GRAZING COVER CROPS

NDSU EXTENSION SERVICE

SOIL HEALTH

DESIGNING *Your Mix*

Using 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 in some cover crops.

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

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 oats and barley, are in general of better quality than warm-season grasses (forage sorghum, millet) but the latter produce more tonnage. When planting cover crops in August, select 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 as opposed to the stems. Stems have much lower content of protein and are higher in fiber than leaves. Digestibility of the fiber in legume stems is lower than that of grasses. For fall grazing, legumes with fast growth rate and frost tolerance are preferred. Hairy vetch and faba bean can survive well into November and tolerate temperatures down to 20°F. Clovers grow very slow in the fall providing little forage, making them 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). Brassicas in mixture with cool-season grasses work great because they complement each other. There are many different forage brassicas including some well-adapted for full-season growth (swede and kales) and others for fall grazing (radish, turnip, rape). Avoid to use radish and mustard in full-season mixtures, because they will quickly go to seed.

TOPICS *covered*

Brassica 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 brassicas 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 for grazing.

Section written by: Marisol Berti, NDSU

RESEARCHER *Profile*

DR. MARISOL BERTI

Professor of Forage & 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 forage quality, and also for improving soil health properties with the focus being on root structures and residue.

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 Crops Council (mccc.msu.edu).

ag.ndsu.edu/plantsciences/research/forages

ENDLESS CHOICES
Species & Variety Selection

When it comes to selecting a forage for grazing it is important to keep in mind there are great differences between species and between varieties within species. There are many varieties available in the market as cover crops or forage for grazing. So, how do you know what to choose?

Farmers should select varieties based on performance in their region instead of cost. Cheaper seed may not always result in the best returns, this is especially important when relying on a resource for grazing. Fortunately, region-specific research has been done at North Dakota State University on species and varieties.

Table 1: Forage brassicas were planted in the fall and harvested in November. Yield did not vary significantly, but notice the differences in crude protein and total digestible nutrients among species and varieties (read the "Is the Difference Real or Not?" Sidebar for information on how to interpret the table).

Species / Cultivar	Yield (tons/ac)	Crude protein (%)	Total digestible nutrients (%)
Turnip			
Appin	2.3	16	72
New York	1.6	15	72
Rack	1.6	15	73
Pointer	2.1	14	72
Purple Top	1.8	16	72
Barkant	2.0	14	73
Forage Rape			
Barnapoli	1.5	16	78
Dwarf Essex	1.3	15	80
Hybrids			
Winfred	1.7	15	80
Pasja	1.7	15	73
Hunter	1.7	14	74
T-Raptor	1.6	14	72
Vivant	1.6	15	72
Radish			
Daikon	1.6	18	70
Graza	1.3	17	72
Groundhog	1.7	18	71
E. cabbage†			
Corine	1.5	16	80
LSD‡ (0.05)	*NS*	*2*	*2*

Species / Cultivar	Dry matter yield (tons/ac)	Crude protein (%)	Total digestible nutrients (%)
Kale			
Siberian	1.7	24	77
Maris Kestrel	4.3	18	79
D. Blue Vates†	3.0	20	80
Sovereign	3.3	19	79
Swede			
Major plus	2.9	24	76
Am. Purple Top	2.5	26	75
Dominion	2.3	25	76
Turnip			
Purple Top	1.8	23	71
Rack	1.7	24	75
Pointer	1.9	22	73
Hybrids			
Winfred	2.5	21	78
Pacer	1.0	22	72
Forage Rape			
Rangi	2.3	21	78
Barsica	3.1	21	79
Dwarf Essex	1.8	24	78
Bonar	1.9	24	78
W. canola			
Riley	1.6	25	77
Griffin	1.5	25	77
Athena	1.7	25	78
Summer	1.5	27	77
LSD‡ (0.05)	*0.6*	*4*	*2*

Forage yield and quality results are shown in Table 1 for fall-seeded and Table 2 for full-season forage brassicas and varieties within those species. Results are an average combined across locations (Carrington, Prosper and Fargo) and years (2012, 2013 and 2014) for experiments conducted in North Dakota.

Section written by: Marisol Berti and Osvaldo Teuber, NDSU

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Table 2: Forage brassica species and varieties within species planted as a full season cover crop. Dry matter yield crude protein and total digestible nutrients all showed differences amongst species and varieties. This shows how important species and variety selection within species is for grazing.

