Managing Spring Planted Cover Crops for Livestock Grazing under Dryland Conditions in the High Plains Region

Fact Sheet No. 0.309

by Joe Brummer¹, Sandy Johnson², Augustine Obour³, Kat Caswell⁴, Angie Moore⁵, John Holman⁶, Meagan Schipanski⁷, and Keith Harmaney⁸

Selection of Species

Determining what to plant can be a daunting task with all of the varied species available for use as cover crops. For Kansas and Nebraska producers, local Land Grant Universities and the Midwest Cover Crops Council have developed a decision tool to help select species based on specified goals. When cover crops are grazed, one needs to choose species that will not only benefit soil health but will also be palatable and safe as forage for livestock. Fortunately, many of the species currently recommended for use as cover crops are also good for forage production. Factors such as nutritive content and potential toxicities must be considered.

While a number of potential problems can occur with various forages, most can be managed. The most frequent problem is the accumulation of nitrates that is common with oats and brassicas but can occur in a variety of species under certain growing and management conditions. Most recommendations for feeding nitrate containing feeds come from dry forages. Anecdotal evidence would support the idea that the tolerance level may be different in green growing forages than in dried and baled hay. Rate of intake is less in green forage than baled feed, and selectively grazing leaves prior to stalks, which are lower in nitrates, helps reduce the potential toxicity issues associated with high nitrates. However, caution is still required when grazing high nitrate forages and testing before grazing is recommended. Prussic acid is another toxicity to beware of when grazing, particularly with sorghums, but these species are less common in spring planted mixtures. Refer to publications on nitrate (CSU or KSU fact sheets) and prussic acid (CSU or KSU fact sheets) toxicities for more information. For a more complete overview of forage crops with potential toxicities, please see the publication Grazing Management: Toxic Plants.

For spring planted cover crops, most, if not all, of the species planted should be classified as cool-season in order to be able to plant early and take advantage of winter and early spring moisture. Species that fall into this category include the small grains (e.g. wheat, barley, oats, triticale, and cereal rye), brassicas (e.g. turnip, rapeseed/canola, and radish), and legumes (e.g. field/winter peas, winter lentils, vetch, and sweetclover). In our experience, including warm-season species like millet, sorghum-sudangrass, and sunflower in spring planted mixes results in only minimal establishment and contribution of these species to yield and forage quality. By the time warm-season species germinate, the cool-season species have already established and have a competitive advantage. Therefore, instead of investing in complex mixes that include both cool- and warm-season species, your options are to cut back on the total seeding rate by eliminating warm-season species from the mix, increase the seeding rate of cool-season species in the mix, or add other cool-seasons to the mix. Depending on your crop rotation, a targeted planting of warm-season cover crops for summer forage grazing can be a good option.

Complex mixtures of 6 or more species, often referred to as “cocktails,” are commonly recommended. The benefits of cocktails relative to single species or simple mixtures of 2 to 4 species depend on your specific management goals. Competitive cool-season grass species tend to be the highest biomass producers, which can optimize weed control.

¹Joe Brummer, Associate Professor/Extension Forage Specialist, ²Angie Moore, Research Associate, and ³Meagan Schipanski, Assistant Professor, Colorado State University, Soil and Crop Sciences; ⁴Sandy Johnson, Professor/Extension Beef Specialist (Colby); ⁵Augustine Obour, Associate Professor (Hays); ⁶John Holman, Professor (Garden City), and ⁷Keith Harmaney, Range Scientist (Hays), Kansas State University; and ⁸Kat Caswell, Extension Educator (McCook), University of Nebraska. (12/18)
and forage production. Mixtures that contain these competitive species along with legumes and/or brassicas can provide similar or, in some cases, less biomass than single species (Table 1). Mixtures are often used for benefits other than biomass production, such as providing nitrogen fixation by including legumes or soil pest suppression by including brassicas. From a grazing perspective, mixtures can produce forage with a range of palatability that can provide benefits and limitations. For example, when a legume is in the mixture, protein can be increased, though protein already tends to be high in cool-season mixtures (Table 1). In addition, species in mixtures are often grazed selectively, which can result in lower utilization of some species although this and be more cost effective compared to more complex mixtures while still meeting or exceeding the nutrient requirements of most classes of livestock (Table 1). Grazing management in regard to the maturity of forage consumed will have a large impact on animal performance. Based on our experience from additional studies in eastern Colorado and western Kansas, cereal grains are most competitive and tended to dominate mixtures, even when other cool-season species were included in the mixture, such as rapeseed and forage peas. Once an area has been grazed and competition from the cereal grains reduced, then species like rapeseed and forage peas will grow and/or regrow if soil moisture is available.

