INCORPORATING COVER CROPS

NDSU EXTENSION SERVICE

SOIL HEALTH

COVERING UP *North Dakota*

One soil health building approach gaining interest with farmers is the inclusion of cover crops in rotation. In a short growing season like we have in North Dakota, effectively using cover crops can seem like a challenge. However, farmers are interested in including cover crops to meet specific on-farm goals such as minimizing soil erosion, moisture management, weed suppression and improving soil conditions that they are unable to achieve by only having their cash crops in rotation. Establishing a specific on-farm goal is key to successfully utilizing cover crops.

To **minimize erosion**, farmers are generally looking to increase cover following low residue crops like soybean or edible beans. In this case, having a cover crop that can be seeded after harvest or flown on just before leaf drop is beneficial. If seeded after harvest, a winter annual like cereal rye, winter wheat, or winter triticale would be a good fit because of cold tolerance and an ability to overwinter to put on biomass in the spring. Winter camelina is a broad leaf that will also overwinter, but it needs to be mixed with a grass to get coverage and reduce erosion. If broadcasting or flying on cover crops prior to leaf drop, small seeded species along with a cool-season grass are desirable. Timing is everything to avoid issues of a growing cover crop underneath a bean crop prior harvest.

Moisture management is a good fit for using cover crops in both reducing and maintaining moisture. Transpiration by plants to remove water, water movement down intact root channels into the soil profile to store water and residue to reduce evaporation and maintain surface moisture and are all ways water cover crops can help manage the system. Depending on rotation, soil properties and goals, cover crop mixes including deep and shallow rooted species, varying levels of water use, biomass production and residue breakdown can be selected.

Suppressing weeds by using cover crops as additional mode of action to a herbicide program is becoming more popular. In this case, cereal rye is the primary cover crop used because of competition and a strong allelopathic effect. Other cover crops can be competitive as well, depending on the situation. To manage weeds in a salt-affected areas, using barley (which is more salt-tolerant than cereal rye) or a mix of barley and cereal rye are great options. The whole goal is to use cover crops that work with a herbicide program.

Improving soil conditions using cover crops is centered on having a living root growing in the soil for as long as possible. A living root provides benefits of supporting

TOPICS *covered*

biological activity in areas immediately surrounding the roots (a zone called the rhizosphere), wrapping around and gluing soil particles together to form aggregates, capturing nutrients that are readily leached from soils like nitrates, and creating intact root chanels from the surface into the soil for water and air movement. To maximize on a having a living root in the soil, approaches like interseeding can be used.

There are additional benefits of using cover crops in the Northern Great Plains region. It's important to remember that those benefits and goals are different for every farm, really every field. Getting familiar with and then fine tuning approaches is important to achieve desired outcomes. In this book, we provide a starting point based on what we know at North Dakota State University.

DR. CALEY GASCH

Assistant Professor of
Soil Health-Research

By leading the soil health research program at North Dakota State University, I have a unique opportunity and responsibility to provide science-based, research-driven information on management practices which build soil health. I not only look for the gaps in existing information to guide my research, but also build relationships with farmers to learn about their needs as they integrate new practices on-farm. I ask myself at the end of each workday, "what did I do to help farmers today?" Asking this question helps me stay in touch with needs related to soil health and keeps the research being conducted at North Dakota State University relevant.

@ckgasch

RESEARCH *& Extension* NDSU

DR. ABBEY WICK

Assistant Professor of
Soil Health-Extension

Getting information developed by researchers in the hands of farmers, consultants and industry is incredibly important for the adoption of new practices on-farm. On the flip side, sharing information and questions from those same groups with researchers on campus is also important for generating meaningful research. I focus on personal relationships, partnerships and using both high- and low-tech approaches to share information. This may be in the form of twitter to reach a broad audience or one-on-one visits with farmers to evaluate a system.

ndsu.edu/soilhealth

@NDSUsoilhealth

COVER CROPS BY *Function*

Cover crops can be classified by botanical family (grasses, legumes, brassicas, others), by growth cycle (cool- and warm-season), and by function.

The main functions are:

Soil builders: Crops with fibrous root system (grasses) add carbon to the soil increasing organic matter and provide food for soil microorganisms. These crops form symbiotic association with mycorrhizae which form a web in the soil channeling nutrients to the plant. Also, microorganisms exude glue-like substances that keep soil particles together forming stable aggregates.

