

## PASTURES/GRAZING

## Bale Grazing



Photo: Saskatchewan Agriculture

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Bale grazing on fields is a method of providing feed to beef cattle during the winter months. With this system, livestock are allowed access to bales previously placed on a field or wintering site. When properly managed, it does not compromise the health, comfort or performance of the livestock.

Bale grazing can offer both economic and environmental advantages compared to traditional intensive winter feeding. Economically, bale grazing can reduce the costs for labour, machinery and fossil fuels, both in the feeding of the bales and manure

handling. Environmentally, research has shown increased nitrogen capture in the soil profile compared to intensive feeding in a corral followed by manure spreading with equipment. Proper site selection and bale density will ensure the nutrients from manure, urine and leftover material are uniformly deposited at acceptable rates to enhance forage growth and minimize environmental impacts on water quality.

This publication compiles the latest knowledge on bale grazing. The information is gathered from research trials and the experiences of producers.

### Intensive and extensive bale grazing

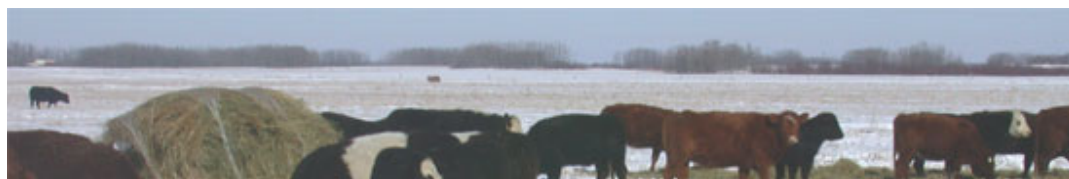
Bale grazing on a field is a method of extensive winter feeding compared to intensive feeding on a confined area, which results in a manure pack. There are variations on how producers are setting up and managing extensive bale grazing systems.

On the intensive end of the spectrum, bales are transported to a site and placed relatively close together. A typical density is placing bales 40 feet apart on a grid, which equates to about 25 bales per acre. In this situation most producers are controlling the livestock with electric wire. Livestock are limited to a three- to four-day feed supply at a time, with or without bale feeders. This publication is written mainly with this method and intensity in mind.



Intensive bale grazing on a selected site. Electric fencing controls livestock access to the bales.

Photo: Saskatchewan Agriculture





Extensive bale grazing on the hayfield where the bales were made and ejected from the baler. Photo: Saskatchewan Agriculture

On the extensive end of the spectrum, bales are grazed in the field and on the spot where they were ejected from the baler. A typical bale density would be two to four bales per acre. With this density, some producers have been leaving the net wrap on the bales and allowing a three- to four-week allotment of bales at a time.

## Choosing a site

### Land use

Producers can select bale grazing sites that are seeded perennial forage, annual cropland or native prairie. The preferred bale grazing site would be seeded perennial forage. Annual cropland is less suited for bale grazing. Native prairie sites are not recommended as bale grazing.

After bale grazing, even with good livestock management resulting in relatively high feed utilization, there will be a significant layer of organic material left behind. This consists of manure mixed with soiled and leftover feed. Depending on the amount of snow on the site, livestock traffic may create an ice pack underneath this layer. The organic layer is effective at insulating and slowing the warming of the soil in spring, artificially creating a longer winter season.

### Seeded perennial forage

Seeded pastures and hay fields are the preferred land use for bale grazing sites.

Bale grazing delivers a significant amount of nutrients to the site, especially on the points where the bales are placed. This nutrient supply is released over several years from the organic layer. Seeded perennial forage is generally the best suited vegetation for taking advantage of and utilizing this relatively high level of fertility.

Research at Western Beef Development Centre in Lanigan compared bale feeding on perennial grass pasture to traditional feeding in confinement, followed by mechanical manure spreading. The alfalfa/grass hay bales averaged 1385 pounds (lbs) with 27 pounds of nitrogen per bale. When bales were fed on pasture during winter, 34 per cent of the nitrogen in the bales was recovered by the grass during the following two growing seasons. With confinement feeding followed by mechanical manure spreading, one per cent of the nitrogen in the feed was recovered by the grass.