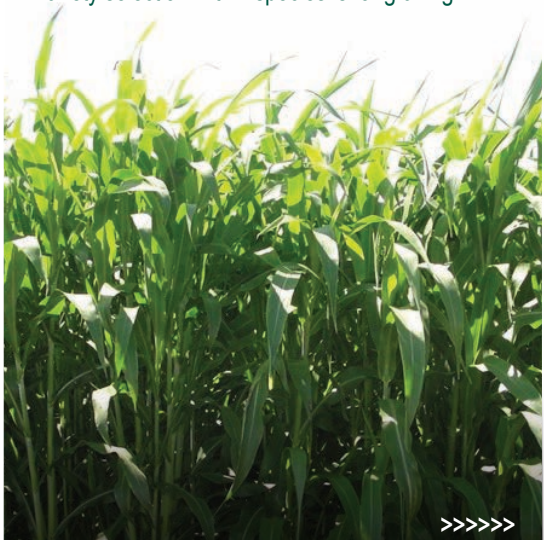

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Table 3: Forage sorghum, sorghum x sudan hybrids, sudangrass, sweet sorghum and millet yields for different varieties. Notice the striking difference in yields based on variety.

Variety	Dry matter yield *(tons/ac)*
Forage Sorghum	
S9-09	5.8
BMR 90 Leafy	6.5
BMR 105 MS	6.0
Greentreat 128	4.5
FS-05	6.8
CHR-FS9	5.4
CHR-FS4	6.4
CHR-FS3	5.6
Pampa Centurion	5.8
Brachytic sorghum BMR-6	5.8
Pampa Karamelo	8.7
Sorghum x Sudan	
Sweething	6.0
BMR Sweething	6.7
Green Dynamo	4.8
BMR AL 53	5.3
Greentreat Plus	5.4
SX-17	6.5
CHR-SS2	5.6
Pampa Verde Pacas	7.5
Pampa Verde BMR-6	5.9
Pampa Triunfo XLT-BMR	6.8
Forage King	4.0
Sudangrass	
Piper	5.5
Hayking	5.1
Forage king	4.0
CHR-SG1	6.4
Sweet Sorghum	
Sweet sorghum 54126	8.3
Sweet sorghum 56111	9.7
Sweet sorghum 36111	8.6
Sweet sorghum 36126	9.8
Dale	4.3
M81-E	6.1
Theis	7.7
Top 76-6	3.4
Millet	
Pampa Mijo BMR-6	4.3
LSD‡ (0.05)	*1.3*

Is the Difference REAL or Not?

The abbreviation at the bottom of each table, “LSD”, means “Least Squares Differences”. Let’s explain what this means and how it helps us make a decision for species and variety selection.

LSD is a statistical measure to determine if the difference observed between two varieties is real or not. Numerical differences between two varieties do not necessarily mean one is higher than the other, which is why we need statistics.

Using the LSD value is fairly easy.
Follow these steps:

1. Subtract the average yield value between two varieties of interest
2. Is the yield difference greater than the LSD value? If the difference between the two varieties is greater than the LSD value then they are statistically different.

Example:

Variety A yield = 4.3, Variety B yield = 3.1
4.3 - 3.1 = 1.2 tons /acre
LSD = 0.6

1.2 > 0.6, so Variety A is truly higher yielding than Variety B

SEASON'S *Grazing*

Cover crops provide opportunities to use cropped land for grazing livestock or to produce baled feeds. Livestock grazing on cover crops can further recycle nutrients back into the soil. Baled cover crops as hay, when harvested at the correct time, can provide a nutrient-rich winter feed.

Many annual forage species can provide excellent grazing opportunities for livestock or hay mixtures. However, with the relatively short growing season of 110 to 150 days in the northern Plains, limitations occur for many species. This is especially true when developing forage mixtures for planned late- and early-season grazing periods. When considering haying options, seeding should occur in late spring to early summer for planned summer haying.

Recommended seeding rates, depths and dates for each cover crop also must be considered when planning to integrate cover crops into an operation. Cover crops for late-season grazing should be seeded no later than August 15 to be cost-effective, and in many years, it should be seeded by August 1 so that the young plants have time to develop prior to frost.

Be aware of herbicide carryover if the field has been burned- down or sprayed chemically due to sensitivity issues for some cover crop species. Some herbicides may have residual effects that inhibit cover crop growth.