Nitrogen fixers: Legumes fix atmospheric nitrogen (N_2) by symbiotic association with soil bacteria. Once the legume plant dies nitrogen-rich root nodules release the nitrogen to the soil feeding microbes which in time will release nitrogen to the following crop.

Nutrient scavengers: Plants in the Brassica family (radish, turnip, rape) have a tap root that can grow 4 to 6 ft deep and capture nutrients lost from the crop's rooting zone, preventing nitrate leaching.

Soil looseners: Brassicas thick and strong tap root reduce soil compaction and increase water infiltration providing macropores and channels for the water and crop roots to move through.

Soil erosion preventers: Soil particles lost by wind in dry winters and springs are rich in phosphorus. Further, soluble-nitrate can easily run-off with large rain events throughout the season.

Most cereal cover crops provide good cover in the fall and their residue protects soil in the winter. Cereal rye is the only cover crop that consistently survives the winters in North Dakota and it is the best cover crop to provide soil cover in the spring.

Cover crops can provide many other functions such as suppress weeds, conserve soil moisture, improve water quality, recover salt-affected soils, enhance wildlife habitat, provide food sources for pollinators, and forage for grazing. Seelcting cover crops based on function is a good way to successfully achieve on-farm goals.

5 TIPS FOR *using cover crops*

1. Get more information by attending Extension events and using other resources that are science-based
2. Connect with farmers interested in or already using cover crops
3. Determine on-farm goals and how cover crops can help accomplish those goals
4. Select species based on function, crop rotation and comfort level
5. Evaluate cover crops used on your farm and continue to modify approaches

RESEARCHER *Profile*

DR. MARISOL BERTI

Professor of Forage and Biomass Crop Production

I conduct research on forage and cover crops at North Dakota State University, working with cover crop production for grazing, interseeding cover crops in corn and soybean along with including perennial phases in crop rotations. Selecting cover crops based on function has led to recommendations specifically for grazing based on above-ground biomass production and protein content and also for building soil health with the focus being on root structures and residue. Finding appropriate cover crops for use in the Northern Plains climate has led to evaluation of winter camelina as a winter annual for interseeding or relay cropping.

Helping farmers and training other educators on effectively using cover crops is important for seeing adoption of concepts from research. From large meetings to one-on-one interactions, I provide valuable science-based information that can be adopted to meet on-farm goals.

I am also involved in the Midwest Forage Association (**midwestforage.org**) and the Midwest Cover Crop Council (**mccc.msu.edu**).

ag.ndsu.edu/plantsciences/research/forages

ADDING DIVERSITY
A Balanced

Soil health is like human health – a balanced diet increases function and efficiency. Because of the biological component of soils, we can relate our inputs to the soil like we do food to our bodies. When we eat healthier and more diverse food, we feel better and operate at a higher level than when we are eating poorly. Diversity of high quality materials being added to soils can have the same effect on soil function.

Developing a diet to support diverse biological communities in the soil can be done by using crop rotation and also inclusion of cover crops. A diverse biological community is important for maximizing processes in the soil that release nutrients for crop use, develop soil structural components to aid in soil water and air movement and interactions that help control diseases and pests. If diversifying the crop rotation is not an option, including cover crops in a current rotation is an important tool for building healthier soils.

Determining which cover crops to include for a given rotation can be guided by the "Five Food Groups" concept developed by Lee Briese, Certified Crop Advisor with Centrol Crop Consulting. The five food groups include a cool-season grass, cool-season broadleaf, warm-season grass, warm-season broadleaf and legume. The primary goal is to include each of the five food groups within a couple of years using both cash crops and cover crops. For example, in a corn-soybean rotation, the cash crops being grown already fill the warm-season grass, warm-season broadleaf and legume groups. So, we just need to add a cool-season grass and a cool-season broadleaf. This can be done by interseeding cereal rye and radish into a corn crop. By doing this, we can include all five food groups in two years with a simple approach.

As the soil health system advances, additional cover crops may be included to add more diversity to the system. For example, additional cover crops like flax or dwarf essex rapeseed may be included in the interseeding mix to add more functions to the system. Cover crops may be interseeded or flown on into soybean before leaf drop to again provide more diversity.

Consider the five food groups when selecting cover crops to round out the system, but also consider adding diversity in root structures. Not all roots are created equal in structure, quantity or quality. Having a mix of fibrous roots of grasses along with deep tap roots of brassicas and nitrogen fixing legumes can also build

Diet

the system. Some roots like those of a brassica or legume have more nitrogen in them and less carbon, meaning they are also a higher quality food source for soil biological communities.