Bale grazing straw on a bunchgrass pasture (Russian wild ryegrass). A 12-inch layer of straw was left behind after grazing. After four years, "dead spots" remain where straw bales were placed. Photo: Saskatchewan Agriculture

Ideally, the stands should have at least one rhizomatous grass species (smooth brome grass, quackgrass, Kentucky bluegrass). After grazing, if a relatively thick layer of residual material remains on the spots where bales were placed, these grasses have a greater chance of growing through the layer and filling in from new shoots produced by their rhizomes. On fields dominated with bunchgrass species (crested wheatgrass, meadow brome grass, Russian wild ryegrass), there is greater potential for "dead spots" and weed growth on the spots where bales are placed.







Bale grazing alfalfa/grass hay on a bunchgrass pasture (Russian wild ryegrass). A three-inch layer of material was left behind after grazing. After four years, the stand is slightly thinned where bales were placed. Photo: Saskatchewan Agriculture

The effect of bale grazing on legumes in a perennial stand is variable. When the residual layer after bale grazing is greater than four inches thick, alfalfa appears to be injured. When the residual layer is less than four inches, alfalfa can be enhanced. In some regions, alsike clover has been increasing on fields where bale grazing occurs. On perennial fields with a high percentage of legumes, producers are encouraged to experiment and proceed with caution.

### Annual cropland

Annual cropland is somewhat less suited for bale grazing sites for several reasons. First, the layer of manure and leftover feed in the following spring may cause trash clearance problems with seeding equipment unless the residue is spread with heavy harrowing. Harrowing may or may not be effective, depending on the amount of material left over and the spacing of the bales. Second, an ice layer underneath the residue may keep soil temperatures cold beyond the date for optimum seeding. Third, if any plastic twine remains behind, it could cause problems with the seeding machinery. Fourth, the uneven distribution of nutrients after bale grazing would likely cause significant variation in following crops.

### Native prairie

Bale grazing is not recommended on native prairie sites. The primary reason is bale grazing may increase the opportunity for invasive weeds and forage species, through seed introduction and increased soil fertility. Secondly, native plant species evolved and produce forage under relatively low fertility conditions. Native species will not respond to increased soil fertility similar to the level observed in seeded perennial forages.

Bale grazing has a greater potential to spread weeds compared to feeding systems where the manure is piled, composted and spread. Composting kills the germination on a high portion of weed seeds.

The first step is to be aware of the weed seed species in the bales. Although some of the seeds will be consumed and digested in the rumen, many will be trampled into the litter and soil around the bale. This is a highly fertile zone with good opportunity for weed establishment. **Avoid introducing new and/or competitive weed species that have the ability to establish on a site.**

Generally, annual weeds are less of a concern than perennial weeds, but not always. Sites with sod-forming rhizomatous grass species have a greater ability to compete with weeds compared to bunchgrass pastures or annual cropland.

### Soil texture, nutrient leaching and water runoff considerations

Fields or bale graze sites with coarse-textured soils (sandy, gravelly) are not the preferred locations for bale grazing, due to the risk of nutrients leaching below the rooting zone and into the water table. If bale grazing is planned for these areas, consider using a lower bale density to reduce the risk of nutrient leaching. It is recommended producers avoid bale grazing on coarse textured soils above shallow aquifers.

Ideally, bale grazing should occur on a site where water runoff to surface water bodies is minimal or contained on the farm. Avoid bale grazing in riparian areas (wetlands), on steep slopes next to riparian areas, and on upland areas that drain directly into a water body used as a water source.