COVER CROPS FOR SPRING GRAZING

Spring grazing options require preplanning eight to 12 months prior to forage utilization. The most common options are winter cereal crops planted in early to mid-September or interseeded into cash crops like corn during the growing season. Winter cereal options include winter wheat, cereal rye and winter triticale. The use of a winter annual such as hairy vetch may be incorporated into a cereal crop seed mixture to enhance soil health benefits and diversity in the forage system while providing an additional source of protein and energy for grazing livestock.

So, which winter cereal crop should you use? Select cereal grain types based on goals for the land, grazing needs, crop insurance guidelines and herbicide carryover (if applicable). If the goal is to graze the winter cereal crop, winter triticale provides the most palatable feed type while cereal rye is least palatable. In recent years, winter triticale seed has been the least cost effective, while cereal rye has been the most cost effective. Thoughtful planning of early spring grazing or later season haying must be considered when choosing a cereal grain type or mix. Spring grazing of cereal varieties should occur at the optimum stage of plant development for animal nutritional requirements.

COVER CROPS FOR SUMMER GRAZING AND HAYING

(mid-July to early September)

Cover crops and annual forages make excellent feedstuffs for grazing or haying during the summer season. Often, the development of a summer-season forage crop in North Dakota dedicates the land use for an annual single-crop system. Forage species selected for summer use will vary, depending on intended practice.

Although most forage species will fit a grazing program, some are better than others. In comparison, some broadleaf forages are not recommended for baled feed due to high moisture content (i.e brassica species). In some operations, dual use of a cover crop is preferred, with haying followed by grazing if sufficient regrowth provides full use of the resource.

COVER CROPS FOR LATE-SEASON GRAZING

(mid-September to mid-January)

Cover crops for late-season grazing can provide a significant cost savings to producers by minimizing the need for baled forages. A mixture of brassica varieties and small grains will dominate late season due to their remarkable forage quality, even after a killing frost. Introduce livestock slowly and allow them to adjust to a fall cover crop mixture that may be nutrient-rich in comparison with late-summer range.

Late-season grazing of cover crops can be part of a dual-crop system in which a grain, other cash crop or hay crop can be planted beforehand in the spring, followed by the cover crop.

Section written by:
Kevin Sedivec, NDSU

5 STEPS FOR FALL GRAZING *After a Cash Crop*

1. Adequate moisture is essential to grow the cover crop
2. Spraying regrowth from cash crop with a burn down herbicide can help reduce competition with the new cover crop seeding
3. Fertilizing with a nitrogen fertilizer (i.e. urea) may be needed to enhance forage production of cover crops, especially brassica species
4. Determining proper seeding rate of each species within the cover crop mixture can assure proper production levels of each species - do not over-seed brassica species
5. Providing a high fiber forage source (hay or straw bales, residue crops, rangelands) to the cover crop pasture being grazed can be important if the cover crop mixture is dominated by brassicas and small grains.

EXTENSION *Profile*

DR. KEVIN SEDIVIC

NDSU Extension Range Specialist
& Interim Director Central Grassland Research Extension Center

I conduct research on late-season grazing alternatives including cover crops at North Dakota State University, working with cover crop mix options and management for grazing livestock. Our goal is to create a high quality cover crop mixture that is economically efficient while providing high quality grazable forage for livestock. This grazable cover crop mixture should provide a secondary benefit that improves soil health properties, reduce fossil fuel use associated with winter feeding, and reduce labor.

These educational programs, research and demonstration trials, and training of Extension Agents on effectively developing a cover crop mixture that provides cost-effective livestock grazing feed while building soil is important the North Dakota State University Extension Service and Agricultural Experiment Station.

Additional information in NDSU Circular

Annual Cover Crop Options for Grazing and Haying in the Northern Plains (R1759)

RESEARCHER & EXTENSION *Profile*

DR. GREG LARDY

NDSU Animal Sciences Department Head

I was raised on a dryland farm and cattle ranch on the edge of the North Dakota Badlands near Sentinel Butte, North Dakota. From 1997 to 2009, I served as the North Dakota State University Beef Cattle Extension Specialist with programming emphasis on use of alternative feeds and forages in beef cattle operations. I currently serve as department head for the Animal Sciences Department.