It is also important to consider the quantity of roots and the areas of the soil that those roots might reach. Fibrous roots, though they are lower quality than brassica or legume roots, can explore parts of the soil the other cover crop roots may not reach. Plus, fibrous roots are excellent for building soil aggregates and creating space for microbial communities to survive and thrive.

When adding diversity to a crop rotation, keep it simple. As you get more comfortable with the concepts, additional diversity can be added to the system.

5 FOOD GROUPS *to include in rotation*

1. **Cool-season grass**
   (*barley, spring wheat, winter wheat,* cereal rye, oats, triticale)
2. **Cool-season broadleaf**
   (*canola, peas, flax,* dwarf essex rapeseed, faba bean, radish, turnip)
3. **Warm-season grass** (*corn*, millet, sorghum x sudangrass)
4. **Warm-season broadleaf** (*buckwheat, soybean, sunflower*)
5. **Legume** (*peas, soybean,* clovers, faba bean)

**crops in italics are those grown as cash crops* – cash crops count towards one the five food groups.

CONSULTANT *Profile*

LEE BRIESE

Edgeley, ND

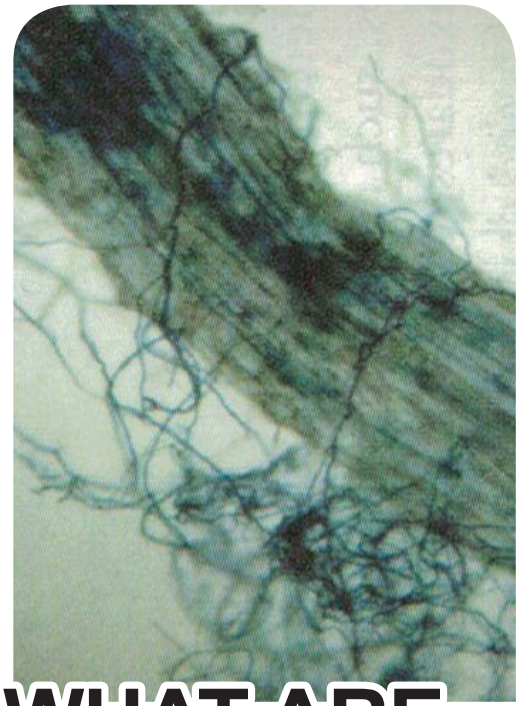
Lee is a Certified Crop Advisor with Centrol Crop Consulting – advising on 16 different crops over 80,000 acres. Based out of Edgeley, ND, he has helped many farmers incorporate cover crops along with other approaches to achieve goals related to soil health.

He encourages simple cover crop mixes that farmers are comfortable managing, using the “Five Food Groups” concept. Simplifying the approach makes it easier to include cover crops in any system.

Integrating cover crops as a mode of action for weed control is also an approach Lee helps his growers adopt. He recommends growers should select their herbicide management program first and then fit cover crops into that program. This has led to providing guidance on effects of herbicide residual on cover crop establishment.

Information from Lee relating cover crops to the NDSU Weed Control Guide is posted on the NDSU Soil Health webpage (**ndsu.edu/soilhealth**).

@Lee_Briese



WHAT ARE *Mycorrhizae?*

In agricultural and grassland soils, the most common type of mycorrhizal fungi are the arbuscular mycorrhizal fungi, or AMF. About 80% of all plant species form relationships with AMF, which is good because these fungi cannot survive without a root. AMF are a diverse group of fungi and they are widespread in soil.

In this symbiosis, the plant sends carbohydrates to the fungus, which it uses for energy and growth. The extensive network of microscopic hyphae explores a large volume of soil, scavenging nutrients that the plant roots cannot access on their own. The fungus then sends the nutrients (especially phosphorus) to the plant, improving plant nutrition and resistance to stress. In this way, the relationship is mutually beneficial. AMF hyphae also stabilize soil aggregates.

NUTRIENT CAPTURE *Keep it*

Cover crops play an important role in nutrient capture, preventing nitrate loss by leaching and phosphorus by run-off or soil erosion during the fall and winter months. Once the cover crops are winter-killed, nutrients are released into the soil to feed soil macro- and microorganisms (bacteria, fungi, earthworms, insects and other arthropods).

Cover crops capture nutrients different ways according to their root structure, symbiotic association with microorganisms, and the biomass produced during the growth of the cover crop.