The two photos above illustrate forage production two years after bale grazing took place on a low fertility, rhizomatous grass pasture (smooth brome grass, Kentucky bluegrass). The top photo shows an area between bales where low levels of nutrients were deposited by livestock. The bottom photo shows the area that was underneath and adjacent to a bale, where high levels of nutrients were deposited by livestock. This area is now dominated by smooth brome grass. Photos: Saskatchewan Agriculture

### Soil fertility considerations for bale placement

Where there are variable soil conditions and/or rolling topography, producers may want to place bales on fields or target areas within a field where the nutrients, manure and residue from the bales will provide the greatest economic benefit. One example would be placing bales on hilltops where there is shallow topsoil and low fertility. Another example would be placing bales on fields with the lowest overall fertility. Avoid low lying areas and depressions with high natural fertility as excess nutrients and higher leaching rates will increase the potential for groundwater contamination.

### Physical impacts on the bale graze site

The majority of bale grazing occurs during the fall on dry soils or during winter on frozen soils. In these cases, there are minimal physical impacts on the soil surface and on perennial plants. When bale grazing occurs during spring thaw, there is potential for hoof damage (pugging) to the soil surface. Producers should monitor this situation and have alternative plans until the soil surface is able to support livestock traffic. Options to minimize pugging during spring thaw are to bale graze on rhizomatous grass areas, higher elevations and south facing slopes.

### Logistics of site selection

A main goal of bale grazing is to reduce winter feeding costs without compromising the health, comfort or performance of the livestock. When choosing a location, ideally the site should:

- be easy to monitor on a regular basis;
- be on or near the field(s) where the bales were made to reduce bale handling and transportation costs;
- be on land that is already perimeter fenced or can be fenced at low cost;
- be on seeded perennial forage in a nutrient deficient state, resulting in a large increase in forage productivity from added nutrients;
- have power available for electric fences to control livestock access to the bales (not needed if the fencing is solar powered);
- have a water source if adequate soft snow is not available;
- have wind protection for the livestock (protection can include natural bush, planted shelterbelts, or portable windbreaks); and
- have access to a handling facility if needed.



Permanent electric fence to protect the shelterbelt from livestock damage. Photo: PFRA

### Wind protection and watering

Portable windbreaks should be used for wind protection if there is insufficient natural shelter. The windbreaks need to be moved on a regular basis to facilitate uniform distribution of livestock, and subsequently uniform distribution of nutrients from manure and urine.







To discourage lingering and the deposit of manure at the winter watering site, place portable windbreaks, feed, mineral feeders and oilers well away from the watering site. Note the high concentration of manure at this wintering site. Photo: AESB

When possible, avoid the natural shelter of riparian areas. If riparian and upland wooded areas must be used, you may need to limit or stop livestock access with fencing to allow for regeneration of trees and to avoid excess nutrient overloading.

When surface water bodies, such as dugouts and sloughs, are used as a water source, pumping to a winterized system is recommended. This will minimize the risk of cattle falling through the ice. These systems also reduce the potential for manure and nutrient contamination of the water source.

## Bale placement

### Time of year and amount of feed placed

Bales can be placed during summer, fall or winter. There are several advantages to placing bales early in the season.

First, there are lower equipment costs if bales are grazed on the hayfield where they are made, or if they are taken directly from the hayfield to the wintering site.

Second, there is less wear on equipment and there are lower operating expenses during mild weather.

Third, the producer has eliminated the cost of moving snow. Fourth, there are lowered costs of operating equipment in the snow. Fifth, the producer has the opportunity to remove plastic twine prior to freezing rain or wet snow.



Bales placed in fall, hauled directly from hayfield. Twine can be removed prior to freezing rain or wet snow. Photo: Saskatchewan Agriculture

Some producers have placed the entire winter supply of bales prior to winter. In some cases, this may be relatively high risk because of potential wildlife damage or livestock access problems due to snow drifting. If so, a portion of the bales can be placed in fall and the remainder can be placed during the winter on a weekly or monthly basis from the stack yard. In this situation, some of the cost advantage will be lost because bales are handled an extra time.



### Bale setting and density

When electric wire is used to limit access, the bales are usually placed in rows on a grid system to simplify moving the electric wire.

