Forage Rejuvenation Manual

2026

saskatchewan.ca/agriculture

Saskatchewan

The Saskatchewan Ministry of Agriculture would like to thank the committee that helped in the creation of this publication for their collaboration and support throughout the process. From the University of Saskatchewan, our thanks go to Dr. Bill Biligetu, Dr. Breeanna Kelln, Dr. Jeff Schoenau, Kathy Larson and Claire Owen. A special thanks goes to Stacey Domolewski from the Beef Cattle Research Council. Your work and support of this project is greatly appreciated.

Table of Contents

Introduction

Seeded perennial forages are an important resource for Saskatchewan's agricultural industry. According to the Statistics Canada's 2021 Census of Agriculture, Canada has more than 13 million acres of tame and seeded pasture. With the increasing prices of land and competing commodities such as grain crops, it is more important than ever to get as much production as possible from each acre of forage.

Newly established tame forage stands will achieve peak performance within two to three years. With proper management and ideal environmental conditions, those stands can stay productive for a decade or longer. However, there are many variables that can cause production to decline, including:

- Declining soil fertility;
- Unfavourable weather (particularly drought or ill-timed rainfall);
- Marginal soils where texture, salinity, poor drainage, low nutrient status or structural problems limit plant growth; and
- Long-term management actions that cause the loss of desirable species and the replacement with weedy or undesirable species.

It is important to note that some decline in productivity cannot be prevented even with the best management. Some things, such as the weather, are beyond control.

An understanding of the inherent productivity of a parcel of land and the forage that makes up the stand are the first steps to effective forage management. Keeping records to compare yields and quality against previous years, as well as noting how the stand compares to neighbouring hay fields or pastures, can give a good indication of when intervention is needed to get productivity where it should be. In some cases, it is time to think about rejuvenation.

Rejuvenation is defined as any treatment applied to an existing forage stand to increase productivity. This publication will go through each of the rejuvenation methods and guide forage producers through choosing and applying the method best suited to their situation.

Stand Assessment

Knowing a forage stand's potential can give a clear picture of any areas that require rejuvenation or management changes. When production from a forage stand falls below expectation, it is important to take note of the reason. Knowing how to assess the stand's current condition compared to what it would ideally look like allows producers to identify key issues. Publications such as *Initial Stocking Rate Recommendations for Seeded Forages in Saskatchewan* (Ministry of Agriculture, 2002) or the *Range Plan Development Guide* (Abouguendia, 1990) will enable managers to determine the production expectations and range condition for a particular land base.

Using the assessment methodology from *Initial Stocking Rate Recommendations for Seeded Forages in Saskatchewan* a stand in 'Good' to 'Excellent' condition produces the most forage and should thus be

considered the ideal. From there, how the stand compares will then indicate what level of rejuvenation is required to bring that stand back to optimal performance. For example, when stands are in fair condition, a change in management and/or some form of less-expensive rejuvenation can return the stand to good condition within two or three years. Forage stands in poor condition usually require more expensive rejuvenation methods and take longer to return to good condition.

Table 1: Seeded Pasture Condition Classes (adapted from G. Ehlert, Alberta Agriculture, 1990.)

Condition	Criteria	Recommendation
Excellent	• 95% of the production comes from desirable species. • Less than 5% of the total production comes from weeds or undesirable plants. • Less than 1% exposed soil and more than 95% litter cover.	Maintain current management.
Good	• 75-94% of the production comes from desirable species. • Less than 10% of the production comes from weeds or undesirable plants. • Less than 5% exposed soil and over 95% litter cover.	Maintain current management.
Fair	• 51-74% of the production comes from desirable species. • 25% or more of the total production comes from weeds or undesirable plants. • Less than 5% exposed soil and greater than 75% litter cover.	Change management. May be able to rejuvenate by fertilizing, mowing, herbicide use. Consider adding new species.
Poor	• Less than 50% of the production comes from desirable species. • 50% or more of the total production comes from weeds or undesirable plants. • Exposed soil and a lack of litter is a management concern.	Change management. Add new species and improve grazing management. Should be cultivated and reseeded to desirable grasses and legumes

Other assessment methods that can be used on tame forage stands in Saskatchewan include:

Grazing Response Index (GRI)
The Grazing Response Index (GRI) is a simple, short-term monitoring tool that evaluates the effect of the current season's grazing management on pasture vegetation. The score can be used to change grazing management to improve or maintain pasture health in subsequent years. The three factors used to calculate GRI are frequency, intensity and opportunity for regrowth. All three factors can be affected by grazing management and have significant impacts on plant health.

For more information on the Grazing Response Index, visit the resource page on the Saskatchewan Forage Council's website at *www.saskforage.ca/resources*.

Range Health Assessment
The Range Health Assessment (RHA) methodology is a more detailed system used to assess the health of tame pastures by ranking a series of indicators. As the assessor works through the field sheet, the pasture is scored relative to a perfectly healthy stand. The resulting final score determines whether the field is considered 'Healthy', 'Healthy with Problems', or 'Needs Improvement' and provides insight on management actions that would improve the pasture's condition. The RHA methodology was initially developed by

Alberta Public Lands and has since been adopted for assessing Saskatchewan's Crown lands and private pastures. The field worksheet focuses on six questions:

1. Do introduced forage species dominate the site?
2. What kind of plants are on the site (i.e. are they tall and productive species versus weedy/disturbance induced)?
3. Is there enough litter?
4. Is the site stable (i.e. is there evidence of more erosion than is expected)?
5. Are there any noxious weeds present?
6. Is woody regrowth a problem?

Additional details on completing the field worksheet can be found on pages 65-90 of the *Rangeland Health Assessment for Grassland, Forest, and Tame Pasture Field Guidebook*[1] (Adams, 2016).

Figure 1: Range health assessments are one tool for assessing stand performance. Indicators such as litter, plant composition and bare ground help determine what management actions can be recommended to improve the stand's health and performance.

Identifying Causes of Reduced Forage Production

Once it is determined that the productivity of a stand does not meet expectations, the next step is to identify what is causing the reduction in forage yield or quality. This is an important step because it will help determine which rejuvenation method(s) are most likely to be effective at returning productivity to the desired level. Risk and cost are also considerations, as seen in the Rejuvenation Decision-Making Flowchart on page 5.

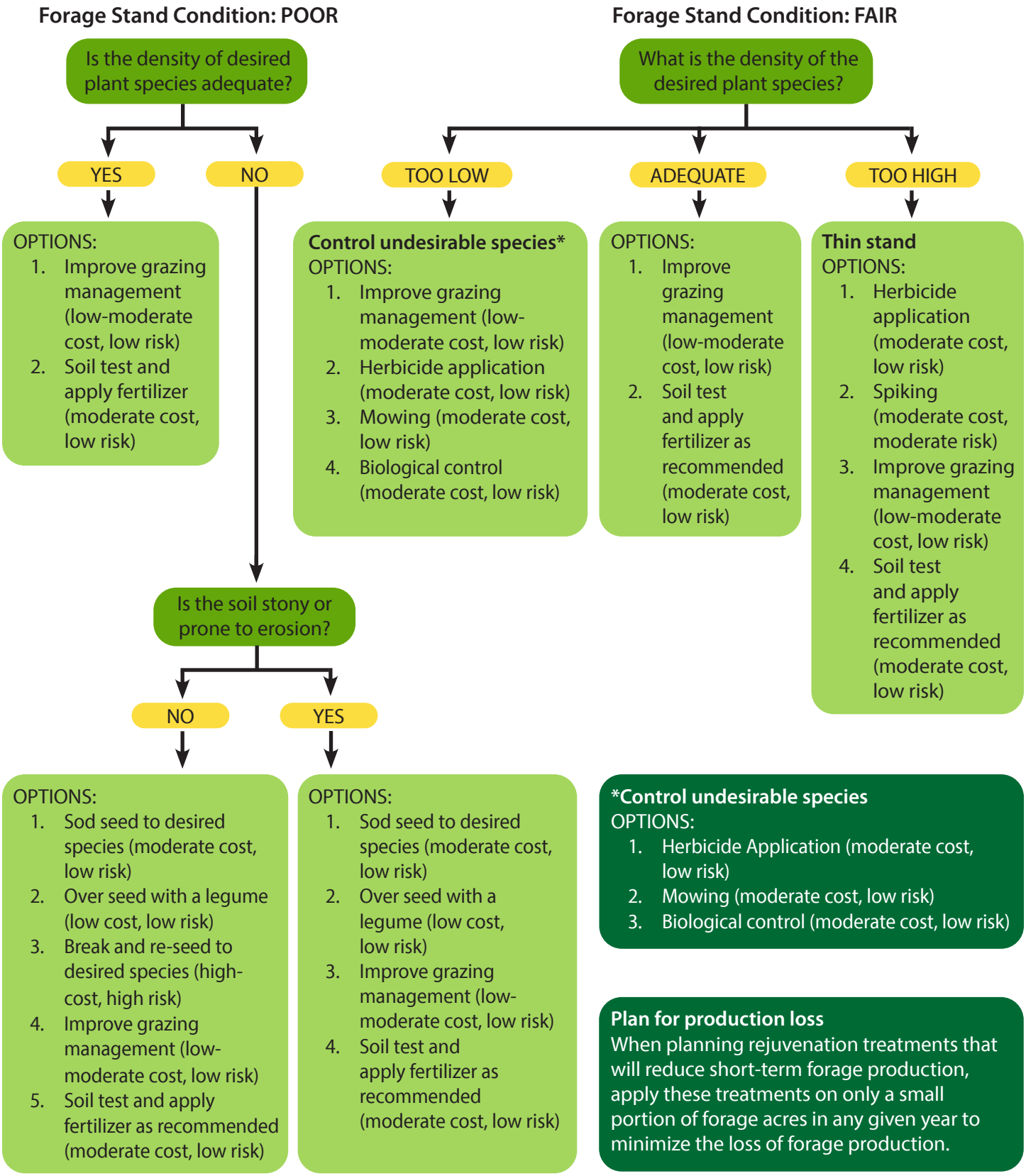
Often, it is a combination of several factors that result in a significant decline in forage production. The weather is beyond our control; however, it is still important to recognize when it is the cause of low yields instead of other management-dependent variables such as fertility. When weather is the cause of reduced yields, production should return to normal when weather conditions improve. If production does not improve, there may be something else limiting yields.