Nutrient capture can be measured by analyzing the nitrogen (N) and phosphorus (P) content in the plant biomass.

N or P content x total dry matter cover crop = total nutrient capture (lbs/ac).

The nutrient capture by a cover crop depends on three main factors:

Soil available nutrient content, from fertilizer, N_2 fixation, or P mobilization by mycorrhizae.

Size matters: Plant growth, the more growth or dry matter produced from planting to hard killing frost, the higher the nutrient capture. Plant growth depends on available soil moisture so if it doesn't rain, growth and nutrient capture will be limited.

Time matters: The longer the cover crop is allowed to grow before killing frost the larger is going to be, more nutrient capture. Plant as early as possible after cereal crop harvest. In corn or soybean, plan to broadcast or interseed the cover crop before harvest. If planting after August 15, do not plant warm-season cover crops. They won't grow big enough to capture nutrients.

Efficient

With a soil test (0-24") > 60 lbs N/ac before planting the cover crop, a planting date before August 15, and enough rainfall to grow. Nutrient capture ranges between:

Cool-season legumes *(faba bean, hairy vetch, pea)* = 80-120 lbs of N/ac

Brassicas *(radish, rape, turnip)* = 40-60 lbs N/ac and 8-15 lbs P/ac

Cereals *(barley, oat, rye, triticale)* = 40-60 lbs N/ac and 10 lbs P/ac

Warm-season cereals *(forage sorghum, sudangrass, millet)* = 100 lbs N/ac, if planted before July 30

Availability of the nutrients being captured by cover crops to the following cash crop are currently being evaluated by North Dakota State University.

OVERWINTERING *Stayin' Alive*

With a short growing season in the Northern Great Plains, using winter annual cover crops in rotation is a benefit for getting growth in the fall and then again in the spring prior to planting. With an overwintering cover crop, it is extremely important to (1) consider any additional management steps and monitoring that need to occur and (2) recognize that there are limits for which cash crops can be planted the following year.

For example, a winter annual will use water in the spring and may excessively dry the soil prior to planting. In dry conditions, winter annual cover crops need to be monitored and terminated prior to planting.

For limitations on cash crops in rotation, a winter annual could contaminate grain at harvest in the case of small grains, transfer diseases and pests to the cash crops, tie up necessary nutrients and/or not be compliant with RMA guidelines and affect crop insurance. It is extremely important to evaluate the entire system prior to using winter annual cover crops.

Of the winter annuals, cereal rye (also called winter rye and grain rye) is the most winter-hearty giving it a high success rate for survival in our climate. Other benefits are that it is fairly easy to establish, grows quickly, provides excellent weed suppression and the seed is fairly inexpensive. Seeding rates should be selected based on goals and conditions, but here are some starting points:

Interseeded in corn (any time after five leaf stage), rates from 20 - 40 lb/ac

Flown on into corn (up to tasseling), rates from 40 - 70 lb/ac

Seeded following harvest of an early season crop (early August), rates from 30 - 40 lb/ac

Seeded following harvest of a late season crop (late September), rates from 40 - 60 lb/ac

Variable rate seeding rye based on soil type, rates from 10 - 60 lb/ac

These rates are merely starting points and should be adjusted based on moisture conditions, soil type, method of seeding and comfort level. Other winter annual grasses that may survive the winter include winter wheat and winter triticale.

5 TIPS FOR *using cereal rye*

1. Depending on conditions, cereal rye can be seeded late into the fall with a majority of growth occurring in the spring
2. Increase seeding rates with later seeding dates
3. Bump up rates when broadcasting versus seeding
4. Try variable rate seeding or broadcasting cereal rye on fields that have both sandy and high clay soils
5. Terminate 14 days in advance of planting corn and never use cereal rye before a wheat or barley crop

BLOWING *In The Wind*

Wind erosion of topsoil resources weighs heavily on the mind of farmers and educators. Topsoil is a non-renewable resource and contains organic matter and fertility that has been built naturally and also applied over the years. It is the highest quality material of the entire soil profile and it is in the best interest of everyone to protect topsoil from erosion.

Estimates of how much soil is lost in our region to wind erosion are on average 5 tons/ac/year. This may not seem like much, but over time, this can lead to significant losses of a minimum of 1" of topsoil over 20 years. North Dakota State University conducted a study evaluating topsoil depth recorded in the 1960's against topsoil depths recorded in 2014 from the exact same locations. In Walsh County, a total of 19" of topsoil was lost over the nearly 50 year time period.