@greglardy

TOP SHELF *Forage Quality*

Forage quality is critically important to livestock performance. Forage quality will impact production parameters such as growth rate and level of milk production, as well as other production parameters. With cover crops, forage quality is impacted by a variety of variables including forage species, planting date, soil type, amount of precipitation, stage of growth, and other variables.

For optimum use, producers should be concerned about both the quantity and quality of the forage produced. Nutrient requirements of grazing livestock are impacted by pregnancy and lactation status, body weight, expected performance, and environmental conditions. As an example, non-lactating cows will have a lower nutrient requirement than rapidly growing calves or lactating females. Keep this in mind when selecting cover crops for grazing.

In general, forage quality is improved when the ratio of leaf material to stalk is increased. In addition, forage quality is greater when the plant is vegetative compared to when it is producing seed. In part, the goal of grazing management, is to keep the plant in a vegetative state as long as possible.

Forage quality parameters we are most concerned with include digestibility, protein content, fiber level, as well as levels of minerals and vitamins. Our goal is to meet the protein requirements of the animal, have a forage mix with relatively high digestibility, and relatively low fiber levels. In addition, it is important to be aware of potential anti-nutritional factors and toxins such as nitrate, cyanide, and other compounds which can accumulate in cover crops.

Section written by: Greg Lardy, NDSU

5 TIPS FOR *Maximum Quality*

1. Select a mixture of cover crop species suitable for your growing conditions
2. Select a planting date that will allow forages to be in a vegetative state during grazing
3. Manage grazing and forage allotment through the use of a grazing system
4. Match the forage to the type of animal which you intend to graze (gestating cows have lower requirements that rapidly growing calves)
5. Be aware of any potential toxicology concerns such as nitrates and cyanide levels in forages

TIPS *Forage Quality Testing*

Forage quality parameters to be most concerned with include crude protein, digestibility, fiber level, as well as minerals. Collecting a representative sample is one of the most important steps in accurate forage quality analysis. For cover crop mixtures, it may also be necessary to order a wet chemistry analysis rather than a Near-Infrared Spectroscopy (NIRS) analysis. The North Dakota State University Veterinary Diagnostic Laboratory provides testing for nitrates, cyanide, and other potential toxins (**www.vdl.ndsu.edu**).

Additional information in NDSU Circular

Alternative Feeds for Ruminants (AS1182)

TOXICITY *Concerns*

Some forages can cause toxicity to animals making it important to know what those risks are for effective management.

PRUSSIC ACID OR HYDROCYANIC ACID (HCN)

Forage sorghum, sudangrass, and hybrids contain HCN in the leaves and stems. In intact plant cells, HCN is linked to a sugar preventing HCN release. HCN concentration depends on species and varieties, maturity, plant injury, and environmental damage, such as hail and frost.

Sudangrass has less HCN than forage sorghum and hybrids. As plants mature, HCN concentration decreases. Hail, insect feeding, frost, or harvest cause cells to break releasing the toxin.

Grazing management to avoid toxicity includes:

- Delay grazing until 18-24" tall for cows and 12-15" for sheep. Regrowth after harvest can be toxic if less than 12" tall
- Do not graze after hail or a light frost
- Grazing after a killing frost in the fall is safe. HCN is a gas so after the plant dies, it will be dissipated quickly
- Haying or ensiling forage sorghum reduces the potential toxicity since HCN is released as a gas soon after it is cut

NITRATE

Nitrate toxicity can occur in many forage species, forage sorghum, corn, brassicas and cereals, especially when there is drought and high rates of nitrogen fertilizer have been applied to the crop. Always test for nitrate content in forages under drought for a prolonged time before grazing.

COUMARIN

Present in sweetclover but not toxic in green or fresh hay. Coumarin is converted to dicoumarol when sweetclover hay gets moldy causing bleeding disease in cattle. Grazing sweetclover in a forage mix is safe.

Sulfur-containing compounds: Forage brassicas, leaves, roots and seeds contain glucosinolates and S-methyl cysteine sulfoxide (SMCO). Rumen enzymes can metabolize some of the toxic compounds derived from glucosinolates and SMCO, but they can reduce animal growth when consumed in high amounts by young ruminants. Forage mixes containing grasses and legumes eliminates the risk of toxicity. Supplementing forage brassicas with wheat straw, hay or corn stover is recommended.

PESTICIDES RESIDUES

Restrictions on grazing/feeding/haying of crops treated with herbicides, insecticides or fungicides can be found in the North Dakota Weed Guide, Field Crop Insect Management Guide or Fungicide Guide. Most pesticides have a time interval in which the crop cannot be grazed or used as hay.

