

Options for Improving Forage Production on Pastures and Hay Lands

Fraser Stewart, Manitoba Forage Council 2004

The productivity of a forage field depends upon many factors including available moisture and nutrients and the presence of productive forage species. Loss of production may be due to weather, decline in fertility, and loss of productive forage species due to management. We cannot affect weather but there are options to correct some of the other causes. It is important to understand the reasons for low productivity and correct it before initiating rejuvenation.

If the management, which caused the original loss of productive forages species, is not changed - it will be a short period of time after renovation when the forage field will have deteriorated back to the original state.

For pastures that consist primarily of native species, adjusting the grazing management is perhaps the most common method used to encourage the growth and development of the more productive forage species. This will require time for the more productive species to return to the pasture.

Similar management applies to seeded or tame pastures; however, there is more interest in introducing new, more productive forage species into the forage than waiting for a natural shift to the more productive species. Seeding more productive and adapted native species into an existing native stands is also being done successfully.

Perhaps the most important practice to improve the productivity of a pasture or hay land is to use a management system that allows the productive forages **to rest and recover** following a grazing or hay harvesting period.

Knowledge of what the potential forage production could be on your farm and an assessment of the forage species that are in your pasture or hay land will determine if and when to make improvements.

When to Improve a Pasture or Hay land ?

<i>Condition</i>	<i>Criteria</i>
<i>Excellent</i>	<ol style="list-style-type: none"> 1. 75-100% of the potential yield for the area 2. 95% of the production coming from the desirable species 3. (Recommendation) Maintain management system
<i>Good</i>	<ol style="list-style-type: none"> 1. 60-75% of the potential yield for the area 2. 75%-94% of the production coming from the desirable species 3. (Recommendation) Maintain management system
<i>Fair</i>	<ol style="list-style-type: none"> 1. 50-60% of the potential yield from the area 2. 51%-74% of the production coming from desirable species 3. (Recommendation) Consider management changes and rejuvenation methods
<i>Poor</i>	<ol style="list-style-type: none"> 1. 33%-55% of the potential yield for the area 2. Less than 50% of the production coming from desirable species 3. (Recommendation) Introduce new forage species and adjust management system

(Adapted from G.Ehlert, Alberta Agriculture)

Forage Rejuvenation Options

In general, there are a number of several accepted management practices that will assist in the rejuvenation of a forage stand in addition to grazing or hay land management: There are many ways to improve a forage stand or to introduce new forage species, some are very expensive systems and some very low cost but do take time for the results to be seen.

The results of an improved pasture or hay land can be increased carry capacity of a pasture or yield from the harvested forage. The economics of the increased production usually are far greater than the cost of the inputs.

Fertility

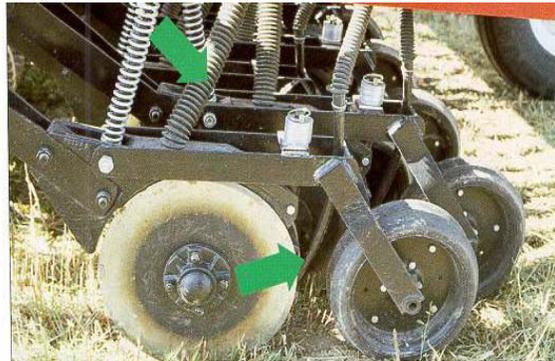
Fertility has a major effect on forage production, perhaps second only to moisture. Fertilizer should be applied to the crop, based on the needs of the plant and the availability of nutrients in the soil based on soil tests.