Using cover crops and reducing tillage are effective ways to protect the soil resource from wind erosion. If efforts are made to reduce soil loss to wind erosion, water erosion will also be managed.

For more information, visit the North Dakota State University Soil Health webpage: **ndsu.edu/soilhealth** and click on the video tab to watch several videos on erosion and management approaches suitable for our region.

WATER MANAGEMENT *Take a Drink*

Cover crops got their start for most farmers trying to using excess moisture following a small grain crop in a no-till system. For others, having an extra tool like a winter annual cover crop in place for using spring moisture when transitioning to reduced till is a primary goal. Both goals are related to moisture management in reduced tillage systems and require different approaches to get the job done.

With small grain cash crops, moisture stops being transpired earlier in the season that other late season crops. Any rainfall events following harvest fill the soil profile and can lead to wet conditions in the spring, especially if there is a thick mat of residue. Managing moisture following a small grain crop relies on an entire system, so here are a few pointers.

First, cutting height at harvest to leave taller, standing residue and residue spreading evenly out the back of the combine are critical starting points. Residue management, like vertical tillage, may need to be used in some cases. Planting a cover crop consisting of low carbon to nitrogen ratios (like dwarf essex rapeseed, radish or turnip) into the wheat residue can help break down the residue and use excess moisture later in the season. Consider adding 20-30 lbs of nitrogen to promote cover crop biomass and accelerate the system. Nitrogen added while planting cover crops should be captured by the cover crop and released again into the soil, though timing of release is not known.

Using a winter annual like cereal rye (winter wheat or triticale) can be an excellent tool for managing spring moisture. The goal is to get cereal rye established in the fall so that it can start

growing and using moisture in the spring before any equipment can get into the field. Having a living cover crop in the spring may also help with trafficability and timely access to the field. Keep in mind that a winter annual can use too much moisture and needs to be monitored closely in the spring prior to planting a cash crop.

Typically, radish or other high nitrogen cover crops are not included for this goal of spring moisture usage because of timing of seeding. If there is not enough time for radish (or other cover crops) to grow and be cost effective in the fall, then it should not be included in the mix.

Having an additional method for water management in the form of transpiration by plants in reduced till systems is important. But again, keep in mind the entire system, the current crop being grown and the next crop in rotation to select the best possible cover crops to do the job.

AgWeek Soil Health *Minute*

North Dakota State University Soil Health is featured on the Soil Health Minute with AgWeek TV and Magazine. Every other week during the growing season, Abbey Wick shows how farmers are incorporating cover crops and using other soil health building practices to achieve on-farm goals. Additional information from each TV episode are also included in a column in AgWeek Magazine. The goal is to show farmers how the practices work and then follow up with more detailed information on integrating these practices on-farm.

Topics covered have included water and salinity management using cover crops, picking cover crops based on desired residue cover, cereal rye for weed suppression, interseeding corn, cover crops with sunflowers and evaluating soil health.

Videos and articles are posted on the North Dakota State University Soil Health webpage (**ndsu.edu/soilhealth**). The Soil Health Minute is sponsored by the ND Corn Council and ND Soybean Council.

BUILDING AGGREGATION *Add Some*

Soil structure provides a variety of services from environmental to logistical. Aggregation is just one component of soil structure that can be built by incorporating soil health building practices like reduced tillage and cover crops.

Environmentally, aggregation improves water and air movement into the soil profile and also helps with water retention. Aggregates stabilize organic matter in the soil for release at different rates on the order of years to decades. Lastly, aggregates provide habitat for a diverse array of biological components in the soil.

Not all aggregates are created equal – different sized aggregates have varying levels of stability and serve different functions in the soil. A mixture of both large and small aggregates is required to achieve desired benefits. Soil texture also plays role, clay soils are more conducive to building stable aggregates than sandier soils. Both will build aggregates, but the stability of those aggregates and mechanisms for development varies greatly.

