

If herbicide use is an option, it's usually a good idea to plant a cover crop with a multitude of species. USDA conservation enhancement activity E340C, "Use of multi-species cover crop to improve soil health and increase soil organic matter," advocates planting a minimum of four different species: a cool-season grass, a cool-season broadleaf, a warm-season grass, and a warm-season broadleaf (legumes are included in the USDA's definition of a broadleaf).

Grazing is another way to terminate a cover crop. While this practice may not completely kill the cover, it could be performed prior to winter kill or herbicide use in order to maximize soil health benefits.

Finally, some growers are beginning to experiment with the roller-crimper, an implement that rolls over a single-species cover crop at the flowering stage to kill the plant but leave all of the residue. This requires precise timing and special equipment, but it is a growing practice in the Midwest and could possibly be implemented in Colorado in the future.

The Key Objection: Cover Crops Utilize Moisture

Cover crops — like all plants — require moisture in order to germinate and survive. It would be wrong to try to argue that they don't actually take up some of the water that cash crops could otherwise use. But this concern needs to be weighed against all of the aforementioned possible benefits covers can provide.

Here's Dale Strickler on the question: "Much of the resistance to this practice comes from people in drier areas, concerned that cover crops use moisture, which is true; but so does bare ground. If bare ground stored soil moisture effectively, a lake would

be sitting on top of every dirt road in the country — but, in fact, a dirt road dries out far more quickly after a rain than a soil with residue on it. Cover crops can take up moisture, but they can also create a soil condition that is more moisture efficient."

The key to answering this objection is thus understanding how cover crops create a more moisture-efficient environment that cash crops can then take advantage of. One meta-analysis on the use of cover crops in arid areas found that in most cases, the ecosystem services offered by cover crops came without yield penalties for cash crops. The study, from researchers at Nebraska and Kansas State, published in the *Soil Science Society of America Journal*, shows that in areas with less than 20 inches of rain, cover crops can increase soil wet aggregate stability (suggesting less water erosion in those soils), reduce nitrate leaching, reduce weed biomass, and improve soil microbial biomass. And most of the time, the covers did not affect cash crop yields. The study also found that when hayed or grazed, cover crops "could provide net economic returns without negating soil benefits."

Researchers have found that the use of cover crops on non-irrigated land in southwestern Colorado can improve soil structure and control erosion, although in one particular study they determined that covers can also lead to decreased yields — possibly due to the cover crop using some of the available water and nitrogen. But the researchers also conducted a simulation in which they estimated that 50 percent of the cover crop biomass was sold as forage; in that case, the cover crops were more than able to offset the decrease in revenue from lower wheat yields. Another Colorado study found that managed grazing can be helpful in maintaining the benefits of cover crops.

Also of importance in this conversation is the fact that an increase in soil organic matter means that the soil can store additional moisture. Quoted statistics vary, but the NRCS reports that a 1 percent increase in soil organic matter in the top 6 inches of soil enables that soil to hold an additional ~27,000 gallons of water per acre. This implies that, in the long term, the use of cover crops to increase soil organic matter could aid in the retention of water in arid areas.

While the current published research on the effects of cover crops on soil moisture may be mixed, sometimes farmers themselves are the best sources for what is and isn't possible. As one research study notes, "Cover crops are an important strategy to improve agroecosystem health, but tradeoffs with water use in dryland systems necessitate a creative approach to cover crop use and management."