BLOATING

Although not a toxin, many forage legumes cause bloating, which can cause animal's death. Among this are alfalfa, sweetclover, red clover and white clover. Legume-grass mixtures reduce the bloating incidence.

Section written by: Marisol Berti, NDSU

PESTICIDE *Residues*

Most pesticides have a time interval in which the crop cannot be grazed or used as hay. Restrictions on grazing, feeding or haying of crops treated with herbicides, insecticides or fungicides must be considered. Information on grazing restrictions can be found in the North Dakota Weed Guide, Field Crop Insect Management Guide or Fungicide Guide. Guides are available online through North Dakota State University Extension and can be found by searching "NDSU ND Weed Guide" (for example) on a web search engine.

STAYING REGULAR *Cattle Diet*

Cover crops can provide an excellent source of nutritious forage for grazing. Here are a few tips when determining what to include in the mix or supplement to create a balanced, healthy diet.

GRAZING BRASSICAS

Brassicas such as turnip and radish are commonly added to most cover crop mixtures because they are inexpensive, very tasty to the animal and high quality. However, too much of a good thing can be dangerous. The brassicas are 70 to 80 percent water while actively growing. Because the protein and water content is so high and fiber content low, rumen (stomach) function will be "out-of-whack", thus not functioning properly. When livestock consume a high protein – low fiber diet the rate of passage of the forage will be high and diarrhea common – reducing performance and possibly creating sick animals.

Always provide plants in the seed mixture that can provide fiber. These plants include foxtail millet, sorghum, sudangrass, and corn to name a few. You can also provide free choice low quality hay. The grazing animals will seek fiber when grazing high protein and high water content feed, creating a great opportunity to increase intake and use of lower quality feedstuffs (i.e. straw, slough hay, carry-over hay, and crop residues).

INCLUDING OILSEEDS

When including flax in a mix, it should be limited to 12 percent of a livestock diet (dry matter) because of its high fat content. Excessive fat (more than five percent fat) in ruminant diets can impair the livestock's ability to digest forages normally. Flax residue can cause impaction if consumed in large quantities. Also, if flax in a cover crop mix has gone to seed, the fat in the seed can impair normal ruminant function.

Section written by: Kevin Sedivec, NDSU

FARMER *Profile*

JUSTIN ZAHRADKA

Lawton, ND

The ability to extend the grazing season is a main benefit of cover crops on my farm. Grazing early in the spring or late in the fall keeps cattle out of the feedlot, saving time and feed while improving soil and animal health. I started grazing cover crops back in 2011 and have been collecting data and fine tuning the system ever since.

I like to use a diversified mixture of four to seven different species (mainly oats, peas, radish, turnip, sorghum x sudangrass, hairy vetch and cereal rye) that provide a high nutrition with Relative Feed Values (RFV) as high as 163 and average daily gains exceeding 2 lbs/day on calves. Since I started collecting information from my system, soil organic matter levels have increase by 0.1% each year over a three-year average. Cover crops not only increase soil organic matter levels, but I see increases in water holding capacity, soil structure, and erosion control in my fields. I utilize rotational grazing to manage cover crop biomass efficiently. Some advice I have for grazing cover crops is to ***"start grazing earlier than you think you should, and leave more residue than you think you want".***

@JustinZahradka

OUT THE BACK END
Manure & Compost

It's no secret that manure is a valuable fertilizer resource. Whether it hits the field from a spreader or "naturally" via grazing livestock, the nutrients are not only useful for crop yields but also for boosting soil health properties. On average, North Dakota beef manure contains 13 pounds of nitrogen (N) and sixpounds of phosphorus (as P2O5) per ton. Although manure contains these nutrients, most of them are in an unavailable form until microbial breakdown occurs. These necessary microbes are an indigenous part of manure, so as long as soil temperature and soil moisture are favorable, this process (mineralization) happens naturally during the growing season. For crops that require high amounts of N early in the growing season, manure needs to be applied the previous fall or together with a commercial starter N product in the spring as mineralization occurs slowly over the growing season. During the first growing season after applying manure, 50% of the N and 80% of the P are available for plant use. So if your manure test total N is 13 pounds, 6.5 pounds of N will be available for plant use during season one, 20% during season two and 10% during season three. During season two after applying manure, 10% of the P can be credited.

