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

Fact Sheet No. 0.309 Crop Series | **Production**

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Quick Facts

- Cool-season species should be chosen for spring planted cover crops to optimize growth and take advantage of winter and early spring moisture.
- Cool-season grasses tend to dominate, often to the detriment of other species, when planting cover crop mixtures in the spring.
- Yield variability is high when growing cover crops under dryland conditions in the High Plains Region ranging from under 1,000 lbs/ac in dry years to almost 5,000 lb/ac in wet years.
- Stocking rates must be flexible because of the large year-to-year variability in cover crop productivity.
- Spring planted cover crops can provide an average of 30 to 45 days of grazing.
- Start grazing spring planted cover crops when they reach 6 to 8 inches of growth to take advantage of their high nutrient content and palatability.

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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

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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.

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.

	Yield, Brownell (2015-2016)			Yield, Garden City (2015-2018)			Forage Quality, Brownell			
Treatment	Low	Avg	High	Low	Avg	High	CP	ADF	NDF	IVDMD
	lbs/acre						%			
Oat	1885	2313 b[3]	2741	145	633 d	1318	12.1 b	37.4 ab	60.3 bcd	76.0 ab
Triticale	3052	3192 a	3331	319	1427 b	1911	13.0 b	38.6 a	63.0 a	71.9 d
Oat/triticale	2836	3126 a	3416	222	1130 bc	1811	12.1 b	38.5 a	62.4 ab	72.9 cd
Oat/triticale (flex)[1]	2575	3066 a	3557	-	1887 a[4]	-	12.4 b	37.8 ab	61.0 abc	74.4 bc
Oat/triticale/pea	2043	2282 b	2521	110	896 cd	1586	15.0 a	36.8 b	58.2 d	76.8 a
Cocktail[2]	2241	2303 b	2364	40	693 d	1359	14.4 a	37.3 ab	59.7 cd	76.1 ab
Cocktail (flex)[1]	-	-	-	-	800 d[4]	-				

[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.

may ultimately help achieve your residue goals.

Based on a study conducted in western Kansas, the 6-way cocktail mix had higher CP, lower total fiber as measured by NDF, and higher digestibility (Table 1) primarily due to forage peas. However, the drawback to the more complex mixture was that yield tended to be lower and chemical weed control options were limited or not available. Similarly, in a 2-year on-farm study, complex mixtures with 8-9 species were dominated by 2-3 cool season grasses (oats, barley, and triticale) that contributed an average of 66-87% to total forage yield depending on the year. In reality, if your main goal is to produce forage for livestock, then monocultures or simple mixtures of cereal grains may produce more biomass

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. Grazing a stocker only herd or the inclusion of stockers with cows and calves makes it relatively easy to add or subtract animals based on differences in carrying capacity among years. If it is difficult to adjust herd size, then the number of days a field can be grazed will have to be shortened or lengthened to achieve residue goals. See the section on “Determining Stocking Rates” for how to calculate the potential number of animals or number of days a field can be grazed based on estimated forage productivity.

In reality, expect to graze spring planted cover crops for about 30 days in most years. This resource should be viewed as supplemental forage during the late spring and early summer to help

Table 2. Examples of dryland cover crop planting dates, growing days, grazing start and end dates, grazing days, and forage production in 2016 and 2017 for various farm fields located in western Kansas, southwestern Nebraska, and eastern Colorado.

Location	Planting Date	Growing Days	Start Graze	End Graze	Days Grazing	DM Yield (lbs/ac)
2016						
NW of Bucklin, KS	3/1	85	5/25	6/30	36	4040
NW of Grainfield, KS	3/17	62	5/18	6/16	29	4460
N of Almena, KS	4/11	86	7/6	8/2	28	3930
S of Oberlin, KS	3/21	65	5/25	6/22	29	4920
NE of Venango, NE	5/15	53	7/7	8/5	28	2610
2017						
NW of Bucklin, KS	3/20	85	6/13	7/13	31	2040
NW of Grainfield, KS	3/16	75	5/30	6/28	28	2400
N of Almena, KS	3/27	71	6/6	6/27	27	2850
S of Seibert, CO	3/14	93	6/15	7/7	22	1880
NE of Brush, CO	3/23	91	6/22	7/17	25	990
Average					**28**	**3012**

relieve dependence on other forage resources such as native rangeland and baled hay. The short spring grazing window is due to the quick growth of cool-season forages which go from 6 to 8 inches of vegetative growth to full seed production in about 30 to 45 days. Producers in our on-farm trial noted that palatability and intake decreased significantly when seedheads emerged, and livestock were standing at the fence looking for something else to eat. In most years, native pasture growth is sufficient for turn-out when cool-season cover crops near maturity. One producer did allow the cover crop forage to stockpile into July before he grazed it, but animal performance was low because of the low nutrient content of the mature forage. High stocking rates can help suppress stem elongation and heading, but producers need to be careful to not overgraze and leave sufficient residue for soil health benefits.

As a final note, in years with minimal precipitation and forage productivity (i.e. ~1,000 lbs/ac or less), the best choice might be to not graze at all if your primary goal is soil protection. Ideally, you want to maintain a minimum of 30% ground cover, and approximately 1,000 lbs/ac is needed to achieve that goal.

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.

The need to move fences every day or every few days and how to handle watering the animals are two of the biggest 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

Figure 1. Example of grazing and trampling impacts when predominately cool-season cereal grain cover crops are grazed during the heading stage. Regrowth is minimal and utilization is light (<30%) at this point, but trampling is heavy with greater than the target minimum of 30% ground cover.

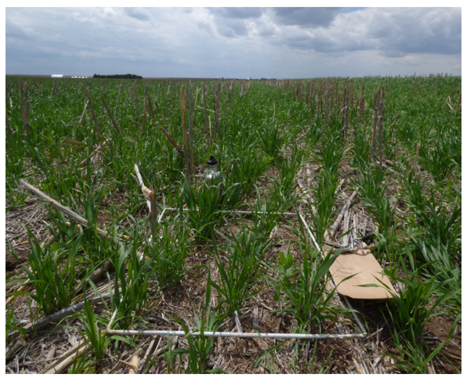

Figure 2. The above photo illustrates the proper time to start grazing (6 to 8 inches) while the photos to the right show the same field heading 30 days later on June 16 when nutrient content and palatability of the forage had dropped significantly.

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.

Table 3. Example calculations to estimate length of grazing for a set number of animals or number of animals for a set grazing period.	
Variables	**Inputs**
Acres	160
Total yield (lbs/ac dry basis)	3000
Utilization (%)	30
Animal wt (lbs, average for period)	800
Dry matter intake (% of body wt)	2.5
Example 1 – estimate number of animals for given grazing period	
Length of grazing (days)	45
Stocking rate (hd) =	acres x yield/acre x utilization / animal wt x dry matter intake x length of grazing
Stocking rate (hd) =	160 x 3000 x 0.30 / 800 x 0.025 x 45 = **160 head**
Example 2 – estimate number days a given number of animals can graze	
Number of animals	150
Length of grazing (days) =	acres x yield/acre x utilization / animal wt x dry matter intake x number of animals
Length of grazing (days) =	160 x 3000 x 0.30 / 800 x 0.025 x 45 = **48 days**

Determining 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.

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