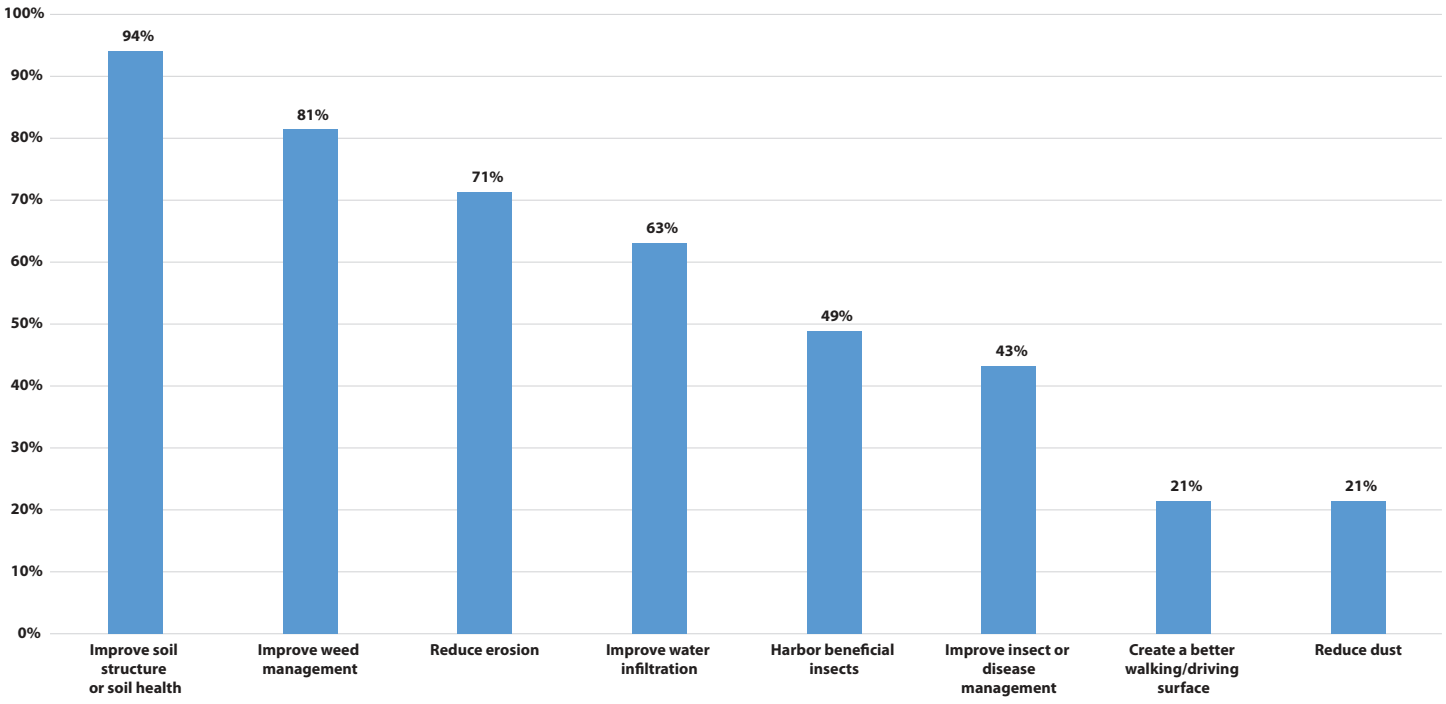
Here's how several innovative Colorado growers are creatively — and successfully — utilizing cover crops to make their operations more profitable.

Lowell King

Lowell King is a grower in Loma, Colorado, in the Grand Valley. His farm receives less than 10 inches of rain a year, although he is able to use

▼ Improving soil structure and soil health is the most popular reason why farmers and ranchers in a 2020 USDA survey said they are using cover crops. *Source: USDA*

Figure 13 **What are your primary reasons for using cover crops (Check all that apply)**



in-furrow irrigation from the Colorado River. Most years he has about 500 acres in hay production and rotates those acres with corn, winter wheat, and cover crops.

King emphasizes the importance of always following the combine directly with the no-till drill, in order to always keep a living root in the ground — whether a cover crop or another cash crop. "The soil health principles work and will flourish for you. Treat your no-till drill as if it's as important as your harvesting equipment — as valuable as your grain. When you're out combining a cash crop and you have the grain cart out there, your no-till drill needs to be out there to plant the next crop. This stuff just flat works."

Into his wheat fields, which are harvested in the middle or end of June, King immediately plants a diverse cover crop mix — fifteen to twenty species of the four categories: brassicas, legumes, grasses (both warm and cool season) and broadleaves.

Livestock were earlier mentioned as an important part of maintaining the gains incurred by cover crops, and this is something that is vital for King's operation. He has about 200 cows who spend May through October grazing on the Grand Mesa. When they come home in October, he weans their calves on the cover crop that was planted after the wheat harvest. He runs the cows there for four or five days with the calves and then pulls the cows off to go graze corn stalks (which are usually overseeded with a cereal rye cover crop); the calves stay on the cover crop to fatten until the middle of January, when they're sold as "all-natural" — to gain a premium price.