We will switch gears now and look at manure in another form: compost. Things here can get a little tricky, but not hard. When manure is properly composted (heated and turned several times) the availability of N becomes even less (20% vs. 50%) while the P availability remains the same (80%). This is why it is suggested to use properly composted manure as a P fertilizer vs. N fertilizer. Composting manure is a simple process that requires the manure with a particular carbon (C) to N ratio to be piled and turned at specific temperatures for a certain amount of time. Composting reduces the volume of the initial pile by approximately 50%, changes the availability of N, and if done correctly, kills weed seeds. If turned with an implement specific to composting, the end prodtuct is more consistent in particle size than raw manure which allows for a more even spread across the field.

Spreading manure/compost will cost someone money. It is common for the person receiving the product to pay for the hauling and spreading costs. This cost will vary based on mileage from manure storage site to field. A list of North Dakota custom manure haulers can be found on the LEM website: https://www.ag.ndsu.edu/lem. Another option for spreading manure is to let the livestock spread it themselves. One benefit of grazing cover crops is that there no spreading cost. Another benefit is that you are getting the added N fertilizer from the urine of the livestock. The N in urine is a readily available fertilizer that plants can use right away. If grazing is something you would like to try, there are fencing strategies that can be followed to manage manure application from the live animal as opposed to haphazard piles spread around the field.

Whether you're spreading or grazing, manure, like commercial fertilizer, is a nutrient and can cause water pollution if not properly handled. Manure should be applied only at rates needed by the crop you're planting according to soil test results and fertilizer recommendations.

Section written by: Mary Berg, NDSU

5 TIPS FOR *Getting Composting Right*

1. **C:N** – a proper carbon to nitrogen ratio (20:1 – 40:1) will ensure an efficient composting process
2. **Pore Space** – 50% of the pore spaces should be filled with water while the other 50% need to contain oxygen
3. **Temperature** – when the pile falls below 120˚ F or goes over 155˚ F it's time to turn it
4. **Turning** – this is an imperative step as it reintroduces oxygen to the microorganisms allowing them to continue the composting process
5. **Testing** – sample the compost when it is done so you know what the nutrient content of the fertilizer is

Additional information in NDSU Circular

Annual Cover Crop Options for Grazing and Haying in the Northern Plains (R1759)

EXTENSION *Profile*

MARY BERG

NDSU Area Extension Specialist/Livestock Environmental Management

Carrington Research Extension Center

I tell producers, ***if it stinks or is decomposing, it's my thing!*** Working in the field of Extension nutrient management looks different every day. I might be in one area of the state helping a manure composting company get off the ground, in another area composting dead livestock or out-of-state representing North Dakota at manure and soil health conferences around the region. The one thing that stays the same is the applied approach of the program. My job is to be out with producers (crop and livestock) helping them figure out the best way to use manure as a fertilizer product.

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DOUBLE DUTY
Grazing & Soil Health

Adding livestock to a soil health system that already includes cover crops is a great way to get multiple benefits for livestock and also soils. Livestock can graze on a nutritious food source and soils can gain improved soil properties from cover crops breaking up compaction and building aggregates, recycling nutrients, adding organic matter and boosting microbial activity.

COMPACTION, AGGREGATES, AND NUTRIENTS

Many grazing mixes contain turnips and/or radishes which serve double duty as a high nutrition food source for cattle and can also accomplish the soil health goals of reducing compaction and capturing nutrients. Deep-rooted cover crops recycle nutrients that have leached deep in the soil profile and bring them back up to the surface. Livestock further recycle those nutrients back into the soil by processing the vegetative material and then spread their manure back to the soil. Mixes used for grazing may also contain grasses, which are excellent for building soil aggregates with fibrous roots that wrap around soil particles to hold them together.