When weather is not the main limiting factor, then low fertility and improper grazing management are the other two most likely causes of low and declining forage production. Different forages have different characteristics that affect their grazing tolerance, ideal season of use, nutrient requirements, moisture requirements and high/low temperature tolerance. Knowing these different characteristics is essential when choosing a forage blend as well as knowing how to best manage the stand for maximum productivity.

Many fields in Saskatchewan are not reaching their yield potential because they lack the soil nutrients to maximize growth. The best way to identify if a yield decline is a result of a fertility issue or nutrient deficiency is by collecting a soil sample and having it analyzed in a recognized soil lab.

Remember, forage species in tame stands are often not as well-adapted to a site as the native species. The process of natural succession may favour an increase in well-adapted grasses, forbs and shrubs. Sometimes, good management can prevent this from happening. For example, invasion by pasture sage into poorly managed crested wheatgrass or Russian wild rye pastures on dry sites can be prevented and/or reversed by long-term management changes that provide the grasses time to adequately recover between grazing. Meanwhile, invasion by bluegrass into hay land or tame pasture on moist sites is difficult to prevent, even with good management.

Rejuvenation Decision-Making Flow Chart for Low Forage Production



Rejuvenation Methods

Breaking and Reseeding

Breaking and reseeding is one of the most common methods of rejuvenating forage stands in Saskatchewan. Typically, a disk or cultivator is used to rip up the old stand and the field is then chem fallowed and/or cropped for a season or two before a new forage stand is seeded. Breaking is commonly done in the fall so the producer can spend the entire next season cropping the land before re-seeding forage.

There are some important things to keep in mind when considering this method. These include:

- Unfavourable weather conditions can make establishing the new forage stand a challenge. In some cases, this may take more than one year and potentially require the same land to be re-seeded several years in a row for successful establishment.
- The risk for severe wind and water erosion is high with this method, especially on sandy soils or land with rolling topography.
- Nutrients are released into the soil as the dead plant material decomposes. New forage seedlings can access this flush of available nutrients to kickstart germination and forage production once established, but so will weeds. This could result in a flush of new weed seedlings competing with the forage seedlings for resources.
- This method is useful when a change in forage species mixes is desired.

Figure 2: Including legumes such as alfalfa (left) in a mixed stand (right) when reseeding helps reduce the need for supplemental nitrogen to maintain productivity. Legumes fix atmospheric nitrogen, making it available to the other plants in the stand.

In the year forages are reseeded, weed populations can become quite high and may prevent successful re-establishment. Most weeds in the first year are annuals and their populations drop dramatically in subsequent years as the tame forage becomes more competitive. To help minimize competition in newly established stands, many producers will cut and bale the weeds early in the season to prevent seed-set and to set the weeds back.

Additional Notes

When and How to Use - If disturbance is the only treatment, no more than 30 per cent of total forage acres should be disturbed. If combined with overseeding, then up to 50 per cent of the stand can be disturbed. Spiking can make the land very rough and land may have to be levelled with a drag or land roller. Harrowing to level land after spiking is not recommended as it may result in too much damage to the forage stand. More than one mechanical disturbance in any given year is not recommended as the surviving plant population may be too low to give the desired increase in production.

Effect on Forage Yield – Most studies show forage yield increases significantly for only a couple of years after breaking and reseeding. Production declines rapidly and long-term forage production is not effectively improved unless a legume was included in the mixture (Figure 2).

Effect on Forage Quality – Forage quality or protein content will improve following reseeding as nitrogen is released into the soil from decomposing organic matter following cultivation. This improvement in quality is usually short-lived as the additional soil nitrogen supply is soon removed by grazing or haying.

Combining Treatments – Combining fertilization with breaking and reseeding should improve the long-term forage yield and quality. See "Fertilization" section for more information. Terminating the stand with a herbicide prior to breaking is recommended to ensure a fresh start. Read more on stand termination on our website at *www.saskatchewan.ca/agriculture*.

Because of the high cost and risks associated with breaking and reseeding, it should only be used when the success potential of the other rejuvenation methods is low.

Mechanical Disturbance of Soil

Mechanical disturbance is when a tillage implement is used to disturb 30 to 50 per cent of a perennial forage stand to a depth of three to six inches. This disturbance increases the decomposition of forage root material, releasing nutrients (mainly nitrogen) into the soil to make them available for plant use. Given sufficient precipitation, the release of nitrogen results in a burst of grass growth like using fertilizer. Implements used include cultivators with one- to four-inch spikes, rotary harrows, or rotary plows.

Figure 3: Sainfoin (left) and birdsfoot trefoil (right) are two non-bloat legumes that can be included in blends to increase yield and quality of forage stands.

There are some important things to keep in mind when considering this method. These include:

- Forage production will be reduced in the year of treatment in dry years, depending on the severity of the disturbance.
- There is the potential for an increase in forage production after the treatment year if moisture is favourable.
- Rough land may hinder grazing.
- This method may damage legumes in pure or mixed stands.
- Creeping-rooted alfalfa may benefit from mechanical disturbance.
- Water infiltration into the soil may be improved using mechanical disturbance.

Additional Notes

Soil disturbance may not provide any benefit to legume stands and instead may even be detrimental. The additional nitrogen released into the soil as nitrates may reduce symbiotic nitrogen fixation by legumes. If mechanical disturbance is used, the operation should be done as early in the spring as possible for the best chance of yield improvement. There should be good soil moisture at the time of treatment to ensure the stand recovers from the disturbance and the released nitrogen can be used by the forage plants. Good soil moisture at the time of mechanical disturbance can also help reduce roughness of the field following treatment. In the year of treatment, there is usually a reduction in forage yield. This is because the tillage operation stresses the forage plants, especially in dry years. It also takes time for the soil microorganisms to free up nitrogen. A yield increase from mechanical disturbance is most often evident in the year following treatment.

In most cases, by the second year following treatment, little yield improvement remains. An example of long-term effects is provided in Figure 4.

Change in Plant Species – Sod-forming grasses such as smooth bromegrass will decrease in density in the year of treatment but will recover to pre-treatment levels which may take multiple years. Bunch grasses can be thinned using spiking and should only be considered on very dense stands in good soils. Pure tap-rooted alfalfa stands should not be spiked or rotary harrowed as it may cause excessive thinning, resulting in lower productivity and stand life. The productivity of tap-rooted alfalfa-grass mixed stands may also be negatively affected by mechanical treatment. The soil disturbance caused by spiking or rotary harrowing can encourage the establishment of undesirable plants. This is most serious in dry years following mechanical disturbance but may only be temporary, provided the undesirable plants are annuals and the perennial forages are vigourous enough to provide competition. If undesirable perennial plants invade the site following mechanical disturbance, control measures may have to be applied before perennial forage production will improve.