Variability in Forage Production

Forage productivity will vary from year-to-year under dryland conditions, which makes this one of the biggest challenges facing producers that graze cover crops in the High Plains Region because stocking rates will need to be adjusted annually. As an example of yield variability across years and among cover crops, Table 1 lists the low, average, and high forage yields for 2 sites in western Kansas. Based on a 2-year on-farm study conducted in western Kansas, southwestern Nebraska, and eastern Colorado, forage yields ranged from just under a 1,000 lbs/ac up to almost 5,000 lbs/ac (Table 2). Spring precipitation was higher in 2016 at all farms, which resulted in an average forage yield of just under 4,000 lbs/ac. Due to the dry spring conditions in 2017, forage yields averaged about 50% less across farms at just over 2,000 lbs/ac. The effect of the east-west precipitation gradient within the region was also evident as the 2 farms that were in the drier part of the region (i.e., eastern Colorado) produced less in 2017 than the farms farther to the east.

Producers have several options to manage this variability in forage production. A flexible herd size where animals can be added or subtracted based on a given years productivity is the ideal situation.

Table 1. Forage yield and nutritive content (crude protein (CP), acid detergent fiber (ADF; higher values reflect lower digestibility), neutral detergent fiber (NDF; higher values reflect lower animal intake), and in vitro dry matter digestibility (IVDMD; reflects relative energy differences) at heading, before grain fill of various cover crops and mixtures averaged over 2 years at the Kansas State University HB Ranch north of Brownell, KS and 4 years at the Kansas State University Southwest Research-Extension Center near Garden City, KS.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Avg</td>
<td>High</td>
</tr>
<tr>
<td>Oat</td>
<td>1885</td>
<td>2313 b3</td>
<td>2741</td>
</tr>
<tr>
<td>Triticale</td>
<td>3052</td>
<td>3192 a</td>
<td>3331</td>
</tr>
<tr>
<td>Oat/triticale</td>
<td>2836</td>
<td>3126 a</td>
<td>3416</td>
</tr>
<tr>
<td>Oat/triticale (flex)1</td>
<td>2575</td>
<td>3066 a</td>
<td>3557</td>
</tr>
<tr>
<td>Oat/triticale/pea</td>
<td>2043</td>
<td>2282 b</td>
<td>2521</td>
</tr>
<tr>
<td>Cocktail2</td>
<td>2241</td>
<td>2303 b</td>
<td>2364</td>
</tr>
<tr>
<td>Cocktail (flex)1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

1 Only planted when there was adequate moisture.
2 Species were spring oat, triticale, forage pea, buckwheat, turnip, and radish.
3 Values within a column followed by the same letter are not significantly different at the p>0.05 level.
4 Planted in 2016 only.
The need to move fences every day or every few days and how to handle watering the animals are two of the biggest

Grazing Management

When it comes to managing grazing of cover crops, numerous options can be considered. The ultimate strategy that is chosen will be influenced by your overarching goal(s) for the cover crop. Cover crops are generally grown for more reasons than just achieving high levels of harvest efficiency (i.e. percent utilization of available forage) as you would if this were a dedicated forage crop. You want to leave enough residue behind to maintain most of the benefits associated with planting cover crops (Figure 1). With that in mind, the use of continuous grazing is not a bad option. Basically, you would calculate a stocking rate based on the estimated yield and put the whole herd in one large field to graze. Advantages associated with this system of grazing are that no fences are moved and only one water source is needed (i.e. labor and inputs are minimal). However, if the field is large, livestock will tend to overgraze the forage closest to the water source while underutilizing the forage farthest from the water, unless you are able to move the watering location. Livestock are also free to choose any plant or plant part, so their diet quality and performance will be high, especially at first, but will decline over time as they are left with the less palatable and nutritious plants to choose from. Harvest efficiency will generally be around 30% with continuous grazing.

Some form of rotational grazing where a large field is divided into two or more smaller units, or paddocks, and the animals rotated from one paddock to the next is also a good option that has some advantages and disadvantages. The more paddocks that the field is divided into, the higher the stocking density (i.e. number of animals per acre). As stocking density increases, harvest efficiency may increase to the point where 50% or more of the available forage can be utilized by the livestock. This increase in harvest efficiency means that you can graze longer or with more animals, but this benefit may or may not fit with your goal of leaving a given amount of residue in the field. In our experience working with producers that rotated through only 4 paddocks, residue remaining at the end of grazing averaged 75 to 80% of the biomass from ungrazed exclosures even though utilization was greater than 50% in the early grazed paddocks. This simple rotation allowed regrowth to occur in the early grazed paddocks and maintained the level of residue desired. Higher stocking densities will also result in plant material being trampled onto the soil surface, which will result in faster decomposition and nutrient cycling. Manure and urine also tends to be more uniformly distributed across the field as stocking density increases, which reduces the buildup of nutrients near water, shade, and other loafing areas. One of the big drawbacks to concentrating animals into small paddocks is that the effects of soil compaction can be compounded, especially when grazing on heavier clay soils following a significant precipitation event. Alleviating soil compaction is not easy, especially for no-till producers. Expect traffic lanes to and from, and around the watering location to have the most soil compaction. These isolated areas will require either tillage or manure spreading to correct the problem but are generally a small fraction of the entire field.
hurdles to overcome that keep many producers from practicing rotational grazing. However, with the use of temporary electric fencing, it is relatively easy to move fences in minimal time. Water can be more problematic, but with small, moveable tanks and a moveable supply tank on a truck or trailer, water can be moved right along with the animals. Alleys can also be constructed using temporary fencing so that animals can access permanent watering points.