Since he started using cover crops, King no longer needs to feed hay over the winter to either his cows or calves. "One of the huge benefits of cover crops, as far as the economics of it in our operation, is simply that we're selling thousands of tons of horse hay a year — that we'd have to be keeping hundreds of tons of that back to feed our cows if we weren't growing cover crops. So that in itself is a win-win."

In April, the part of the diverse cover crop that managed to overwinter is terminated with Roundup, and then that field is planted with no-till corn. Having those roots in the ground into the spring — about six of the original twenty species, usually — keeps carbon flowing into the soil. King plants short-season corn in order to better enable the use of cover crops.

After corn, King no-tills either wheat or rye. He does this without irrigation and has had success with germination even when planting rye as late as the beginning of December.

"Farmers around here say they can't plant wheat after corn harvest because they have to till to plant the wheat," King says, "and when they till, they lose all their moisture. And if the wheat doesn't have enough moisture in the fall it won't germinate — which most falls here it wouldn't."

"When we no-till the wheat right into the corn beds, without disturbing the soil, there's always some moisture there. And most times it's enough to germinate the wheat. If there's a half inch of rain in the next month, that's plenty of moisture. It works every time if you don't disturb your soil. As our soil health has improved, that obviously helps, too . . . . There are cascading and compounding effects in everything we do in agriculture."

After a second year in corn, King gets ready to establish an alfalfa stand by no-tilling a half measure of his twenty-species cover crop mix along with 20 pounds of alfalfa. His calves graze this — as long as the ground is frozen — and in the spring King has a new stand of alfalfa. "It's partway established without any waiting period," he remarks.

King does have access to irrigation water from the Colorado River, but "even though we're double cropping and growing these cover crops, our water bill is down about 10 percent." He's also reduced his synthetic chemical use quite a bit. "A cover crop is much easier to terminate than perennial weeds. We can reduce our rates and still get a very effective control."

Some of King's neighbors are starting to imitate his practices, although he estimates that "fear of failure is the number one thing that keeps people from engaging fully in the system — the fear of it not being as profitable or of looking like they're a trashy farmer." This problem is exacerbated by the fact that much of the farmland in the area is owned by investors who are wary of innovative practices — which can be viewed as more risky.

Curt Sayles

Curt Sayles grows dryland grain crops and raises livestock in eastern Colorado, where he receives an average of 17 inches of rain a year.

Sayles has moved away from the traditional crop in the area — winter wheat — because it's not as strong a soil health tool as other crops. Cereal rye is his go-to as both a cash crop and a cover, as well as for grazing. He also grows sunflowers, dryland corn, and several types of millet, and last year was his first growing buckwheat and chickpeas. Millet is a big phosphorus user and buckwheat helps make it available, so the two are grown in rotation. Chickpeas, similarly, help improve the nitrogen profile.

The farm also rotates safflower as a companion crop with sunflower because it's a good soil-health crop. Likewise, Sayles is going to begin growing mung beans as a companion for millet. While perhaps not technically cover crops because they're not grown on their own before or after a cash crop — and they may be harvested, like a cash crop — companion crops serve the same function as a cover: their primary purpose in the field is to improve the soil and thus the cash crops.

Many of his neighbors follow the traditional year-long fallow before planting wheat in order to retain moisture. Sayles isn't convinced — "water is either going up or going down. It never sets anywhere." It makes more sense to him to use that water proactively to benefit his soil via cover crops.

"You come to that fork in the road," he says. "And instead of trying to move

forward with cover crops and reducing your dependence on chemicals and fertilizers, some guys are going to go back to tillage, which will reduce the carbon in their soil, which will increase their dependency on fertilizers and chemicals."

Brendon Rockey

Brendon Rockey grows certified seed potatoes in the San Luis Valley in south central Colorado, where without irrigation row cropping would not be possible. He has successfully integrated both cover crops and companion crops to improve his soil and reduce insect pressure.