- Fertility will have a major effect on an existing forage stand and will be very cost effective. However the cost/benefit must be considered to ensure the profitability
- Fertilizer is most effective on forage stands that are in fair condition or better. It may not be economic on very poor or depleted forage stands.
- The use of legumes in a forage mixture will improve the soil fertility and the productivity of most forage fields. This is accomplished by the use of nitrogen fixing bacteria (Rhizobium), which grows on the legume roots and allows the legume plant to convert nitrogen from the air for plant use. The Rhizobium is applied to the legume seed at seeding. Grass/legume mixtures that have at least 50% legume content are usually fertilized with phosphate fertilizer as this nutrient encourages the growth of the legume. If nitrogen is applied, it will encourage the grass at the expense of the legume. Other nutrients are applied if required by soil test.
- Nitrogen is the major nutrient for application to grasses and will increase both feed value and total yield. Other nutrients should be applied according to soil test recommendations.
- Commercial fertilizers are most effective when applied when temperatures are low and the probability of moisture is high. Early spring or late fall are the preferred options. Banding fertilizer into a forage field is the preferred method of application although broadcasting is most common due to lower cost.
- Pastures usually require less fertility than hay land as the grazing animal excretes approximately 70% of the ingested nutrients back through the manure and urine to the soil and plants. The grazing management system, to some degree can be used to redirect the nutrients where most needed.

Complete cultivation or renovating

Seeding into an existing pasture or hay field has always been a popular “fix” for a tired pasture. Adding new, more productive forage species into a pasture or hay land will increase the productivity. However, there are major challenges to do this successfully.

One of the most effective ways of improving a productive forage is the complete cultivation or renovation of the existing forage and then seeding down a new forage stand as it will usually result in the most successful forage establishment. However, this is usually considered as the most expensive option and in some soils, where soil erosion or other environmental conditions are a concern, may not be the most profitable or accepted option. Where forages are used in a crop rotation, it is usually the accepted method.



Some of the management highlights include:

- The existing forage species are killed out by the use of an herbicide and/or cultivation so there is minimal competition for the emerging forage seedlings.
- A firm, even seedbed is developed to encourage seed germination and plant establishment
- A seeding system is used to place the small forage seeds shallow for maximum emergence. In this picture, the forage seed is placed on the soil surface and a press wheel is used to press it in. Also fertilizer may be banded below the seed. Minimal tillage systems are being used which result in excellent seed placement with minimal soil disturbance.

- An environment is provided to allow the emerging forage seedlings to establish by the use of adequate fertility and suppression of competing plants such as weeds and cover crops. Following the breaking of a forage field, the nutrients released from the decaying vegetation are available to the establishing forage seedlings. Weeds however also utilize this nutrient source and can very quickly choke out the new forage seedlings if not controlled.

Sod seeding

This is a practice used to introduce a more productive forage species into an existing forage stand. Sod seeding is often used instead of more extensive cultivation due to limitations to cultivation by stones, brush or soil erosion problems

- **Equipment:**

Sod seeding equipment must be able to penetrate the sod layer (thatch layer) and place the seed into the mineral soil. This usually involves triple disc drills where a heavy disk cuts a slot in the sod and the next set of disks places the seed. Depth control is required on the seeding disks so that the seed is not buried too deep or emergence will be restricted. A packer wheel is used to close the slot to reduce drying out of the soil.



Hoe drills or the use of spike equipment is also used but are not very satisfactory for areas where there are stones.

The major problem in most areas is the availability of equipment as this specialized equipment is often very expensive. However, after frost, early in the spring, most soils are quite soft and many traditional seeders will be very effective.

- **Fertility:**

- a) Soil tests need to be taken to identify limiting nutrients that will have an effect on successful establishment of a new forage crop.
- b) Phosphate fertilizer has been recognized as perhaps being the major nutrient required to promote seedling establishment and root development.
- c) The ideal seeding equipment should be able to deliver the required fertility in a banded form at time of seeding.

- **Vegetation Control:**

Establishing a new forage seedling into existing sod is a challenging experience as the seedling is usually placed into a very hostile and competitive environment. The sod thatch is very acidic and can affect germination, there is competition from the existing forage and other plants, and there are also insects that love the freshly germinated seedlings – a very hostile environment.

- a) To reduce the competition from other plants, which is usually the major competition: use of a non-selective herbicide such as Roundup (glyphosate) applied one to two days prior to seeding is a common practice. Fall herbicide application is sometimes used but in the event of a dry spring, may be a higher risk. The forage to be controlled needs to be actively growing for the herbicide to be effective.
- b) Many of the non-selective herbicides, do not provide complete vegetative control, more of a suppression effect, however, if the suppression is enough to allow establishment of the forage

seedlings that is all that is required. Some forage/weed species are resistant to herbicides such as glyphosate and may increase as a result of the application eg: pasture sage.