One common method used when grazing annual cover crops is referred to as strip grazing. It is similar to rotational grazing where a temporary fence is set up to allow animals access to one to a few days’ worth of feed but differs in that there is no back fence and animals can graze both fresh, residual, and regrowth forage. This method is convenient for watering animals as the fence can be set up so they have continuous access to a single water point. One drawback to this method is that animals are continually crossing back and forth across the same ground as they come and go from water, which can increase the chances of soil compaction, especially near the water source. In addition, the area closest to the water will be grazed more heavily. Manure and urine also tend to concentrate near the water source.

Unlike rotational grazing, little regrowth accumulates when strip grazing because animals will continually search out and graze any new growth in the previously grazed strips. Because of this, you may not be able to meet your residue goals. Utilization levels will also be high in the strip grazed first and gradually decrease as you move across the field to the last strip grazed, resulting in uneven distribution of residue, which also may not be ideal for meeting your goals.

Once you have settled on a method of grazing, the next decision you need to make is when to start grazing your cover crop. If you are grazing steers and heifers and your goal is to achieve a given level of weight gain, then you need to start early to take advantage of high forage quality. The mixes we have been using for spring planted cover crops tend to be dominated by cool-season cereal grains like oats and barley. Once these species achieve 6 to 8 inches of growth, you should think seriously about starting to graze (Figure 2). It often looks like not much growth is available and you need to give animals plenty of area at this time or move them often if rotationally grazing, but these forage species will soon enter the rapid growth phase and animals may not be able to graze enough forage to keep up with new growth. Once these cereal grains start to joint, forage quality rapidly declines along with palatability. In as little as 4 to 5 weeks, plants will begin to head and start to dry down and utilization will drop off significantly (Figure 2). At this point, you should think about moving animals to other forage sources if you want to maintain individual gains. If using rotational grazing, you can generally expect to see significant regrowth in the early grazed paddocks, sometimes to the point you can hardly tell paddocks were grazed. You could decide to utilize this regrowth, which will be of higher quality, by rotating animals back through those paddocks, or just leave it as standing biomass to meet soil health goals.

Alternatively, some producers are more concerned about meeting their biomass goals for soil health and delay the start of grazing until plants are fairly mature. In these situations, animals will be very selective and utilization levels will be low. Forage quality will also be lower, so this approach is better suited for grazing cows that have lower nutrient requirements compared to steers and heifers. You will get some forage benefit by doing this, but the main benefit will be trampling of the forage, which will provide ground cover and speed decomposition.
Determination of Stocking Rates

Several key pieces of information are needed to estimate a stocking rate. The first is an estimate of the forage yield your field will produce during the period it will be grazed on a dry matter basis (see the section on variability and Table 1). How much forage will be consumed each day will depend on animal body weight and forage quality. For green and growing forages, intake will run from 2.5 to 3% of body weight on a dry matter basis. Another key input is the percent utilization desired. In dryland systems, 30% is a conservative starting point unless it appears to be an excellent moisture year with above average yields. Calculations can be made to estimate days of grazing for a given number of animals (example 1 in Table 3) or the number of animals for a set grazing period (example 2 in Table 3). A Carrying Capacity Calculator is also available to help with these calculations.

Other Considerations

Keep in mind for spring-planted cover crops dominated by cereal grains, palatability will decline as plants mature. How quickly the crop matures may determine how long a field can be grazed. Producers that can add or subtract cattle as needed in relationship to fluctuating forage availability, or that remove cattle during wet conditions to an adjacent native pasture or drylot will have an advantage in using these forages. The historical variation in spring growing conditions on dryland acres strongly suggests that backup plans are made at the same time as plans to graze cover crops. In years with excess moisture and high forage production, one should consider putting part of the crop up as silage or hay for drought years.

If grazing starts in a predominately cereal grain cover crop at 6 to 8 inches in height, forage quality will be very high and will work well for growing cattle. Young, old, or thin lactating cows that need to regain condition post calving would also benefit from this high-quality forage. If more grazing pressure is needed than planned, allowing young, growing cattle to graze ahead of mature cows would be a good approach. Moving pairs with young calves when grazing cover crops can be a challenge, thus planning ahead can help when it comes time to implement grazing.

Example Timeline

Following is an example timeline with suggested planting, start grazing, and end grazing dates for spring-planted cover crops. This timeline will allow cover crops to effectively utilize winter and spring moisture to produce the highest yields possible under dryland growing conditions while providing livestock with high quality forage.