For example, if 10 bales are needed to feed a group of livestock for three days, then bales are set in rows of 10. Most often, bales are placed on their round side, just the same as when they are stacked from the



Photos above: These photos show the manure and leftover material following bale grazing at a density of 25 bales per acre (40-foot centres). At this rate, the overall average nutrient deposition from urine and manure is considered environmentally safe and economically optimal. Photos: Saskatchewan Agriculture

side, just the same as when they are ejected from the baler. This way, the bales stay relatively intact after the twine is removed.

Using alfalfa/grass hay bales that average 1,300 lbs. current research is suggesting a maximum density of 25 bales per acre. To obtain this density, place bales in a grid on 40-foot centres.

At this rate, an overall average rate of about 75 lbs. per acre of plant-available nitrogen will accumulate in the soil profile the following spring. The nutrients will not be evenly distributed, but overall this is considered an environmentally safe and economically optimum rate for nitrogen application.

In a follow-up year, bales can be placed in the lower fertility areas of the grid.

When straw bales are included on the bale grazing site, overall bale density can be increased because straw results in a lower level of nutrients being excreted by the livestock. On a per-bale basis, assume that a straw bale contains about 25 per cent of the nutrients of an alfalfa/grass hay bale.

### Feed rationing: quantity and quality

When planning for bale placement, assume cows will consume hay that has a 10 per cent moisture content at the rate of about 2.6 per cent of body weight per day.

Therefore, a herd of 100 cows with an average weight of 1,400 lbs. would consume about 3,640 lbs. of hay each day ( $100 \times 1,400 \times 0.026 = 3,640$ ).

Allowing for 15 per cent feed waste, the herd of cows would need access to 4,186 lbs. of hay for each day ( $3,640 \times 1.15 = 4,186$ ). If the electric wire fence is to be moved every three days, then the herd would need 12,558 lbs. of hay for each move ( $4,186 \times 3 = 12,558$ ).

When all the bales being grazed are of similar feedstuff and forage quality, they are simply placed in rows and allocated to the livestock as needed. As with any winter feeding program, it is recommended to sample and feed test to determine if the feed provides adequate nutrition.

However, when bales are from different feedstuffs and of different forage quality, then some planning is needed. The planning involves the mix of different types of bales and the number of bales associated with each move of the electric wire. Different feedstuffs could include alfalfa, alfalfa-grass mix, grass, greenfeed or straw.

Bales of different feeds need to be weighed to determine their average weights. Each lot of bales needs to be sampled and analyzed to determine forage quality. The information can then be used to calculate the combination of bales required to balance the nutritional needs of the cows.

When bales of different feed quality are placed together and rationed to the livestock, the bale grazing must be managed so that all animals get a relatively equal chance at the better quality feed.

For example, suppose a combination of three hay bales and one straw bale will meet the daily intake and nutritional needs of a herd. However, if three hay bales and one straw bale are allocated each day, the aggressive animals will get the majority of the better feed.

To ensure that all animals have relatively equal access to the better quality feed, allocate nine hay bales and three straw bales for a three-day period. On the first day, animals will have the all opportunity to fill up on the higher-quality hay. By the third day, all the animals will have to eat straw or a similar lower-quality ration.

An alternate option is to place lower-quality bales by themselves in one location, and higher-quality bales by themselves in another location. At any point, the herd can be limited to low-quality feed for a period of time, or can be given free access to higher-quality feed.

This allows rations to be adjusted during the winter in response to the changing nutritional requirements of the cows. These requirements will change over winter in relation to air temperature, body condition score, and stage of pregnancy.



## Livestock and electric fence management

Livestock access to the bales needs to be controlled. This minimizes fouling of feed and reduces the potential for partially grazed bales to be buried under drifting snow.

Livestock access is commonly controlled with an electric fence, but can also be accomplished with a series of small permanent paddocks. Livestock access to individual bales can be further controlled using bale feeders.

The optimum time period for each move of the electric fence appears to be three to four days. The electric fence does not necessarily have to be moved at specifically set intervals. With changes in temperature and livestock body condition score, the feed cleanup should be monitored and moving done accordingly.