- c) The use of some broadleaf herbicides (eg: Banvel) may result in some herbicide residues in the soil for 2-3 weeks , which could effect the germination of broadleaf forages such as alfalfa or other clovers.
- d) Seeding Alfalfa into an old alfalfa stand is not recommended unless the old plants are sparsely spaced due to the auto toxicity of the old alfalfa roots and leaves, which prevents the establishment of new plants.
- e) Over grazing or very close grazing of a forage stand the previous fall will often weaken the existing plants enough so as to reduce competition to the new forage seedlings.
- f) Close cutting (mechanical), can sometimes reduce the competitiveness of the existing stand.
- g) Fire is often used to burn off old growth that could interfere with the seeding process. However, as fire stimulates new growth, it should be used with careful management

- **Timing of seeding:**

This is often a critical factor for successful sod seeding.

- a) Early spring seeding is the most effective time for sod seeding, as there is usually sufficient moisture and cooler weather. If seeding takes place directly after the snow melts, the sod is very soft and even a double disk drill will penetrate very easily.
- b) However, if it is too early and there is insufficient insulation for the new seedlings, some legumes could be killed out by late spring frosts. Seeding into an old stubble will often provide the necessary insulation or protection,
- c) Later spring seeding and summer seeding may be successful but higher risk due to moisture limitations and excessive heat, which can kill seedlings.
- d) It is often a good management practice to sod seed a few pastures/hay fields every year as some years there is sufficient moisture and it works well, other years the technique may not work.

- **Forages for Sod Seeding:**

Legumes have generally being most successful for sod seeding although there are a number of grass species, including some native species that will establish reasonably well. Legumes are usually preferred as they reduce the need for nitrogen application and will improve the quality of the forage.

- a) Red Clover is very aggressive; where there is good moisture, but usually a short-term legume.
- b) Alfalfa has more long term potential, however, introducing alfalfa into an existing alfalfa stand can be limited due to the auto toxicity of the existing plants. New seedlings within 8 inches of an old plant have very limited chance of survival, at 16 inches there is survival but low yield while at 24 inches there is no effect on establishment.
- c) Trefoil has been successful where there is sufficient moisture. One advantage of this species is that it will reseed itself and it does not cause bloat.
- d) Grass species, which can establish easily such as: Orchard, Timothy, Tall Fescue and Meadow Brome have worked well where there is sufficient moisture. Some native grasses have also been sod seeded but are usually slower to establish.

Over seeding

Over seeding involves the broadcasting of seed into an existing pasture or hay land. The cost of this process is usually quite low cost, however due to lower seed germination and establishment, the amount of improvement may be quite limited, thus establishment risk is greater than other options. However, if there is successful establishment of one to two legume plants per square meter, this will result in improved forage quality to the pasture or hay land.

Some specialized renovation equipment such as the Aer-Way units, which consists of spikes on a shaft, which can be angled to increase soil disturbance. These units were originally design to aerate the soil but are also being used to open the sod on rough land for seeding new species.



The teeth open the sod, and allows for the broadcasting of the seed into the soil. They will kill some of the existing plants but if there are sufficient creeping rooted plants, they will quickly fill in. This equipment will negatively affect alfalfa and bunch type grasses. The renovation is usually done in early spring and can result in 50% -70% disturbance of the sod..

These units work better than a spiked toothed cultivator which some farmers have used as they can be used on rough land

Beam Scrapers

In recent years, drag bars or beam scrapers have been built that have resulted in successful forage stands.

The drag bar consists of a heavy steel beam (eye beam) followed by grader blades bolted together on edge so that they will cut or scrape the sod. This heavy unit will level and cut into the sod enough to bare the mineral soil. Very adapted to rough terrain. These units are easily home made from scrap materials.

This equipment has been used to reseed old pastures The scraper, opens and levels the sod, seed is broadcast into the semi cultivated soil and then a second pass with the beam will work the seed into the soil.