ORGANIC MATTER

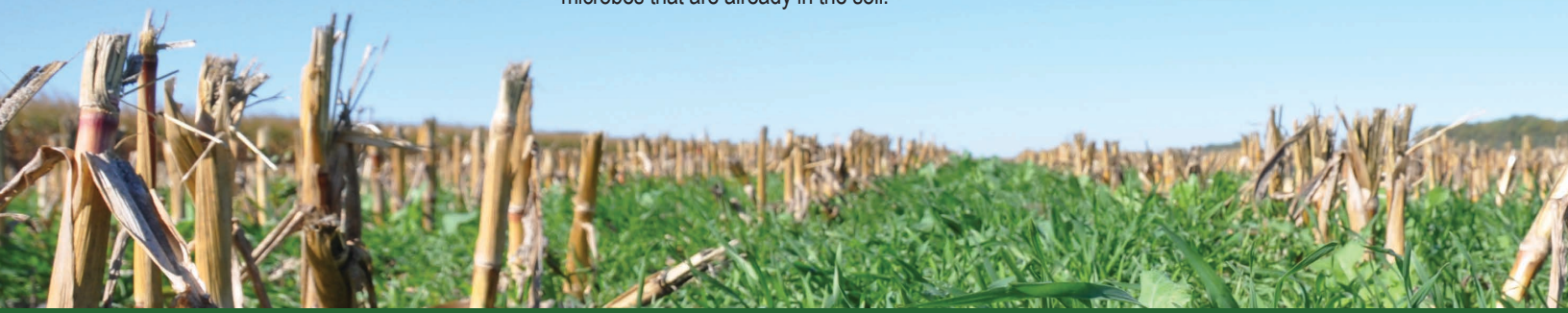
With timely rains, cover crops biomass can be a resource not only for grazing but also provide root additions to build organic matter. As roots turnover in the soil, they add an excellent source of organic material of varying quality. This can be especially important in sandy soils where organic matter additions are the primary way to increase water holding capacity. Manure additions with grazing can help increase organic matter as well.

MICROBIAL ACTIVITY

Cover crops lengthen the time a living root is in the soil before or after a cash crop. The immediate zone around the root, called the rhizosphere, is a hot spot for microbial activity. Supporting and diversifying rhizosphere activity is one benefit of using cover crops. Vegetative material processed through the rumen of cattle is also high in biological activity, but it consists of primarily anaerobic microbial communities (meaning they thrive in an oxygen limited environment). So, the microbes in the manure are not necessarily adding biological communities to the soil since oxygen is present, but the organic material stimulates the aerobic microbes that are already in the soil.

Using specific cover crop mixes with cash crops can achieve both on-farm soil health related goals and provide a balanced diet for cattle. For example, interseeding a cover crop which include radish and turnip into standing corn is one way to get a jump start on cover crop growth while establishing a high quality vegetative material intermixed with corn stalks for grazing. Other options may include seeding a cover crop mix following small grain harvest in a field adjacent to a corn field. Cattle will move back and forth between the cover crops and corn stalks for a balanced diet. No matter how it's done, integrating cover crops and livestock into a grain operation can provide many benefits related to soil health.

Section written by: Abbey Wick and Luke Ressler, NDSU



DR. ABBEY WICK

NDSU Extension Soil Health Specialist

I partner with farmers, consultants, industry representatives, researchers and other educators to evaluate and establish soil health building practices on-farm. These practices focus on whole systems approaches for reducing tillage, incorporating cover crops, diversifying rotations and managing salt-affected soils. Recently, I have started working more with grazing cover crop systems. I learn something new from everyone I meet and try to connect farmers with common interests to accelerate on-farm adoption of practices. I also share ideas "from the field" with research faculty on campus for further evaluation so we can get farmers the information they need to help make decisions.

ndsu.edu/soilhealth

@NDSUsoilhealth

EXTENSION *Profiles*

LUKE RESSLER

NDSU Research Technician in Soil Health

I provide technical support for the on-farm research projects and extension activities for the Soil Health Program. I have always been interested in systems which promote soil health because we use many of these practices on my own family farm. We farm in Cooperstown, ND where we've have been growing cover crops for grazing for about 8 years. We began by planting a mixture of turnips, radish, and field peas after wheat harvest. With a timely rain, cover crops can provide late season grazing in late October or November. After field pea harvest we plant a small grain such as barley, oats, or cereal rye along with turnips and radish. Those fields are grazed or left alone so the cover reduces wind erosion and provides snow catch. Recently we mounted a valmar broadcaster onto our sidedress unit, and started broadcasting 1-2 lbs of radish into corn at the V5-V7 stage when applying 28%. After corn harvest we graze the corn stalks and cover crop.

@ResslerLuke

HAVING A PLAN

Stocking Rates & Land Agreements

STOCKING RATES

Stocking rate is one of the most important management decisions made by livestock producers. Setting appropriate stocking rates is critical for maintaining livestock and resource health. Stocking rate is the number of specific kinds and classes of animals grazing or using a unit of land for a specific time period.