Effect on Forage Yield – This treatment results in an accelerated release of nitrogen into the soil from decomposing plant matter. The forage stand will respond best to the increased nitrogen when there is

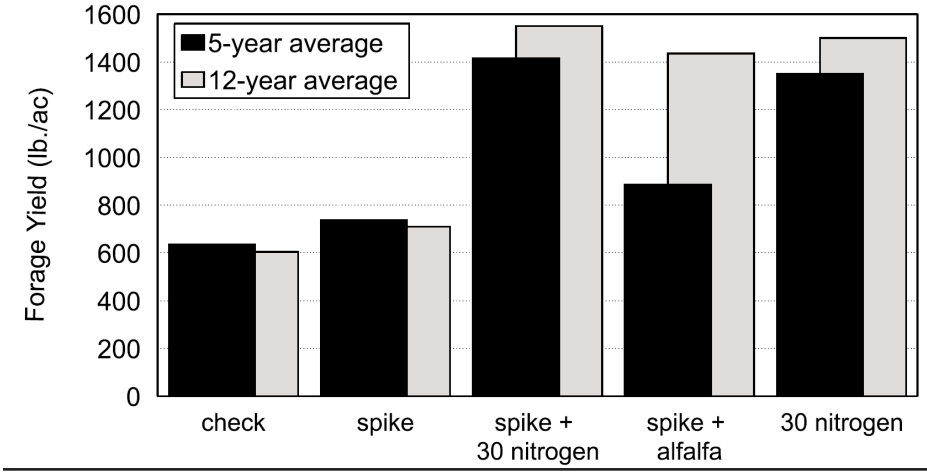


Figure 4: Effects of several treatments over five and 12-year periods on crested wheatgrass forage yields. Lorenz and Rogler, 1949-1960, Mandan, N.D. (Spike & spike + alfalfa treatments in Year 1 only; spike+30N & 30N treatments done in spring each year).

adequate available moisture. Yield gains increase with higher growing-season rainfall during and after the treatment year. In the year of treatment, there is usually a reduction in forage yield. This is because the tillage operation stresses the forage plants, especially in dry years. It also takes time for the soil microorganisms to free up the nitrogen. A yield increase from mechanical disturbance is usually not seen until the year following the treatment. In most cases, by the second year following treatment, little yield improvement remains. An example of long-term effects is provided in Figure 4.

Effect on Forage Quality – As with any treatment that increases the available nitrogen to grass plans, mechanical disturbance will usually result in an improvement in forage quality. However, this quality improvement is short-lived, usually lasting only a year or two and is moisture dependent.

Frequency of Treatment – Since the benefits of mechanical soil disturbance last only one or two years, repeating it every two to three years may be tempting. However, this is not recommended as it will reduce the improved quality and yield and will weaken the stand, which allows the invasion of undesirable species and increases the risk of soil erosion. At most, this method should be used no more than once every five to seven years.

Combining Treatments – Many studies have combined mechanical disturbance like spiking with fertilization and overseeding. Seeding a legume such as alfalfa or sweet clover following spiking has resulted in yield and quality improvement, but only after several years and where growing conditions were good (Figure 4). The existing stand must be sufficiently suppressed to decrease competition for the establishment of a new species to be successful. Research has shown that fertilizer alone improves forage yield as much as a combined spiking and fertilization treatment as seen in Figure 4.

Direct Seeding/Sod Seeding Forages

Sod seeding is when forage is seeded into an existing stand without breaking up the roots. This method is usually done on a forage stand that is in poor condition or when there is a desire to change the species present in the stand, like adding legumes to a grass-only stand. The success of this method depends on three things – adequate moisture, proper evaluation of the existing stand and suppressing the mature vegetation to allow the new forage seedling to establish.

Two common types of seed drills are grain and forage. Usually there is only one seed box on a grain drill which is typically used for planting wheat, oats and other small grains. Multiple seed boxes are found on forage seed drills as they are used for planting different seed types (e.g. fluffy/chaffy seed, small seed, etc.).

Figure 5: Smooth brome is a creeping-rooted grass that can spread quickly via rhizomes. Over time, stands dominated by smooth brome may get overly dense and become 'sod bound'. Some mechanical disturbance can be of benefit to improve yield in these cases.

Requirements for no-till drills

No-till drills must be able to place seed at the right depth, the right rate and ensure good contact with the soil. This must be accomplished in a wide variety of soil types, conditions, slopes and with residue cover. Some necessary characteristics that no-till drills must possess include:

- **Coulters:** Most no-till drills use coulters or "cutters" to cut through the residue allowing seed furrow openers to open furrows where the seed will be placed. Less residue is disturbed using narrow coulters that are less than one inch wide. These work better over a wider range of conditions than wider coulters.
- **Weight:** There must be sufficient weight allowing coulters and openers to press through firm soils and allow press wheels to close the seed furrow while keeping the drive wheels and coulters in contact with the ground.
- **Seed furrow opener:** When planting small seeds like alfalfa or clover, double or single disk openers are more consistent at seeding to a specific depth than hoe or shovel openers. They are also better at handling heavy trash conditions in the field.
- **Seeding depth:** Press wheels or depth gauge wheels are mounted by the seed openers to provide accurate seeding depth. Seeding depth is especially important regarding the type of seed you are planting. Press wheels help cover the seed in the furrow and help control seeding depth. Either a two-inch press wheel or two narrow press wheels forming a V-shape work best on no-till drills.
- **Seeding rate:** For some small-seeded legumes or lightweight fluffy seeds, like some warm-season prairie grasses, special box attachments may be needed in addition to the internal metering devices, already part of the equipment.
- **Power unit:** The required power for pull-type drills is five to seven horsepower (hp) per foot of width. Twice the power (10 to 15 hp) is needed for mounted drills per foot to provide adequate lift capacity.
- **Alignment:** Seed openers and press wheels should stay aligned so the press wheel packs directly over the seed row. Misalignment is more likely on hillsides and during turns. Coulters mounted far ahead of the opener can increase this problem, while coulters positioned close to the opener—or systems without leading coulters—maintain better alignment and more consistent seed placement and packing. Drills with coulters that are positioned close to the openers or that are a part of the opener system have less risk of misalignment.
- **Proper care and operation of equipment:** Often, equipment may be rented. These units may vary widely due to age, type and maintenance. Ensure you know the correct procedure to adjust seeding rate, seeding depth, how the weight and ballasting system works and what horsepower requirements you will need.

Figure 7: Valmar applicators (red, rear) are used for overseeding by broadcasting seed onto the soil surface. No-till drills, such as the John Deere in the foreground, place the seed directly in the soil. Photo credit: Regan Ferguson

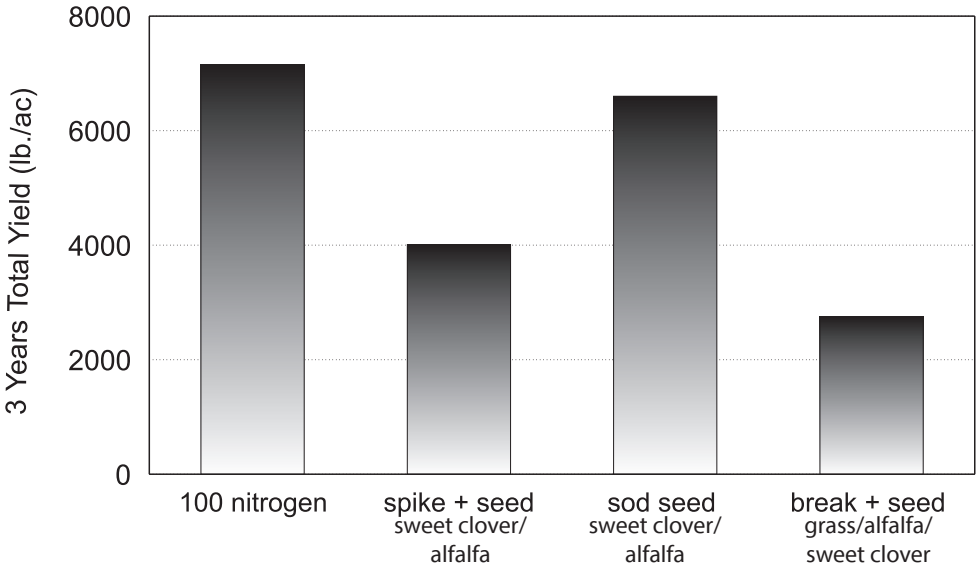


Figure 6: Comparison of sod seeding legumes with other rejuvenation treatments on crested wheatgrass. (SPARC 1995-97)

If vegetation is good to excellent or contains a high level of weeds, a reduced rate of a non-selective herbicide with no residual such as glyphosate can be sprayed to moderately suppress the existing vegetation. It is also possible to use other methods such as heavy grazing to suppress the established vegetation. It is important not to suppress the existing vegetation too much or weed competition may become a problem for new seedlings. Once the existing vegetation is adequately suppressed, forage seed is worked into the sod using equipment like a triple disc drill. These drills use one disc in front to cut the sod and a double disc opener to place the seed in the furrow. While any single- or double-disc drill that can penetrate the sod and place the seed in the soil will do the job, most seeders with narrow openers and suited to minimum or zero tillage systems can also be successfully used. As with seeding into stubble or fallow, it is essential to place the seed at an appropriate depth, ensure accurate metering and follow with good packing to close the furrow once the seed is in place. Leveling the ground following sod seeding is not necessary as most equipment used in this system cause minimal disturbance to the soil surface.

