Saskatchewan Ministry of Agriculture

IRRIGATED ALFALFA PRODUCTION IN SASKATCHEWAN

IRRIGATION

AGRICULTURE

Introduction

Irrigated alfalfa in Saskatchewan became a part of crop rotations during the 1930s, as a result of the Agri-Environmental Services Branch (AESB, formerly known as PFRA) designed irrigation projects in southwest Saskatchewan (Rush Lake, Consul-Nashlyn, Maple Creek and Val Marie). The addition of provincial irrigated hay projects (North Waldeck, Ponteix, Lodge Creek, Chesterfield Flats, Miry Creek and Grainlands) increased the acres of irrigated alfalfa grown in the province. The South Saskatchewan River Irrigation District No. 1 (SSRID No.1) traditionally has about 20 per cent of the project acreage seeded to alfalfa. Irrigated alfalfa is also grown on projects along the banks of the North Saskatchewan River and throughout the grain belt on smaller individual projects.

Alfalfa is popular because of its hardiness, productivity and high nutritional value. The objective of this publication is to improve yields of irrigated alfalfa in Saskatchewan for increased economic returns to the producer. This publication outlines proven production practices and recommendations suited for irrigated alfalfa forage production. Additional information on alfalfa and forage production in Saskatchewan can be found on the Saskatchewan Ministry of Agriculture website at www.agriculture.gov.sk.ca and the Saskatchewan Forage Council website at www.saskforage.ca.

Pre-planting considerations

Alfalfa is a perennial crop and careful planning made at the time of establishment will enhance productivity for the life of the stand. The decision to plant alfalfa on a plot of land should be made at least a year prior to seeding so the land can be prepared for growing a highly productive alfalfa crop.

Weed control

Perennial weeds are difficult to control in an established alfalfa stand. Herbicide options for controlling perennial weeds in alfalfa are limited. Weeds such as quack-grass, sow thistle, Canada thistle, field bindweed and other highly competitive perennials need to be controlled prior to planting the alfalfa stand.

Rotation

Alfalfa production is an effective control strategy for diseases, insects and weeds associated with cereals and oilseeds. Alfalfa is a soil building crop because the roots

and crowns add nitrogen-rich organic matter to the soil when the stand is terminated. Decomposition of alfalfa residues by soil microbes is a major source of nitrogen supply to succeeding crops.

Primary rotational considerations for growing alfalfa are:

- Control of alfalfa diseases - Wait at least three years between the break-up of an alfalfa stand and replanting alfalfa.
- Herbicide carryover - Wait at least two years after the application of some Group 4 herbicides before seeding alfalfa. Refer to the Saskatchewan Ministry of Agriculture Guide to Crop Protection for re-cropping restrictions for residual herbicides prior to seeding alfalfa.

Varieties

Factors to consider in selection of a suitable alfalfa variety include winter hardiness, rate of re-growth, rooting pattern, disease resistance, intended use, irrigated or dryland production, growing season precipitation and the length of intended rotation. In areas where irrigation water is not limited, varieties with rapid re-growth, good winter hardiness and strong disease resistance grow well. Hardier creeping root varieties yield less than tap root varieties under irrigation and are only recommended on the heavy-textured gravity-irrigated soils in southwest Saskatchewan.

The Saskatchewan Ministry of Agriculture publication "Forages - Relative Cultivar Yields for Perennial Species" provides relative yield data for both irrigated and dryland production as well as ratings for disease resistance and fall dormancy. Alfalfa varieties listed in this publication have undergone extensive testing for yield, winter hardiness and quality in Saskatchewan, and have proven suitability for production in this province and are registered in Canada. Varieties not listed are either lower-yielding or have not been sufficiently tested. The planting of a variety relatively new to an area should be limited until the variety's adaptation is better understood.

Cover crop vs. direct seeding

Direct seeding of alfalfa into a firm seedbed produces a more uniform, vigorous and weed free stand than with a cover crop. A cover crop can protect forage seedlings and help reduce the risk of spring soil erosion on susceptible soils. However, a cover crop does compete with the growing seedlings for light, nutrients and moisture and may result in poor establishment of the forage crop.

If selecting a cover crop, choose a non-competitive, short-growing, shorter-season crop that is not prone to shattering or lodging. The most appropriate cover crop is a cereal grain sown at a reduced seeding rate such as 15-20 lb./acre and harvested as annual forage at the soft dough stage of development. The low seeding rate prevents soil erosion without creating excessive

Figure 1: Fertilization of the cover crop encourages its growth to the disadvantage of the alfalfa (left side of photo)

competition to the developing alfalfa plants. Minimize the time the grain swath covers the seedling alfalfa. Direct combining or late swathing reduces the damage to developing alfalfa seedlings. Bale the straw and remove the bales from the field as soon as possible.