Rockey Farms' use of cover and companion crops has evolved and improved over time. His current system consists of a rotation between a cover crop and a cash crop — certified seed potatoes — along with pollinator strips around and through the middle of his fields.

The cover crop is a mix of ten or more different species that is grazed at specific periods during the season by contracted cattle and sheep — in other words, Rockey gains the benefits of diverse livestock integration without the infrastructure and expertise required to actually own the animals. The cover crops and the animals charge the soil for the next year's cash crop.

Rockey noticed several years ago that field peas he'd used in his cover mix sometimes volunteered in his seed potato cash crop the next year and didn't seem to compete with the potatoes. After a few seasons of experimentation, he now interseeds the cash crop with a companion crop mix consisting of field peas, chickling vetch, chickpeas, buckwheat, and fava beans.

One of the many benefits of this companion cropping system is that today Rockey does not need to use any herbicides, fungicides, insecticides, or nematicides. He only uses a small amount of chemical to kill the aboveground potato vegetation prior to harvest.

The cover and companion crops are of particular importance in reducing insect pressure. Buckwheat brings in beneficial insects such as wasps, beetles, ladybugs, and lacewings, helping manage aphids. Fava beans also attract beneficials, while — along with the peas and vetch — providing nitrogen.

▲ Caption: Ground cover can also help attract wildlife, which act as natural defenses against predators and pests. *Source: Colorado Department of Agriculture and Karen Mack*

Rockey believes that the argument against cover crops — that they utilize too much water that could be used for a cash crop — is shortsighted. "In our area," he says, "if I have a dry fallow, I'm not running my pivot that year. My meter is not running, so sure — it appears as if I'm saving water. But everywhere in this valley, where we've seen people dry fallow, it damages the soil so drastically that the next year, when you raise your potatoes, your water infiltration rate goes to crap. A neighbor tried this technique — trying to save some water by going dry fallow — and the next year he could not get water into his soil. Everything he saved that first year he used up the next.

"There's a lot of other damaging impact from not having that living plant in the soil. You have to look at how the system functions as a whole."

This holistic way of management works. But it is admittedly very difficult to quantify — isolating any one variable in such a complex system to determine what's working and how is almost impossible.

Rockey says, "We had to change the mindsets, because what we'd always been taught was that anything other than the main crop out there is competition. And that is absolutely false. When you have the correct combinations out there, you can actually have a collaboration."

Capturing Rain

"How much rain did you get? All of it."

Soil conservationist Mary Ellen Cannon shares an adage from farmers utilizing cover-cropping after precipitation events. Soil and water dynamics are of special interest to Colorado producers. The overarching soil/water goal for most Colorado producers (and any farmer) is to help soils become mediums where plants have access to the water that they need, when they need it and where they need it.

Both soil texture and soil structure exert tremendous influence over water behavior in soil.

A useful framework that farmers use to efficiently shape an understanding of how moisture flows through their land is to look at water behavior through a suite of soil moisture measurements in order to inform crop decisions and land management plans.

Fundamental measurements include: infiltration, water capacity (also known as field capacity) and plant available water.

Water infiltration refers to the movement of water from the surface of soil and down into the soil profile. Infiltration rates are determined largely by soil texture and structure, such as pores sizes in the soil, soil particle size, and spacing.

In general, clay soils, as are often found in Colorado, exhibit slower infiltration rates due to small pore sizes and close particle spacing.

When you study water holding capacity/field capacity, you find that clay soils have a larger surface area due to tighter spacing of particles and less porosity, and therefore, have higher water holding capacity. Increased organic matter in soils also increases water holding capacity, as water is drawn to organic matter.

Imagine a rain-event over a field with a mix of specialty crops in production. As the rain falls and water moves downward, it is infiltrating the soil profile. From here, the water percolates across and through the soil profile (with variances in time and rates according to soil texture and structure) and pores in the soil become saturated, or full. This is when the field is at its **saturation point**. At saturation point, gravity drains excess water, and the remaining water is what we know as "field capacity."

Field capacity is the amount of water that any particular tract of land can hold. Plants can pull from this reservoir of water and will do so until the water remaining in the field is bound to particles and unavailable, which is defined as the permanent wilting point of a soil. The water that exists in a field between its field capacity and its permanent wilting point is the plant-available water (PAW).