Large aggregates are created by fine roots and fungal hyphae (in particular arbuscular mycorrhizal fungi) wrapping around soil particles (sand, silty and clay) and smaller aggregates along with organic materials (dead roots and fungal debris, residue in varying stages of decomposition). Glues, called exudates from roots and polysaccharides from biological communities along with other binding agents, are also secreted creating a “sticky string bag” to further stabilize the aggregate. Large aggregates create large pores that are useful for water drainage and air movement into the soil and typically protect organic matter that is relatively new to the soil, meaning it has a higher carbon to nitrogen ratio. Smaller aggregates are also held within the larger aggregates, which protect more decomposed organic matter with a lower carbon to nitrogen ratio. Large aggregates also house a suite of microbial communities, typically dominated by microbes that utilize oxygen. In the smaller aggregates within the larger aggregates, microbes that function in environments with limited oxygen can be found. There is incredible biological diversity within one aggregate!

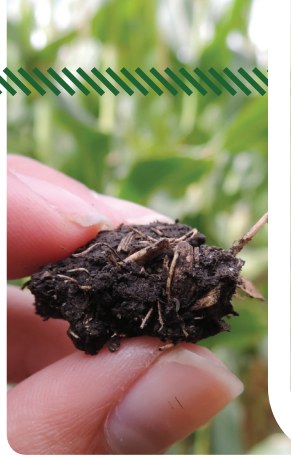
Large aggregates are most at risk based on selected farming practices. Typically, tillage is the most destructive because it rips apart the roots and fungal hyphae that help hold the large aggregate together. This exposes organic materials to oxygen and decomposition. When larger aggregates are broken apart, organic materials will be used by hungry microbes and lost to the atmosphere as carbon dioxide rather than being stored in the soil. With the introduction of tillage to soils in North Dakota, it was this release of organic materials that provided an immediate, short-lived source of fertility, but also led to the long-term decline in organic matter and reduction of other benefits provided by organic matter.

Small aggregates that exist on the outside of large aggregates are also important in the soil

Structure

system, but are less responsive to farming practices. They are formed primarily by clays and microbial glues that hold them together and protect a highly stable form of organic matter that remains in the soil for decades. Small aggregates create small pores in the soil that are important for water retention. This is why having a mix of aggregate sizes (large and small) is important for water management.

Logistically, aggregates help manage water for field access and provide a base for holding up equipment. Water will move down into the soil profile of an aggregated soil and make field conditions more desirable for equipment access. A stable, aggregated soil will also carry weight better than a soil that has un-aggregated primary soil particles (sand, silt, clay). This can be observed by walking into a field under no-till management and a field that has been tilled.



Cover crops play an integral role in building soil aggregation because fine roots, mycorrhizal associations and biological stimulation facilitate the building of aggregates. Including species in mixes that have fibrous roots and host arbuscular mycorrhizal fungi, like most grasses, leads to roots wrapping around soil particles and providing organic materials to the soil to boost biological activity. Also including winter annuals will lengthen the time a living root is in the soil – providing better aggregation, root channels to support water movement into the soil, biological activity to make nutrients available and ultimately better trafficability and field access.

5 TIPS FOR *building aggregates*

1. Evaluate the different management practices being used to find out which works best for building aggregates in your soils
2. Reduce tillage to keep large aggregates intact
3. Increase time of living root in soil by using a winter annual to support aggregate formation
4. Diversify mixes to provide multiple food sources to stimulate biological production of glues to stabilize aggregates
5. Use shallow and deep rooted species in mixes to build aggregates throughout the soil profile

CONSULTANT & FARMER *Profile*

MARK HUSO
Lakota, ND

@husocrop

Mark is an Independent Crop Consultant, starting Huso Crop Consulting and Soil Testing in 2011. He is based out of Lakota, ND and guides farmers on not only traditional practices, but also effective approaches to reducing tillage and integrating cover crops for his area. He sees the benefits of having roots to build soil aggregation and use of a winter annual cover crop, like cereal rye, to improve field access in wet conditions.

Scott farms in Aneta, ND raising wheat, barley, canola, pinto beans, soybeans and corn. Being reduced till (including no-till, strip till and vertical till) since 2002 and using cover crops starting in 2015, he sees the benefits soil structure provide to his system but also values the multiple approaches used to achieve yield goals. He uses primarily cereal rye and radish in his cover crop mixes to keep it simple and economical.