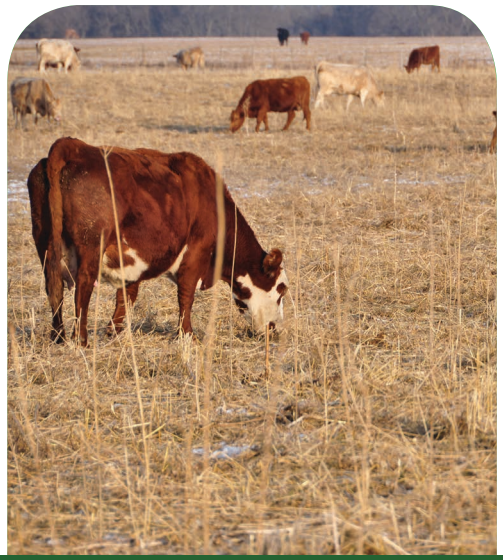
Stocking rates should be calculated based on carrying capacity, which is the amount of forage available grazing animals. Both stocking rate and carrying capacity are typically expressed as animal unit months (AUMs), or the number of animal units grazed for one month. The standard animal unit is a 1,000-pound cow with a 6-month-old or younger calf by her side.

There are a number of factors that influence carrying capacity including soils, type of cover crop, stage of growth and rainfall. To accurately determine carrying capacity one must first determine forage production of the area to be grazed. The most accurate method to calculate forage production is the clip-and-weigh method. This method requires the actual harvesting of standing forage at a given time to predict available forage.

The available forage is measured by hand clipping and weighing a specified number of plots within a grazing/forage production area. See North Dakota State University Extension Publication Range and Forage Production Sample Kits (R1838) for detailed instructions on calculating forage production. Once forage production has been determined then an adjustment must be made for harvest efficiency.

Harvest efficiency is the amount of the plant that livestock will impact during the time they are grazing the pasture. This includes the amount of the plant eaten by the animal, as well as the spoilage from waste and trampling. Harvest efficiency is expressed as a percent and should be multiplied by the total amount of forage on your pasture to give you the actual amount of forage for use by grazing animals while continuing to maintain proper use of the resource. When grazing cover crops your harvest efficiency will depend on the desired amount of residue following grazing. The two most common scenarios are:

1. Take all, no residue left behind, which would be a harvest efficiency of 75%.
2. ***"Take half, leave half"*** that is achieved at 35% harvest efficiency.



LAND AGREEMENTS

Farmers looking to take their soil health program to the next level may consider incorporating livestock into their system. One option that limits the risk to producers is renting fields with cover crops or crop residue to livestock producers looking to expand their grazing resources. The recommended method for calculating rental rates is utilizing Pasture Quality Factors. This method uses current market value for hay price per ton x pasture quality factor x animal unit equivalent. It will undervalue rangelands, especially with good cattle prices and lower hay values:

$60/ton grass hay x 0.15 x 1.15

1,200 lb cow with calf = $10.35/AUM

When developing a contract it is important that the responsibilities of the landowner and tenant are determined. The tenant is responsible for activities related to livestock production. Whereas, the landowner is responsible for activities related to land production. If soil health is one of your priorities, you may want to include information of the desired amount of residue to be on the field at the end of the grazing period.

Section written by: Miranda Meehan, NDSU

Additional information in NDSU Circulars & App

Determining Carrying Capacity and Stocking Rates for Range and Pasture in North Dakota (R1810)

NDSU Range and Forage Production Sample Kits (R1838)

NDSU Extension Publication Determining Pasture Rental Rates (R1823)

NDSU Grazing Calculator App

EXTENSION *Profile*

DR. MIRANDA MEEHAN

NDSU Extension Livestock Environmental Stewardship Specialist

My research and extension program focuses on livestock and environmental interactions. The goal of this program is to provide research based information and tools to producers that enable them to manage their livestock, soil, forage, water and wildlife resources in a manner that preserves them for future generations. My training has instilled in me the importance of a systems approach and the importance of evaluating all the components of a system to enhance sustainability and productivity through implementation of good stewardship practices. A systems approach is important as our producers are running diverse operations influenced by a number of environmental variables and management decisions.

@NDSU_eX_Steward

NDSU Livestock & Environmental Stewardship

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