The use of a non-selective herbicide such as Glyphosate, reduces competition from the existing forage. This system has

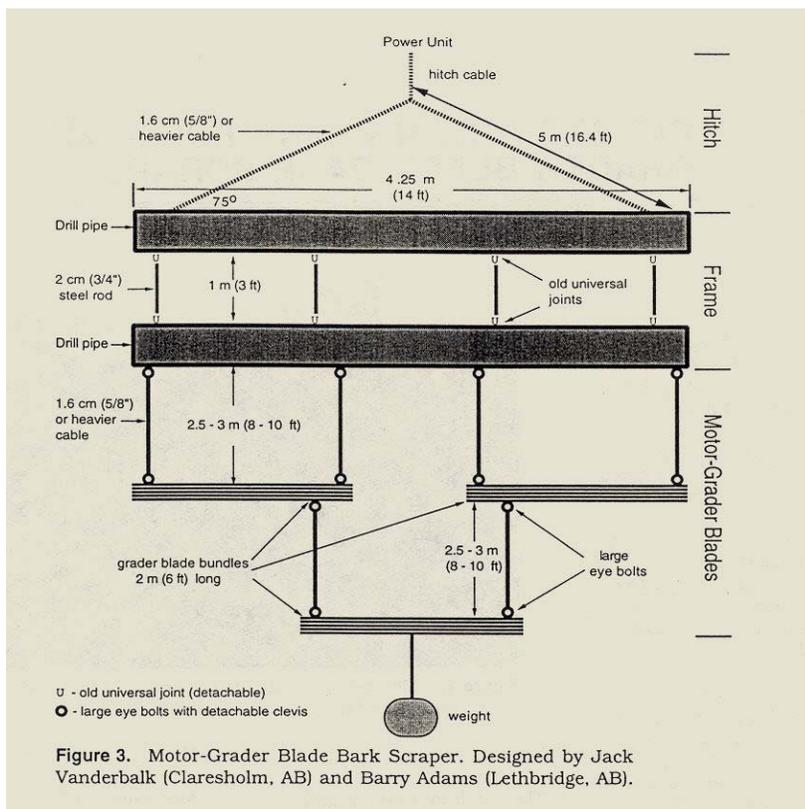


Figure 3. Motor-Grader Blade Bark Scraper. Designed by Jack Vanderbalk (Claresholm, AB) and Barry Adams (Lethbridge, AB).

been used as a relatively low cost method to improve rough land pasture.

These units have also been used to improve rough land pasture where there is excessive brush and small trees. The beam scrapers are pulled over the trees and scrape the bark off so that will dehydrate and die out. This usually done in late spring or early summer before the brush becomes too mature.

Frost Seeding

This technique has been used successfully in Eastern Canada and the NE USA to introduce new forage species into a forage stand. It has had some limited success but if moisture is available can be successful. It is usually used to introduce new forage plants, primarily legumes into an existing forage stand in areas where other mechanical equipment would not be able to go such as where the terrain is very rough or there are stones.



The forage seed is spread on the soil surface using a small battery operated broadcaster mounted on a small tractor. Most units spread about twenty feet wide and the seeding is done in the winter on the snow or early spring period when there are still frosts.

The effect of the snow melt, helps to take the seed down to the mineral soil, the alternate freezing and thawing helps to break the seed coat, works the seed into the mineral soil and stimulates germination. Very similar to what happens in nature

- Most successful establishment with legumes (50%-60%), compared to grasses (20%-30%)
- Usually takes at least two years to see any major effect.
- The cost of the equipment is very low but as the seedling mortality is very high, there is a higher risk for establishment.
- Ideal is to seed a few small fields every year instead of many fields at once so that there is a greater chance of success as not every year will be the ideal year with good moisture or growing conditions. Some farmers, annually frost seed 25% of their fields and over time, increase the productivity of the forage.

Field Trial Results

Some of these options were involved in a trial conducted in SE Manitoba, which was initiated in 2001 and was evaluated over the following two years.

Renovation System	% of Seeded Plants of the Total Plant Population (June 2003)	
	Herbicide plus Phosphate	Herbicide with no Phosphate
<i>Sod Seed</i>	57%	29%
<i>AerWay & broadcast seed</i>	80 %	48 %
<i>Drag& broadcast seed</i>	80 %	44 %
<i>Broadcast</i>	30 %	39 %

The species seeded included alfalfa, trefoil, red clover, timothy, tall fescue and meadow brome. Of interest in this trial was the relative success of the drag system and that the benefit of the phosphate fertilizer at seeding.