SCOTT HUSO
Aneta, ND

@ScottHuso

WEED SUPRESSION
A Little Competition

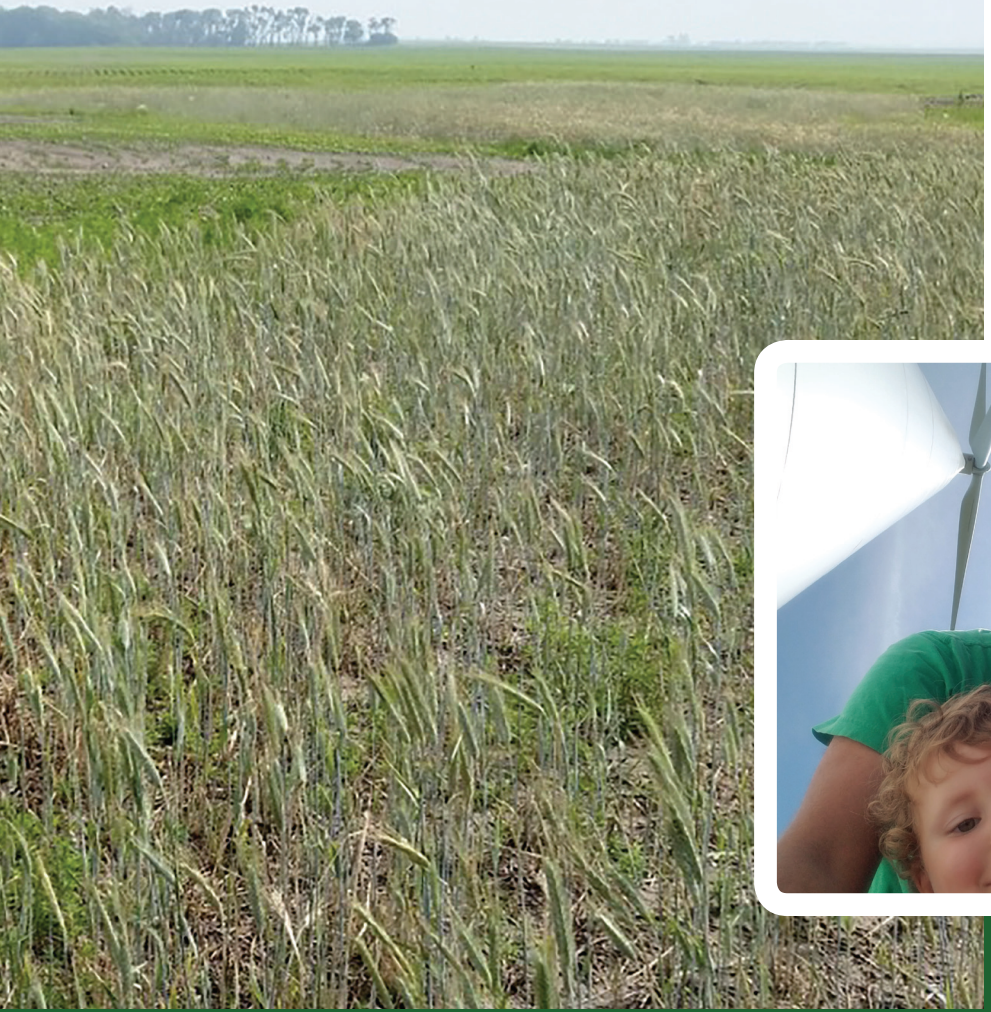
Cover crops can suppress weeds through competition for resources like water, sunlight and nutrients. It's the idea of "pick your green or Mother Nature will do it for you", where seeding a cover crop can replace undesirable weed species and reduce weed pressures. The key to this concept is to pick a cover crop that can easily be controlled and keep the mix simple.

In many systems, cereal rye is being used as a tool to control early-season weeds prior to planting soybean. Cereal rye establishes in the fall, over-winters and starts growing in early spring to compete with weeds that may establish prior to having desirable conditions for herbicide applications. The competition for resources along with a strong allelopathic effect (chemicals leaked out of the cereal rye root that stunts weed growth) are a win for weed suppression.

In studies conducted by North Dakota State University, there is typically 10 times less weed biomass in areas where cereal rye is growing prior to planting soybean than in areas where there is no cereal rye.

The “pick your green” principal is the same when using cover crops on areas with crop failure, including drown outs and salt-affected areas. In these areas, it is important to use cover crop species that will not cause issues with the cash crop currently growing or the next crop in rotation. For drown outs, getting cereal rye established may be a good fit, where barley could be used on salt-affected areas. Problem spots typically harbor weeds, so getting a cover crop established prior to the weeds can be beneficial.

Integrating cover crops into a herbicide program for weed management is a solid approach to getting control of weeds.