Electric wire fencing is held by rods using the bales as support. Photo: Manitoba Agriculture, Food and Rural Initiatives

Controlling livestock with electric fence is more difficult in winter than in summer. The insulating value of snow, heavier hair coats on the livestock, and relatively dry frozen soil are all factors that make it more difficult to deliver a shock to the animal. Monitor the voltage on a regular basis to ensure it remains an effective barrier. If the voltage is low, check for a short. If there is no short, a more powerful energizer may be required. If the voltage is adequate and the animals are still challenging the fence, a getter ground system with more ground rods may be needed.



A producer controls access to bales with portable electric fence. Photo: Saskatchewan Watershed Authority

An alternative for grounding is to use a second wire as a ground. Set the hot wire at a height about 40 inches, and the ground wire 12 to 16 inches below. Many producers prefer galvanized aircraft cable due to its flexibility and ease of handling.

Livestock trained to respect the electric fence in summer will be less likely to challenge the fence in winter. As a safety precaution, a second wire or set of wires should be placed one move ahead, just in case livestock cross the initial wire. Situations to monitor are frost weighing down the wire, winds blowing feed onto the wire, and wildlife interference. Posts can be placed in fall before the soil freezes.

Options for moving the wire during winter are:

- drilling holes with a cordless drill and masonry bit, and placing metal or fibreglass rods;
- opening holes manually with a pilot hole driver;
- pounding metal rods and removing with a pipe wrench;
- free standing posts with base;
- tumble wheels;
- sharpened rods inserted into bales; or
- posts supported by snow. Snow can be packed by snowmobile traffic the day before placing posts.

### Site management after bale grazing

When bale grazing occurs on annual cropland, the site may need heavy harrowing in early spring to spread the residue before a seeding operation can take place.

When bale grazing occurs on perennial forage dominated by alfalfa and bunchgrasses, the site may benefit from harrowing to spread residue and lessen the occurrence of dead spots in the field. Alfalfa and bunchgrasses are susceptible to being killed if the residue layer is greater than four inches.

A disadvantage of harrowing is the economic cost. Harrowing may not be effective when there is high residue and the bales are placed close together. When bale grazing is located on perennial forage with rhizomatous grasses, the occurrence of dead spots is significantly lower and harrowing is likely unnecessary. During the spring following bale grazing, growth of the rhizomatous grasses beneath the bales will be delayed and may be somewhat less robust. However, later that year and following years, forage production is usually quite high.

Perennial forage stands will have delayed growth in the spring following bale grazing. Plant growth is especially delayed on the spots where bales were placed and a thick insulating layer of residue remains along with the ice and frozen soil underneath the residue layer.

Delayed warming of the soil in spring effectively creates a longer winter season and plants are less robust when they emerge. Therefore, bale grazed pastures need sufficient time in spring for the plants to recover before regular grazing begins.



Grass growth in spring is delayed underneath and immediately around the bales. Grazing needs to be delayed until plants have sufficiently recovered. Photo: Saskatchewan Watershed Authority

The suggested maximum rate for bale grazing alfalfa/grass hay on perennial forage is 25 bales per acre. From visual observations, this should be done only once in five years on a given site. It has been observed that bale grazing at this rate will enhance forage production for about five years. Returning to the same site more often will result in missed opportunities to improve other acres. It may also increase the environmental risk of nutrient overloading, resulting in nutrient losses in water runoff and leaching. On sites with greater water runoff and leaching potential, a time interval longer than five years will lessen the environmental risks.

Until more specific recommendations can be made, producers are encouraged to monitor the impact of bale grazing on plant growth, take soil samples to determine soil nutrient status, and manage accordingly.

### Bale twine, net wrap, and bale feeder management



Bales made without twine wrapping. The wind has opened up the bales, thereby making the feed susceptible to weathering. Photo: Saskatchewan Agriculture

When bale grazing occurs on the same field where the bales are made, some producers have experimented with making bales without twine.