Spring-applied glyphosate is most successful when followed by sod seeding and rainfall. Fall-applied glyphosate has been shown to be more effective for control of species such as smooth brome and bluegrasses.

Additional Notes

This method of rejuvenation has less risk of wind and water erosion compared to breaking and reseeding and can be both an effective and economical way of establishing productive forage species into an older stand (Figure 6). This method effectively conserves soil moisture beneath the sod. It is important to note that one season of forage production is lost in the year of treatment due to the suppression of the existing forage. Successful sod seeding relies on good growing conditions. If unsuccessful, additional spraying and reseeding may be necessary—resulting in more than one season with no forage production from the field.

Changes in Plant Species – Plants not controlled by glyphosate may increase after an application of herbicide. In sod seeding trials, pasture sage was a minor species in a crested wheatgrass stand but increased dramatically after glyphosate application. Other perennial species like Canada thistle and sow thistle may also increase following a glyphosate application. It is critical to evaluate the stand prior to seeding to determine what species are in the existing stand and how prevalent they are. If weed species are prevalent, it will be important to control weeds with the appropriate herbicide prior to seeding. If desirable species are present, they should only be moderately suppressed prior to seeding.

Effect on Forage Yield – Forage yield should increase when more productive species are sod seeded into a lower-producing stand.

Figure 8: Sod-seeding alfalfa into grass stands can increase a stand's yield and forage quality while also helping reduce the need for supplemental nitrogen fertilizer.

Effect on Forage Quality – Replacing pure grass stands with legumes or grass-legume mixtures will greatly improve forage yield and quality.

Combination of Treatments – Sod seeding is most successful in the long term if combined with improved grazing management and fertilization.

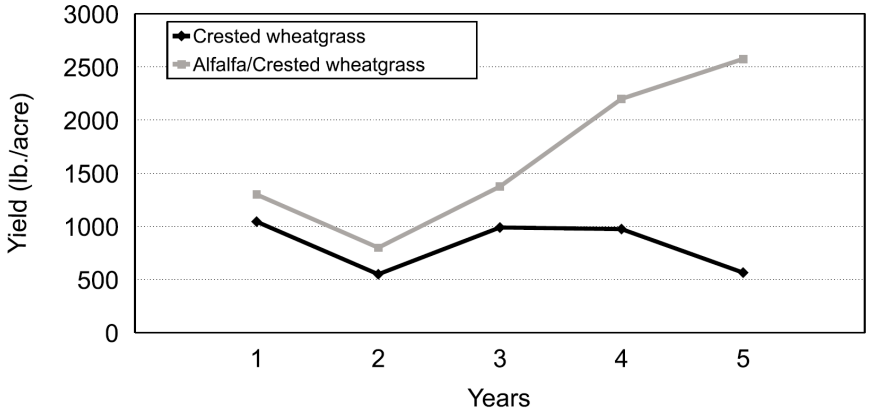


Figure 9: An example of the effect on forage yield that results from including a legume in a grass stand. (Agric. Canada Public. 14731E)

Fertilizer

Fertilization involves the application of nutrients to the soil or plants to correct a nutrient deficiency. The goal of fertilization is to improve forage yield and/or quality. The specific nutrients and amounts required depend on the soil type, average rainfall, soil nutrient status and forage species present in the stand. The best practice is to collect soil samples from each field for analysis and fertilizer recommendation.

Saskatchewan perennial forage stands are most commonly deficient in nitrogen and phosphorus. Potassium and sulphur can also be deficient, especially in legume stands on course-textured soils. Micronutrients like boron, zinc and copper are rarely deficient but may occur in localized areas of a field, especially those that are sandy, high pH or low in organic matter such as eroded knolls. Zone-based soil sampling can help identify areas in a field where there is the greatest probability of response to fertilization.

Figure 10: Balanced nutrition is important for maximum forage stand yield and quality.

In grass-legume stands, nitrogen fertilization creates better growth for the grasses and phosphorus application increases growth for the legumes. Legumes obtain most of their nitrogen needs by fixing atmospheric nitrogen if properly inoculated. Generally, mixed grass-legume stands with more than 50 per cent legume show only a small yield response to nitrogen fertilization. In mixed stands, the legumes provide some nitrogen to surrounding grasses through sloughed nodules and root exudates. For this reason, maintaining legumes in perennial forage stands reduces the need for nitrogen fertilizer.

Balanced nutrition is important for maximum yield and quality. In a study in Northeastern Saskatchewan, application of nitrogen, phosphorus and sulphur fertilizers individually produced some increase in timothy grass yield over the unfertilized control, but the highest yield was obtained when nitrogen, phosphorus and sulphur fertilizer were applied together. On grass stands that soil test low in available nitrogen and phosphorus, observed responses to added phosphorus alone are often limited unless adequate nitrogen is also supplied.

For timing of fertilizer application, later in fall or early spring is a good time to fertilize a forage stand. Cool soils will reduce volatile losses of nitrogen, and snow melt and rainfall will help move the fertilizer nutrients into the soil if the fertilizer is broadcast.

In-soil placement of fertilizer nutrients is preferred over broadcasting as it enables better root access and uptake of added nutrient by the forage crop and reduces losses but may or may not be possible depending on equipment availability. Up to 20 per cent losses of conventional urea fertilizer through volatilization can occur when it is broadcast on a dry soil surface and remains there for several days during warm, dry, windy weather. When broadcasting granular urea (46-0-0), use of a urease inhibitor additive is recommended to slow the loss of nitrogen from surface-applied urea as gaseous ammonia, giving a greater opportunity for rain to come along and move the nitrogen down into the soil where it is retained. Research in the dark brown and black soil zones of Saskatchewan showed that surface dribble banding of liquid urea ammonium nitrate solution (UAN 28-0-0) was effective as in-soil placement when rain came within a week following application to help move the nitrogen deeper into the soil.

Broadcast granules require precipitation to dissolve them and carry the nutrients into the root zone for plant use. For phosphorus and potassium, these nutrients are considered quite immobile compared to

nitrogen due to the adsorption that occurs in the soil. Phosphorus and potassium are not susceptible to loss in gaseous form. However, surface applications do tend to strand phosphorus and potassium at the surface. This lowers the response to fertilization in the year of application. Shallow roots will recover the phosphorus and potassium over the years but a good strategy for these immobile nutrients is to band enough phosphorus and potassium in the soil prior to establishment to account for removal in hay harvest over the anticipated life of the stand.

Figure 11: Granular fertilizer can be applied by broadcasting.

Nitrogen can be applied in several forms, including:

- **Granular Fertilizer:** The most common form for fertilizing perennial forages. With different types of equipment readily available, this can be an affordable and fast way to apply fertilizer to forages. Granular application can be done by broadcasting with a fertilizer wagon or by banding into the soil using a drill or air seeder.
- **Liquid Fertilizer:** May be dribble banded on the surface or placed in soil with coulter or knife banders. The disadvantage of liquids is the higher cost compared to granular and the need for specialized equipment to handle and apply the product. On rough or rocky land, application of liquid fertilizers is only practical with applicators that dribble the liquid on the soil surface. Some volatile ammonia nitrogen losses may occur with this method under dry, warm or windy conditions but can be reduced with use of a urease inhibitor additive.
- **Anhydrous Ammonia:** An economical form of nitrogen but must be injected below the soil surface and the furrows must be closed to prevent losses of nitrogen to the atmosphere. Rocky areas make damage to injection equipment more likely.
- **Livestock Manure:** A good source of nutrients and organic matter for perennial forage stands. Solid manures like cattle penning manure are slow-release sources of nutrients and because of the high carbon to nitrogen ratio may only release a small amount (e.g. 10-20 per cent) of the nitrogen they contain in the first couple years following application until decomposition lowers the carbon to nitrogen ratio. As the manure is left on the surface and incorporation is not possible when spread on a pasture, this further slows nutrient release and delays manure nutrient recovery. Manure spread on the land in the fall gives additional time for decomposition of organic matter and nutrients to be released into available forms and leached into the soil with precipitation. An effective strategy for improved nutrient recovery, recycling and forage response from manure is to feed cattle in-field. Research in Saskatchewan has shown that nitrogen and phosphorus in feed and cattle urine and fecal material is more efficiently recycled when cattle are overwintered and fed in the field versus in yard in dry lot pens.