Since the fundamental soil texture cannot be changed, the variables that can be manipulated through management practices are increasing organic matter and creating soil structure with more stable aggregates. As farmers use STAR management practices that increase soil water holding capacity, the more drought resilient the soils will be.

Conclusion

There's one final benefit to cover crops that wasn't mentioned in the list at the beginning of this paper: making farming more enjoyable.

There are many reasons for farmers to be pessimistic these days — high input costs, labor challenges, and increasing climate variability, just to name a few. Reducing chemical inputs and utilizing biological processes can increase net profitability and soil quality.

Using cover crops gives farmers a way to begin to step away from dependence on outside inputs and to farm more in tune with nature. Covers can help growers become more resilient and less susceptible to weather events. They can enable farmers to not only conserve or sustain their land but to improve it.

As Curt Sayles says, "cover crops with cattle grazing on them doesn't look nice and prim and proper. That's another force against adoption." But, he adds, "it's about dollars in the pocket — not yield in the field."

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Endnotes:

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The STAR program was originally developed by Champaign County Soil and Water Conservation District (CCSWCD) in Illinois and is now also administered in four other states: Colorado, Indiana, Iowa, and Missouri. The Colorado STAR Plus program grew out of a stakeholder process launched by the Colorado Department of Agriculture and other partners in 2019 that was facilitated by the Colorado Collaborative for Healthy Soils, involved more than 250 stakeholders and resulted in passage of HB21-1181 and SB21-235, which authorized and funded the launch of a state soil health program based around STAR. This state stimulus funding and additional grant funding received from the Gates Family Foundation, Colorado Department of Public Health and the Environment, Colorado Water Conservation Board, NFWF, and NRCS have enabled the launch of the first round of the STAR Plus program.

Getting Involved with Colorado STAR

In the summer of 2021, legislation was passed in the Colorado House of Representatives funding the Agricultural Soil Health Program for 2022. The Colorado Soil Health Program is built around the framework of an Illinois program called STAR, which stands for Saving Tomorrow's Agriculture Resources. STAR was developed to be a free resource for farmers and ranchers, helping them evaluate their current land practices, and particularly focusing on nutrient and soil loss. The STAR program encourages best soil health practices, and rewards producers with recognition, a high rating, and a field sign. While the STAR rating system is a useful metric for farmers to measure their own conservation efforts, it is also a tool for consumers interested in a farmer's soil health practices.

The program was originally created in the Champaign County Soil & Water Conservation District in 2017, with the assistance of the Illinois Department of Agriculture, as a means to facilitate specific environmental and agricultural goals that were outlined in the state's Nutrient Loss Reduction Strategy. Colorado, as well as Iowa and Missouri, have adopted this program framework.

Best management practices for agricultural land use have been developed since the 1930s by the United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS). The STAR program utilizes these best practices, and also relies on a panel of experts, including university researchers and scientists, to establish appropriate ranking systems based on different resource factors. STAR Plus is an additional level of producer support that "facilitates capacity building by providing matching state funds towards the cost of these projects and activities within each district". This means that the state provides technical and financial assistance to producers over the course of three years, through grants and services like soil testing that are facilitated through the state's conservation districts.

Any farmer or rancher can visit the STAR website and fill out these forms in order to receive this rating. The first 100 participants in a year also receive a free soil test.

To participate, the only requirement is that the farmer or rancher fill out a form to the best of their knowledge, describing their farm practices in detail for a specific field chosen by the producer. The forms include questions about cropping practices, tillage regimes, fertilizer and nutrient applications, and other management practice information. The producer then receives a STAR rating from 1-5 that demonstrates their incorporation of the five principles of STAR: Soil Armor, Minimize Soil Disturbance, Plant Diversity, Continual Live Plant/Root, and Livestock Integration in their cropping system. Earning five stars in a field means that a farmer or rancher is implementing all five soil health principles on that field, while earning one star means that they are following only one.

COLORADO Department of Agriculture Conservation Services Division

ACRES USA

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SAVING TOMORROW'S S.T.A.R. AGRICULTURE RESOURCES