Winter-feeding on pasture

This is another option that is used to introduce new seeds to a pasture. Bales are unrolled or are shredded and fed on the pasture area over the winter period. Any mature forage will drop seed onto the soil and will be worked in by the animals. The additional fertility by the manure (beef manure: N 35 lbs, P 27 lbs K 31 lbs over 100 days) will provide a good medium for the new seedlings.

Bale grazing is another unique approach to this winter-feeding system. Round bales are set out in rows in the winter pasture area in late fall, a temporary fencing controls the feeding of the bales so that no winter tractor use is required. The animals will spread the manure on the fields and some seeds will be shed from the fed hay. Many farmers have found the pasture from these areas is slow to come back in the spring but the overall effect has been higher forage production from the wintering areas

Feeding bales in a brush area will also help to kill out the invaders and allow new grass to grow. This is an excellent, painless method of removing pasture brush – feed on top of the brush/weeds in the winter!

Livestock Seeding

This has been another method some have used but with usually very limited results. This is where the forage seed is fed to the animals and then the seed is deposited on the pasture through the manure. The limitations are that the animals do a pretty good job of digesting the seed so live seed in the manure may be very low, the ammonia in the manure can also have an effect on the germination and you have minimal control of where the cows will deposit the manure. However, some have mixed 5 lbs of forage seed (primarily legumes) into 50 lbs of mineral prior to putting the animals into new pasture and have seen some results after several years.

Control of Competing Vegetation

Vegetation such as weeds and brush compete with the forage for nutrients including light. It is usually very cost effective to remove them to increase productivity.

- **Mowing** by the use of flair or rotary mowers can be used to remove brush, perennial weeds, and poisonous plants or unproductive forage species. Cattle may not graze some species and mowing several years in a row will reduce the persistency of the shrubs/weeds. However the process is time consuming and expensive but may be the best practice in some situations to allow the more productive forages to persist.

Brush is usually cut in the early spring and perennial weeds are often cut prior to flowering, as that is the time the root reserves are at their lowest point

- **Herbicides** are also used to control brush and unwanted weeds to allow for forage growth.
 - Equipment options include ground sprayers, aerial sprayers; wick sprayers and the use of spot spraying equipment. Selection of the equipment and herbicide will be made on the basis of the weeds or brush that needs to be controlled and the terrain of the field. For example, aerial spraying may be the only option in very rough pastureland and the use of a wick sprayer may be used to remove tall growing weeds or brush from a productive grass/legume pasture.
 - The use of herbicides may be very cost effective and need to be considered in conjunction with other options. Regrowth of plants following the use of herbicides requires follow-up management.
 - Selection of herbicides will be determined by the species to be controlled. Herbicides used may be selective in that they will only affect certain types of weeds, such as broadleaf weeds



- or they may be non selective and will remove or suppress all vegetation. The range of registered herbicides available for use on forage crops is quite limited.
- **The use of fire** has also been effective for some situations. A natural occurrence on many native grasslands, it can be used to control invasion of brush and for removing old growth so that new seedlings and forbs can develop. However brush regrowth occurs after a fire and needs follow-up control.

Management of Reseeded Forage

It is important to reduce the grazing pressure on the newly seeded forages to allow for effective establishment of the forage. After seeding, livestock are often allowed to graze off any surplus forage or weed growth, prior to the emergence of the new seedlings. This will reduce the competition to the seedlings

Depending upon the amount of growth of the seedlings, they may be grazed in the year of establishment but very carefully. Grazing can be beneficial as it can reduce competition from other plants, but a sufficient rest period needs to be provided for the regrowth of the forage seedlings.

In some situations, the reseeded fields should not be grazed for the total season.

In Summary – there are some key options to improve a “tired pasture or hay land”

1. Use a grazing management system that includes a **Rest/Re-growth system** so as to promote the more productive forage species in your pasture and to reduce the opportunities for the undesirable plants.
2. When seeding new forage species into the pasture, plan ahead, reduce the competition, place the seed if possible into the mineral soil and use a grazing or hay management system to promote development.
3. Plan for the future, have some goals, do a little each year, and over the years, you will see a major improvement!