  Liquid manures should be injected into the soil using specialized equipment. Injection of liquid manure will reduce odour, reduce nutrient loss and increase nutrient recovery compared to broadcasting. Liquid manures add less organic matter to the soil compared to solid manure and have a greater proportion of their nutrients in plant-available forms. As the manure contains nitrogen, phosphorus, potassium, sulfur and micronutrients, the yield responses to the addition of liquid manure on old, very nutrient deficient grass stands can very large.

Note that livestock tend to avoid grazing areas that have been spread with manure in the year of application.

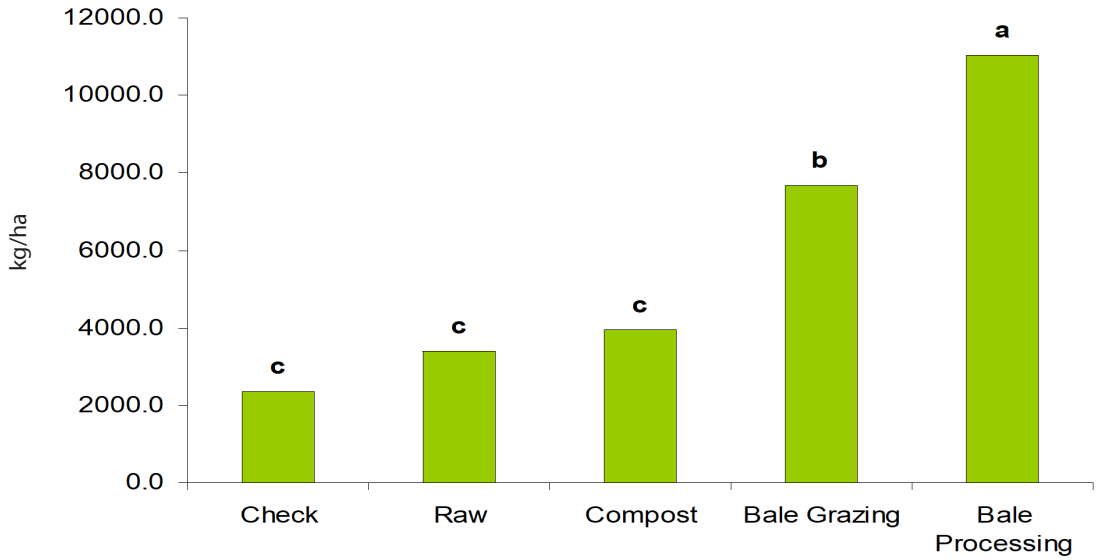


Figure 12: Total Russian Wild Ryegrass growth over 18 months (kg dry matter ha-1) in different feeding systems at Lanigan Western Beef Development Center. Treatments where cattle fed in pens and raw and composted manure hauled to field and surface applied (raw, composted manure) and where the cattle were fed in field (bale grazing and bale processor) (Jungnitsch et al., 2011).

Table 2: Response of crested wheatgrass to nutrients applied as low disturbance injected swine effluent (R. Pastl et al. 2000)

	Biomass	Seed Yield
	----------t/ha----------	
Check	1.0	0.020
3,300 gallon per acre	2.4	0.160
6,600 gallon per acre	4.4	0.210

Using fertilizer has the potential to substantially increase both forage yield and quality while also improving forage stand condition. Improvement in forage yield and quality usually lasts at least two to three years, depending on the amounts of nutrients applied and growing conditions (Table 3). Potential yield improvement is dependent on adequate moisture. Under the right conditions, fertilizer application can be one of the most cost-effective methods of improving forage yield and quality.

Table 3: Forage quality improvement from application of nitrogen fertilizer (late season harvest).

Treatment	% Crude Protein
Control	5.75
50 lb./ac N	7.63

The response to fertilization is greatest in the year of application, provided there is adequate moisture. Forage plants use soil moisture more efficiently when nutrients are in balance.

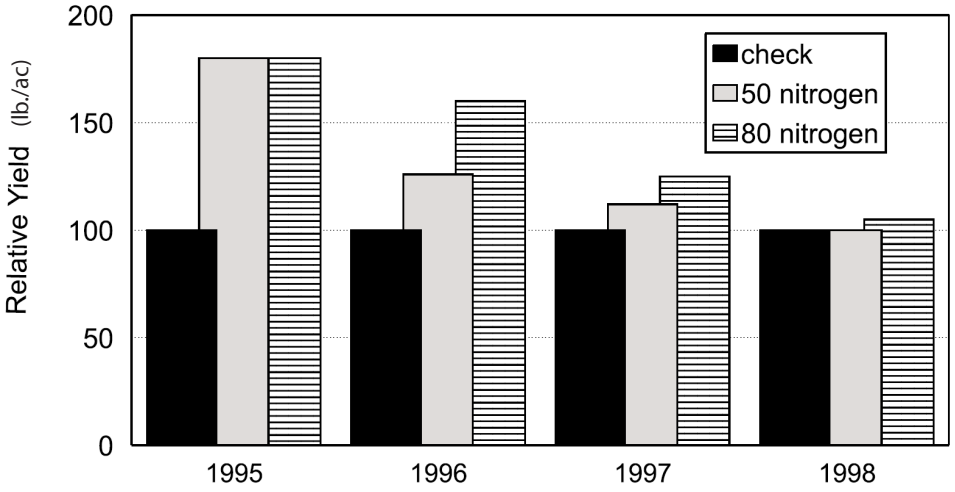


Figure 13: Response of crested wheatgrass to fertilizer application in 1995. Meyronne Community Pasture (Grazing and Pasture Technology Program data)

Additional Notes

Changes in Plant Species – Fertilization tends to favour seeded tame grass species. These species respond to nitrogen fertilization with greater growth than most competitor species, which makes it possible to manage or improve the condition of tame grass stands with fertilization alone. In mixed legume-grass stands, nitrogen fertilization will cause the legume to reduce nodulation, resulting in less nitrogen being fixed from the atmosphere and a greater reliance on synthetic fertilizer to meet the nitrogen requirements. Additionally, grasses are better able to use soil nitrate (nitrogen fertilizer) than legumes and will therefore have a competitive advantage over the legumes when nitrogen fertilizer is applied, causing a reduction in the legume component of the stand. This causes both lower yield and quality over time. Thus, there is no benefit to adding additional nitrogen fertilizer to grass-legume stands unless being used as a tool to adjust the grass-legume ratio. To reverse this effect, the application of phosphorus fertilizer will give the legumes a competitive advantage and increase the proportion of legumes in the stand.

Effect on Forage Yield – Nitrogen is the nutrient with the most impact on perennial tame grass yield (Figure 4). In general, the response to other nutrients such as phosphorous does not occur until the nitrogen deficiency has been corrected or exceeded. Perennial tame grass yield response to nitrogen application is directly related to the availability of soil moisture during the growing season. The duration of forage yield improvement following nitrogen application greatly depends on the growing conditions in the year of application as well as the amount of nitrogen applied and the grass species in the stand. While the degree of response to fertilization depends on the grass species, in general, rhizomatous grasses like intermediate wheatgrass appear to show a greater response to nitrogen fertilization than bunchgrasses. For example, Russian wildrye may not show as much yield benefit from a fertilizer application. However, it would probably have a larger improvement in protein content than the crested wheatgrass plant. This is a reflection of the fertility benefit in different ways.