FARMER *Profile*

LEE TRAUTMAN

Jamestown, ND

Cereal rye is king on the Trautman Farm. They have been growing cereal rye as a cash crop and using it as a cover crop by broadcasting into corn at side-dress using a custom built unit. One main benefit they have seen as a result of using cereal rye is suppression of kochia and ragweed, both problem weeds in their area.

Lee started by seeding cereal rye at a 60 lb/ac rate and taking it to harvest. He then planted soybean into the volunteer cereal rye the following year. He was impressed with not only the weed control in using this approach, but also the moisture management.

The Trautman’s variable rate cereal rye by broadcasting into their corn crop while side-dressing nitrogen, hitting the sandier soils on the hilltop with 10 lbs/ac and the higher clay soils in low areas with 60 lb/ac. Lee is hoping to find the sweet spot with moisture management by reducing water use in the spring on the hilltops and maintaining high water use in the low parts of the field. While at the same time using cereal rye as a mode of action for weed control in their fields.

@lee_trautman

BIOMASS FOR GRAZING
What's on the Menu?

Cover crops are a great forage resource for grazing providing a nutritious and delicious menu. A mixture of cover crops provides a balanced diet for cows with the proper nutrient content and digestibility. Also, a mixture has lower risk of causing toxicity by toxic compounds.

Cover crops choices in a mix will vary with the time of planting (full season or fall grazing), location (dry or normal rainfall), soil health objectives, residual herbicides, type of cattle, and nutrient needs.

Grasses: Cool- or warm-season grasses produce high tonnage. Grasses are low in protein but their fiber has higher digestibility than legumes. Cool-season grasses such as oat, and barley are in general of better quality than warm-season grasses (forage sorghum, millet) but the latter produce more biomass. If you are planting cover crops in August or after, it is preferable that you include only cool-season grasses, since warm-season grasses won't have much time to grow before the first frost.

Legumes: They are high in protein content needed for muscle formation and milk production in the animal. The protein in legumes is mainly in the leaves. Stems have much lower content of protein and are high in fiber with digestibility of the fiber lower than that of grasses. For fall grazing, legumes with fast growth rate and tolerance to frost are preferred. Faba bean is becoming a popular option because it can survive well into November and tolerate temperatures of 20 F. Clovers grow very slow in the fall providing little forage and are more suitable for a full-season cover crop mix.

Brassicas: Forage brassicas are a great addition to a cover crop mixture for grazing. They provide highly digestible forage with high crude protein and energy content. Brassicas are very high in ash and water content and low in fiber. If used as sole feed, brassicas must be supplemented with fiber (dry hay, corn stover, wheat straw) to slow passage. Brassicas in mixture with cool-season grasses work great because they complement each other.

Brassicas tolerance to hard frost varies among species, with turnips and kales being more tolerant than radish and rape. It is very important to consider that forage production of brassicas varies greatly with species and even varieties within species. Make sure to look for variety trials near your area before selecting a forage brassica for grazing, not all turnip or radish varieties have the same forage yield potential. Selecting a high yielding variety adapted to grow in your area is crucial for a successful forage production.

All cover crops can be grazed if in a mix, providing a variety of nutrients. In a mix, possible toxins such as prussic acid, nitrates, sulfates, or bloating compounds are diluted reducing the risk for animal toxicity. But be aware that the mix you planted might not have the same composition at the time of grazing. It is important you assess the composition of your mix at the time of grazing. Taking a few samples to determine the proportion of each crop in the mix and send it for testing if needed. In drought conditions, many plants can accumulate nitrate, toxic for animals.

FARMER *Profile*

ANDY & MITCH HOENHAUSE

Lisbon, ND

Grazing cattle on cover crops is a common occurrence on the Hoenhause farm. They use cover crops in three areas of their rotation; following peas, following wheat and interseeded into corn. They have also been known to put some tough ground into a full season cover crop to both improve the soils and have a high quality material to graze.

Andy and Mitch will use whatever is sitting in the seed shed for their mixes, but most commonly they include radish, turnip, peas, winter wheat, oats or cereal rye in the mix. Interseeding corn with radish (2-3 lb/ac), turnip (1-2 lb/ac) and dwarf essex rapeseed (1-2 lb/ac) has given their cattle a good diet of protein for weight gain and fiber from the corn stalks to help slow passage.

@MHoenhause

United States Department of Agriculture
National Institute of Food and Agriculture

NORTH CENTRAL SARE
Sustainable Agriculture Research & Education

NORTH DAKOTA CORN COUNCIL

North Dakota Soybean Council
Our World Is Growing.