This may be an option as long as the bales remain intact and are able to shed water. However, experience suggests a minimum of twine is needed to hold the bales intact from the wind.

Some producers are wrapping bales with sisal twine because it's biodegradable. It can be left on the bales to save the time and cost of twine removal. During grazing, the twine helps to hold the bale together, which reduces feed waste. It appears from observation that sisal twine is less likely to catch and pull out ear tags compared to plastic twine.

There are two disadvantages to sisal twine. First, bales made with sisal twine may need to be moved before the twine on the bottom of the bale decomposes. Second, the cost of sisal twine is currently about 50 to 75 cents higher per bale compared to plastic twine.



The use of plastic twine is common for wrapping bales. To minimize the time and effort of removing plastic twine, it can be done prior to freezing rain and/or wet snow. An effective method of removing twine is to cut on one side of the bale, tie the loose ends in a knot, and throw the knot over the bale. The knots can be hooked to a quad or truck and the twines pulled as you drive along the bale rows. If bales are tipped on their sides, twine can be cut and removed by walking around the bale.

Potential disadvantages of early season twine removal are: wind will likely open the top layer of the bale; wildlife damage to the bales may be greater; and bales left over in spring cannot be kept over to the following year as successfully because of the reduced ability to shed water.

Some producers are experimenting with leaving either plastic twine or net wrap on the bales during grazing, and collecting it after grazing or the following spring.

With net wrap, generally livestock prefer to feed on the bales that they have started to consume, and feed on them until



Plastic net wrap holds the material together, reducing the opportunity for fouling. Photo: Mark Neuman, Frobisher, SK.

done rather than start new bales. This allows producers to distribute or allocate three to four weeks of bales at a time, and eliminates the time and expense of three-to-four day allotments with electric fence.

Leaving plastic twine and net wrap on the bales creates issues such as: potential ear tag losses; potential hazards to the livestock; and, difficulty in gathering the twine from the field.



Livestock are shown "mob grazing" a bale that was wrapped with plastic net. Once the bale is opened up, livestock continue to graze before starting a new bale. Photo: Mark Neuman, Frobisher, SK

In recent years, there has been a significant trend towards baling with net wrap, and leaving the net on the bales during grazing. Gathering the net wrap in spring is surprisingly easy, and takes about one minute per bale. This is considerably more easy compared to gathering plastic twine from the left over material and manure. .

Another option to limit feed waste is lightweight bale feeders made of one-inch square tubing. These can be tipped on end and rolled from one bale to another.

Bale feeders help reduce the fouling of feed because livestock cannot as easily pull the bale apart and get on top of the material. Bale feeders also reduce the opportunity for snow to drift over the feed that has been scattered from opened and partially grazed

bales.



This photo shows that livestock have cleaned up the net-wrapped bale, that had been located on the right foreground, before starting to graze the net-wrapped bale on the left. The patch of residue on the right was the location of the net-wrapped bale. Photo: Mark Neuman, Frobisher, Sask

## Wildlife considerations

In locations with high populations of big game, it may not be possible to leave bales unprotected in a field during winter

In locations with high populations of big game, it may not be possible to leave bales unprotected in a field during winter due to consumption and fouling of feed by wildlife.

In these situations, one option may be to limit bale grazing to early winter months before game animals "bunch up."

Leaving the wrapping on bales will help to reduce wildlife damage.

There may be extreme situations where bale grazing is not possible at any time due to wildlife damage.

## Conclusion

When properly managed, bale grazing can offer both economic and environmental advantages compared to traditional intensive winter feeding.

Bale grazing can also be done without compromising the health, comfort or performance of the livestock.

Livestock managers will have a greater chance of success if they become familiar with the practice and issues of bale grazing before they start. Plan the bale grazing system. Monitor the feed, livestock and weather conditions during bale grazing. Make adjustments as needed.

New and innovative bale grazing methods are evolving as producers continue to experiment. Further research is being planned for bale grazing. This publication will be updated as new information becomes available.

## Bibliography

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