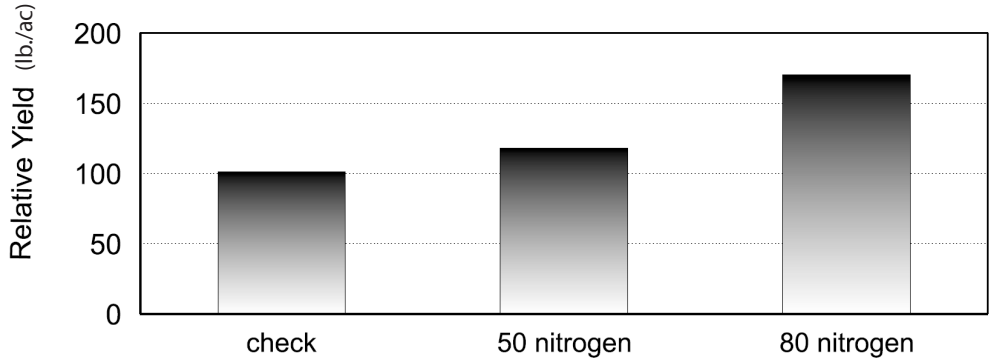


Figure 14: Response of Russian wildrye to nitrogen fertilizer. Arena Community Pasture, 1995-1996 (Green Plan Project)

Effect on Forage Quality – Nitrogen fertilization of grasses will increase their protein content, especially later in the growing season when protein normally declines (Table 3). It will also lengthen the period during which the grass is palatable to livestock, allowing for better use of the forage.

Phosphorous is a very important element in animal nutrition and is often at marginal levels in livestock diets. Phosphorous fertilizer application will improve phosphorous levels in the forages when the soil is deficient, improving the feed quality. If phosphorous and potassium levels are not limited in the soil, applying nitrogen fertilizer may result in higher amounts of both phosphorous and potassium in the forage.

Frequency of Treatment – How often perennial tame forage stands should be fertilized depends on many factors, including:

- Level of nutrient application relative to the soil nutrient level (i.e. whether adequate fertilizer has been applied to restore the nutrient deficiency). Higher levels of fertilization will give longer yield responses, assuming adequate soil moisture.
- Growing season conditions influence how often tame stands should be fertilized. The greater the yield response from nutrient uptake and removal in year one, the less response typically observed in year two.
- The value of forage relative to the cost of fertilizer, which is important when deciding the frequency of fertilizing perennial stands. If feed is cheap and fertilizer is expensive, it may make more sense to buy feed instead of applying fertilizer.

Combination of treatments – Fertilization enhances the effect of all other rejuvenation methods and can reduce the negative effects of harsh treatments like spiking or harrowing (Figure 15).

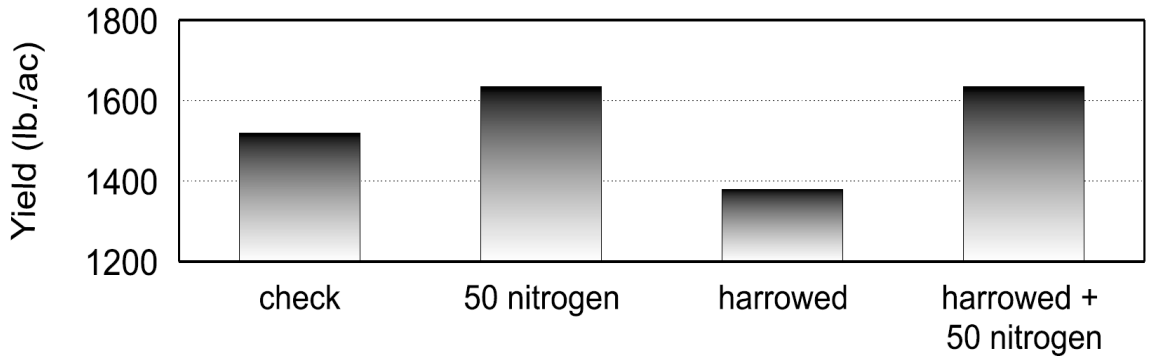


Figure 15: Beneficial effects of combining nitrogen fertilization with harrowing on a crested wheatgrass stand. (W. Houston, USDA, Miles City, Montana, 1950-52.)

The application of phosphorous generally improves the establishment of new forage plants. Forage plants tend to be particularly sensitive to injury from fertilizer placed in the seed row so no more than 15 lb./acre of P_2O_5 should be placed with the seed. Higher rates of phosphorous can be applied as a pre-plant band or banded to the side or mid-row at seeding. This will aid in plant root development, resulting in rapid initial growth known as a 'pop-up effect'.

When and Where to Use – If desirable plant populations are adequate for the stand to be in at least fair condition, adding fertilizer is often the most cost-effective method of rejuvenation. Fertilizers are best applied when temperatures are low and the probability of precipitation is high, such as in early spring. Late fall application has also been successful but there tends to be greater potential for losses from runoff and leaching – particularly with nitrogen. Amounts of nutrients applied should be based on a soil test.

Table 4: Nutrient removal of forage crops

	N (lb./ac)	P_2O_5 (lb./ac)	K_2O (lb./ac)	S (lb./ac)
Alfalfa (5 tons/ac)	260 - 320	60 - 80	270 - 330	23 - 35
Grass (3 tons/ac)	90 - 120	25 - 35	120 - 140	10 - 15

Phosphorous is generally required on forage stands which are more than four years old. Potassium and sulphur may be required on coarse-textured soils. Legume-grass stands require much less nitrogen if properly inoculated and with active nodules that fix atmospheric nitrogen. Nodules that have a bright pink colour when sliced are actively fixing nitrogen.

Legumes have a higher requirement for phosphorus, potassium and sulphur. The application of these nutrients as needed will help maintain legumes in a mixed stand. A balanced forage crop nutrition plan can also reduce winter kill in addition to increasing stand yield and feed quality.

Hay fields require more fertilizer than pastures because harvesting removes more nutrients. Pastures benefit from nutrient recycling through manure left by grazing animals.

Improved Grazing Management

The need to rejuvenate pasture may be a sign that the current grazing management system needs to be adjusted. When using grazing management for rejuvenating pastures, changing the season, duration, frequency and intensity of use can help influence pasture condition. By adjusting these elements of grazing management, producers can direct their management at specific challenges in their pastures. For example, using different species of livestock such as sheep or goats instead of cattle can be an effective way to address challenges such as noxious invasive weeds or brush encroachment.

The easiest way to influence pasture condition is to change the stocking rate. If a pasture is being over-used a reduction in stocking rate may be needed to improve its condition.

The rate of improvement in a pasture's condition depends on the scale of changes that have been implemented and the growing conditions. Small adjustments such as reducing grazing duration may lead to gradual improvements in pasture condition, whereas bigger changes such as resting a pasture for an entire season can accelerate recovery time. Combining strategies such as increasing stock density along with extended rest periods tends to produce even faster results.

Figure 16: Litter is the leftover plant material from the year before and is an indicator of grazing management.

Additional Notes

While grazing management can be an effective tool for improving pasture conditions, there are some considerations to keep in mind. For example, shortening the grazing period and lengthening the rest period may require additional feed resources or adjusting plans for other pastures, and this short-term adjustment will mean a higher carrying capacity in the future. Knowing that, the need to plan for additional or alternative feed sources in the short-term is an important consideration.

It is also important to note there may also be capital investment required, particularly in the set-up phase. This could include building or repairing infrastructure such as fences and water sources.

The timing and intensity of grazing impacts wildlife by creating or altering wildlife habitats. Adjusting either when and how long animals are on the pasture can conserve habitat for wildlife species, including species at risk.

While grazing management may be one of the least expensive methods of pasture rejuvenation, it often takes longer to see noticeable improvements in pasture conditions. It is easy to adapt to meet specific goals or in response to changing growing conditions, making this method ideal to use in combination with other rejuvenation methods such as fertilization or herbicide for invasive species management.

Changing the species of livestock can be an effective tool for rejuvenating pastures. For example, grazing sheep alongside cattle in pastures with high proportions of broad-leaf plants or brush encroachment can lead to improved forage production. Sheep will consume grass but prefer to eat more broad-leaved plants than cattle. Often, you will see reduced competitiveness of broad-leaved plants and brushy species when sheep are included in grazing systems.

Improved grazing management is an ongoing practice that may need to be adapted over time as conditions change. Once a pasture's condition has been improved to the desired level through improved grazing and other practices, it is important to keep managing grazing. If not, the pasture's condition will deteriorate and declines in health will happen at a much faster rate than it improved.

Changes in Plant Species – Providing partial or complete rest to perennial forage plants will improve their vigour and allow them to compete with more aggressive, undesirable plants. Forage stands, in fair condition or with at least 50 per cent of the forage yield provided by desirable plants, are more resistant to invasion by less desirable plants like bluegrasses, dandelions and pasture sage.

Effect on Forage Yield – Adjusting grazing management to improve forage production will eventually improve forage stand condition, resulting in higher yield. The forage production of a pasture in fair condition is approximately two-thirds of what that same pasture would produce in good condition (Table 4).

It will not be possible to return a forage stand in poor condition to good condition with grazing management alone because there will be an absence of desirable plants. Those desirable plants will likely have to be reintroduced somehow.

Table 5: Effect of pasture condition on forage production.

Pasture Condition	Stocking Rate (% of good)
Excellent	133
Good	100
Fair	66
Poor	33

Effect on Forage Quality – Proper grazing management includes using forage plants without causing damage by grazing them too early in their growth cycle or not allowing adequate rest between grazing events.

With tame perennial pastures, the goal is to maximize the pounds of plant protein harvested per acre. This is achieved by grazing when the plants are in a vegetative state and timing grazing rotations to keep them that way while still providing enough rest. Keeping the plants vegetative but still providing adequate rest preserves underground energy reserves. Depleting a plant's underground energy reserves will increase the likelihood of plant mortality, winterkill and susceptibility to disease pressure while also slowing recovery time after being grazed.

When using long rest periods to improve condition, plants will often head out and the forage quality declines as the plants mature. Whatever loss of quality that occurs during the resting seasons will be made up in subsequent years with higher yields.

Combination of Treatments – Improved grazing management should accompany all other rejuvenation methods. Keeping livestock off freshly fertilized pastures till the plants have adequately taken up the nutrients and recovered from the previous disturbance will benefit the pasture's long-term productivity.

Overseeding/Broadcast Seeding

Overseeding involves broadcasting forage seed onto an existing pasture or hay stand to improve forage production and quality. Overseeding is very dependent on weather and available moisture for successful establishment. It is relatively inexpensive and is commonly used for small-seeded species such as alfalfa or different types of clover. When seeding legumes via broadcast seeding, it is normal to use a reduced rate—typically half to three quarters of the normal rate. Smaller-seeded grasses can also be overseeded with some success. Sometimes the stand is harrowed, spiked or rolled with a land roller following broadcast seeding to improve seed to soil contact. There has been some success using the hoof action of cattle or sheep in high-density, short duration stocking improve seed-to-soil contact of the seed.

This rejuvenation method is best suited to grass stands where there is enough space for the new seedlings. More bare ground is better when broadcast seeding—there is a higher chance of successful establishment when there is room for the new seedlings to establish. Note that vigourous harrowing or spiking after broadcasting will impact the existing vegetation and will result in lowered forage production in the year of treatment.

Additional Notes

Dormant seeding in the fall, once the daily and soil temperatures are 5 C or less (typically October 15 until freeze-up) is an option for most legumes except sweet clover. Sweet clover seed loses viability over the winter.

Overseeding can be used on highly erodible sites to reduce the risks associated with high-disturbance rejuvenation methods.

Broadcasting alfalfa seed on an established alfalfa field to thicken the stand is typically unsuccessful. This is because alfalfa has autotoxicity, meaning the established plants release a chemical into the surrounding soil to suppress germination of alfalfa seeds, reducing competition. This chemical only effects alfalfa seeds—there is no effect on grass or other legumes.

Changes in Plant Species – Changes in plant species can be an effective method of increasing the legume component of a mixed stand or introducing a legume into a grass stand.

Effect on Forage Yield – Yield increases are very dependent on the amount of broadcasted seed that establishes. Soil moisture, competition from existing forage plants and suitable germination sites for the seeds are all factors that will affect the time required for establishment and subsequent yield.

Effect on Forage Quality – Forage quality will be greatly improved wherever a legume is successfully established in a grass stand.

Frequency of Treatments – There is no risk with repeated treatments; however, cost can be a consideration for frequency.

Combination of Treatments – Herbicide application or disturbance such as spiking combined with overseeding will reduce competition from existing plants and provide germination sites for the broadcasted seeds. It is important to note that soil disturbance will also encourage germination of weed seeds present in the soil, possibly resulting in the overgrowth of weedy species. Additionally, soil disturbance will not guarantee successful establishment of the overseeded species and may in fact hinder establishment under some conditions.

Figure 17: A high speed disc with a broadcast seeder attachment.

Herbicides

Herbicides should be used in stands that have a good population density of desirable plants but are not producing to their full potential due to competition from undesirable plants. Selective herbicides, for example those targeting broadleaf noxious weeds or brushy species, can be used to kill unwanted plants while leaving the forage stand unharmed. A number of products are registered for weed control in forage crops, and detailed information can be found in the Guide to Crop Protection, published annually by the Saskatchewan Ministry of Agriculture.

Herbicides can be applied in several ways, the most common method being a regular ground sprayer. Wick applicators that wipe herbicide on weeds taller than the forage stand minimize the amount of herbicide applied, benefiting the environment and improving the economics of weed control. More advanced technologies are being developed, but few options are suitable for weed control in an established forage stand.

Herbicide application should be made when the target plant or plant group is most susceptible. For most shrubs and annual weeds, this is when they are actively growing. For perennial weeds, however, herbicide

Figure 18: Nodding thistle (Carduus nutans) is a biennial invasive weed that can sometimes be found in tame hay or pasture stands.

application in summer or early fall is often most effective. The cost of the herbicide application should be weighed against the estimated loss in forage yield and quality due to the undesirable plant infestation.

Additional Notes

Not all undesirable or hard to control species have registered products available for control. It is important to always follow the label instructions.

Treatments can be expensive and/or difficult to carry out, and several treatments or follow-up management may be required for effective control. Additionally, some treatments may damage or eliminate some desirable species or contaminate soil and water.

Biological control of undesirable species may be considered for species such as leafy spurge or scentless chamomile.

Changes in Plant Species – Herbicide treatments can have a major impact on the plant species in a forage stand. Selective herbicides can almost eliminate whole groups of plants, allowing other species room to increase and become more dominant. An example of this would be where the use of a herbicide that selects for broadleaf weed species also impacts the legume content of the stand. Non-selective herbicides can be used to suppress all plants in a forage stand, allowing establishment of new species, such as in the case of sod-seeding legumes into an established stand. Unfortunately, invasive weeds can also increase rapidly when the desirable plants are suppressed, requiring further herbicide application or other management.

Effect on Forage Yield – One of the main reasons for considering herbicide application is to improve forage yield. Pasture sage (*Artemisia frigida*) and prairie sage (*Artemisia ludoviciana*) are two of the most common undesirable plants in tame forage stands and will increase in population with prolonged overgrazing. Herbicide application will provide good control of pasture sage, increasing forage yield (Table 6). The degree of yield increase depends on the density of the undesirable plant in the stand prior to spraying and the level of control achieved. In the case of most undesirable plant species, spraying is only warranted if the resulting forage yield increase is worth more than the cost of applying the herbicide. When controlling woody species, forage yield in the treatment year does not change much due to sustained competition from suckers. In subsequent years, if control measures are continued, forage production will increase as desirable grasses and forbs increase in the stand.

Table 6. Crested wheatgrass yield increases and 2015 herbicide costs (averaged over two experiments).

Treatment	Rate (L/acre)	Estimated Cost [1] ($/acre)	Accumulated Three Year Yield (kg/acre)	% Increase From No Treatment
Check	0	-	983	-
2,4-D [2]	1.0	13.90	1,264	29%
2,4-D 2 year [2], [3]	1.0	27.80	1,178	20%
2,4-D + FERT 2 years [2], [3], [4]	1.0	280	1,699	73%
2,4-D + Dicamba 480 g/L	0.7 + 0.72	32.86	1,178	20%

[1] Herbicide cost/acre based on suggested retail prices (SRP) for 2026
[2] 2,4-D ester 700 g/L activity
[3] Two applications made in consecutive years.
[4] 45 lb/ac N + 71 lb/ac P_2O_5 (cost based on an estimate of $0.85/lb of N and $0.90/lb of P_2O_5, using early spring 2026 retail prices for urea and 11-52-00)
[5] See "Dicamba" in the Guide to Crop Protection for product selection.

ADAPTED FROM: Management of Pasture Sage (Saskatchewan Ministry of Agriculture: https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/crops-and-irrigation/weeds/management-of-pasture-sage)

Effect on Forage Quality – Using herbicides to remove unpalatable herbaceous or woody species will increase palatable forage species and improve nutritional quality. If possible, choose to spot spray target areas instead of a wide-scale application to help avoid removing the high-quality legumes from the stand to maintain stand quality.

Frequency of Treatment – Using the correct product for the target species at the recommended time and rate is the best way to ensure effective treatment and avoid the need to re-apply. When used in combination with other treatments like mowing, herbicides can be an effective tool for controlling woody species. Proper grazing management should be used following herbicide application to have the best control. Note that some herbicides have restrictions on how soon after application the stand can be grazed. This can be found in the Guide to Crop Protection or on the manufacturer's website.

Combination of Treatments – A initial mowing treatment, followed by an application of herbicide on the regrowth can be the most effective for controlling woody species. There may also be a need to apply herbicide following mechanical disturbances like spiking or breaking and reseeding, where the equipment leaves openings in the forage stand for weeds to invade. In this case, selective herbicides that are effective on the most persistent competitive weeds are the best choice. The use of a non-selective herbicide in combination with sod-seeding can be a successful method of stand rejuvenation under the right conditions – see the Sod Seeding section for more details.

Mowing

Mowing is commonly used to remove unwanted vegetation such as weeds or brush or to cut and mulch a large amount of old growth. Removal of woody plants or weeds by mowing or swathing can provide a competitive advantage to the desirable forage plants. However, this method can be challenging on tough terrain, is expensive and time consuming on large areas and may waste usable forage. This method also requires a follow-up treatment, either by repeated mowing or with other rejuvenation methods. Trees and shrubs in particular may sucker if mowing is not followed or preceded by an application of a herbicide.

A rotary flail or sickle mower is used to remove plant growth to a three- to four-inch height. Rotary mowers can effectively shred woody plants up to six feet tall. A swather can be used where vegetation is not woody and mulching is not necessary. Note that swathing or mowing woody plants leaves a sharp stump that can cause injury to livestock and horses as well as damage tires on equipment.

It is important to note that improvements in yield are not guaranteed with this method and in many cases may be minimal.

Mowing of woody species or removal of excessive litter should be done in the spring to prevent damage to the new, emerging desirable plants.

Perennial weeds should be cut prior to flowering and again if regrowth occurs. Removal of a large portion of the undesirable plant's leaves will result in the best suppression. The combination of low root reserves, slow regrowth and reduced leaf area of weedy species following cutting should give perennial forage plants a competitive advantage.

For annual weeds, mowing or swathing is most effective in early summer when their root reserves are the lowest and prior to seed being set.

Mowing should be timed for when the plants are fully leafed out and mowing will inflict the most damage on the target species. Optimal timing depends on the species. More information can be found in *A Guide to Integrated Brush Management on the Western Canadian Plains*. Following mowing, cattle will browse new suckers of most woody species if stocking density is high enough to limit their ability to selectively graze. By having cattle present in these areas for only short periods of time, overgrazing of the grasses can be avoided. Using cattle, sheep or goats for controlling woody suckers should start in the year of mowing and be repeated as part of the new grazing management plan.

Forage stands that have been rested for a long period of time will build up a thick thatch. Using a high stocking density with or without mowing or swathing will open the thatch up to allow sunlight to reach emerging tillers.

Changes in Plant Species – A single mowing has limited impact on plant species in a stand; however, mowing to control weeds favour faster-regrowing species. When mowing to remove old growth or woody vegetation, species that prefer direct sunlight will be favoured. Shade tolerant species, such as Kentucky bluegrass (*Poa pratensis*), will lose all their competitive advantage over the more desirable tame species. Control of woody plants may mean a reduction in wildlife browse supply and cover.

Effect on Forage Yield – When removing old plant material from overgrown stands, forage availability will be reduced for the first year due to the loss of this material. Mowing to control woody plants may increase palatable forage production in the year of mowing. The amount the desirable forage species increase in volume and the number of years it will remain will depend on the condition of the stand prior to mowing or swathing as well as the management of the stand following treatment.

Effect on Forage Quality – Mowing can improve forage quality by removing unpalatable species or dead material, which should be replaced with new growth of desirable forage species. The direct effects of mowing on the quality of forage grasses and legumes are minimal.

Frequency of Treatment – Woody species will require re-treatment as they will sucker after being mowed. Mowing two years in succession is much more effective for woody plant control than only one mowing followed by a second mowing several years later. Both mowings could be done in the same year if regrowth occurs. A combination of treatments including herbicide and mowing, along with good grazing management should suppress woody species for several years. Re-treatment should not be necessary when mowing or swathing is used to remove weeds or accumulated dead forage material. By implementing improved grazing management practices, the problem can usually be prevented from occurring.

Figure 19: Brush encroachment is a challenge across the province.

Combination of Treatments – The use of several methods of rejuvenation is most effective for controlling both weedy herbaceous and woody plants as well as eliminating excessive buildup of dead plant material. Woody species should receive a second mowing or herbicide treatment in the year following mowing. Small suckers can be effectively controlled with herbicide. Sometimes mowing can be used as a way to stop seed-set of undesirable plants thus reducing the repopulation of new plants that rely on seed dispersal.

Prescribed Fire

While much research has been done on the role of prescribed fire for managing woody plant encroachment and rejuvenating stands on native rangelands, there is very little information on the effect of prescribed fire when used as a rejuvenation tool on tame pasture. For more information on the role of prescribed fire in Saskatchewan, please contact the Canadian Prairies Prescribed Fire Exchange or visit their website.

Economics of Rejuvenation

Which rejuvenation method makes the most economic sense for your operation will depend entirely on your own unique situation. As previously discussed, each operation will face their own challenges and have constraints that influence the risk and yield benefit of each rejuvenation method. By understanding the advantages and risks of each method, you can use your own numbers to calculate which will be the best fit for your unique situation.

A simplified cost-benefit analysis was completed on many of the treatments. Direct comparisons of results between treatments is possible for spiking, knives, burning and mowing. Yield responses for the other rejuvenation methods discussed were calculated from various research projects throughout the province. As a result, direct comparisons may not be appropriate.

The cost-benefit analysis was included in this publication to help producers identify rejuvenation methods that may be useful on their own farms. To arrive at a net return for the treatment, several assumptions had to be made in each case. These assumptions are provided. Producers are encouraged to change the costs or yields to better suit the productivity and costs on their farm.

Use *the calculator* to determine which rejuvenation method makes the most economic sense for your operation.

A cost-benefit analysis was not completed for the controlled grazing option. It was felt there were too many variables to provide a generalized net benefit or loss, but this could be calculated for an individual operation. Controlled grazing will improve plant vigour by providing plants with a period of non-use during the growing season and controlling the intensity and frequency of defoliation. Controlled grazing also involves matching the number of livestock to the available forage. Controlled grazing may well be the most useful and cost-effective method of increasing forage production available. Contact your nearest rangeland management extension specialist to receive assistance with controlled grazing systems.

Of all the rejuvenation options mentioned in this publication, breaking and reseeding has the most variable costs and returns. In most other rejuvenation options, the type of machine and number of operations is well defined. For breaking and seeding, producers have many more options in type of machinery to use, whether to use a herbicide or cover crop, which species of forage to seed or whether to summer fallow or annual crop. Improved forage varieties can be chosen at the time of reseeding which will increase either hay or beef production.

Breaking and reseeding provides the opportunity to incorporate forage land into an annual crop rotation by seeding the land to an oilseed or cereal crop for a few years before returning it to grass. Forages in rotation provide many benefits such as increased organic matter and nutrients, better soil health, moisture infiltration and control of weeds. These benefits are difficult to quantify but Entz et al. (2010) describes these benefits in detail.

Using this calculator, producers can input values from their own operation and decide which method makes the most economical sense for their situation.

Assumptions

The rejuvenation method is carried out on a mainly smooth bromegrass hay field. The field has been hayed for more than seven years. Standing smooth brome hay is valued at $50/t or $0.025/lb. Wherever possible, custom farm operation rates for 2024-25 Farm Machinery Custom and Rental Rate Guide have been used to calculate costs. The 2025 value for the rotary mower was calculated using the rate published in the 2011-12 Farm Machinery Custom and Rental Rate Guide and was adjusted using the Bank of Canada's adjustment.

Seed prices and forage values were pulled from the Saskatchewan Forage Council's *Fall 2025 Forage Market Price Discovery Report*. Input prices were gathered from a variety of sources, including the Alberta Farm Input Prices database, *2025 Saskatchewan Crop Planning Guide* and recent studies completed at the Livestock and Forage Centre of Excellence.

For more information on forage rejuvenation, please visit *saskatchewan.ca/agriculture* or call the Agriculture Knowledge Centre at 1-866-457-2377.

For More Information

Contact your nearest Saskatchewan Agriculture regional office:

Kindersley
306-463-5513

Outlook
306-867-5527

Swift Current
306-778-8285

Humboldt
306-682-6701

Moose Jaw
1-866-457-2377

Prince Albert
306-953-2363

Tisdale
306-878-8842

Weyburn
306-848-2857

North Battleford
306-446-7962

Yorkton
306-786-1531

Agriculture Knowledge Centre (Toll Free): 1-866-457-2377

Farm Stress Line: 1-800-667-4442

saskatchewan.ca/agriculture

Saskatchewan