Establishment

Fertilization

Assess the soil fertility of the field prior to planting through analyzing a soil sample. If the field has been levelled, sample the cut areas separately, as they will likely require heavier applications of phosphorus and perhaps potassium. Band or broadcast and incorporate the required nutrients prior to planting the alfalfa. Research work by Dr. Malhi at Lacombe indicates that the efficiency of phosphorus can be improved by banding the fertilizer as compared to broadcast and incorporation because the rate of nutrient uptake is determined by its concentration in the soil. A higher concentration (banded) in the vicinity of the roots improves the uptake of phosphorus by the alfalfa plant.

A general recommendation is to apply 112 kg $P_2 0_5$/ha (100 lb. $P_2 0_5$/acre) and 50 kg $K_2 0$/ha (45 lb. $K_2 0$/acre) prior to planting. Irrigation water may supply sufficient sulphur to meet crop demands. The sulphate form of sulphur moves with the applied water, therefore a deficiency of sulphur is readily corrected in an established stand. The near-surface roots of the alfalfa are able to absorb phosphorus and potassium broadcast-applied to alfalfa. For more information, see the Fertility section below.

Seedbed preparation

Seed into a firm, moist seedbed that is free of weeds. Direct seeding into clean, un-worked stubble is the best choice. A firm, moist seedbed provides uniform seeding depth and rapid emergence. Firm seedbeds can be established by following cultivation with a rod weeder, harrow packer, or press drill. Banding phosphorus fertilizer with a press drill prior to seeding alfalfa is a common and effective method of firming the seedbed. An irrigation application of 2 to 3 cm (.75 to 1.2 inches) with a sprinkler system prior to seeding firms the surface soil and provides moisture for rapid germination and emergence. In areas where few spring rains are expected or where pivot irrigation is not available, the incorporation of chemicals and fertilizer in the fall is a less risky option and is only recommended if crop residue left on the surface is sufficient to prevent wind erosion during the winter and early spring.

Inoculation

Nitrogen-fixing bacteria within the nodules of alfalfa roots convert nitrogen from the air into ammonium, which is usable by the plant. Since natural levels of symbiotic *Rhizobia* in the soil are often low, it is wise to inoculate the alfalfa seed with *Rhizobium meliloti* just prior to seeding. The majority of alfalfa seed is sold pre-inoculated with the correct *Rhizobium* species. Pre-inoculated seed is coated with a plastic film to prevent the bacteria from drying out.

When self-inoculating alfalfa seed, purchase fresh inoculant, checking the expiry date, and store the inoculant in a cool place out of the sun until needed. Apply the inoculant to the seed as a dry powder or water slurry. Most inoculants have a sticker added to the formulation. The following simple and effective procedure for seed inoculation is recommended.

1. Place the required amount of alfalfa seed in a pile (not more than two-feet high) on a clean cement

floor or in a tub away from direct sunlight. A cement mixer also effectively mixes the inoculant with the seed.

2. If the inoculant does not have a sticking agent, a sugar solution or skimmed milk should be added to the mixture as a sticking agent, at a rate of one litre of sticker per bushel (60 lb.) of seed. Mix the seed with a clean shovel.

3. Sprinkle the inoculant powder at the recommended rate over the sticky seed. Coat all seeds with inoculant by shoveling the seed and inoculant mixture back and forth until all seeds appear evenly coated with the powder.

Seed should be sown as soon as possible after inoculation, allowing only enough time for the seed to dry. Wet seeds are potentially damaged by the planter and easily bridge in the seed box. The inoculated seed should be protected from direct sunlight and stored in a cool building.

Seeding

Perennial forage crops, including alfalfa, can potentially be sown at three different times of the year, ncluding spring, early fall and late fall. In the brown and dark-brown soil zones, spring seeding is recommended from early April to mid-May. The seeding window can be extended to mid-June under irrigation. Early seeding offers the best conditions for successful establishment, but field and moisture conditions may warrant a delay in seeding until fall.

Late fall seeding of alfalfa, from Oct. 15 until freeze-up, typically ensures that no germination will occur until the next spring. Soil and mean daily temperatures should be 5 C or less prior to seeding. Early fall seeding is recommended if the forage crop can be sown by Aug. 15. This ensures that the plants have developed to a physiological stage that will survive the winter.

A typical seeding rate for irrigated alfalfa is 7 to 9 lb./acre with 15 cm (6 inches) row-spacing and at a depth of 1 to 2 cm (.25 to .50 inches). Under irrigation, target a seed density of 30-40 pure live seeds/ft^2 (PLS/ft^2). Pure live seed can be determined by multiplying the seed germination and purity percentages together. The seeding rate in pounds per acre can be calculated by multiplying the target seed density by 43,560 square feet in an acre and dividing by the total number of seeds in a pound. The approximate number of seeds per pound for alfalfa is 200,000. Refer to Figure 2 for an example seeding rate calculation.

$$\text{PLS} = \text{germination \%} \times \text{purity \%}$$

$$\text{Seeding rate (lb./acre)} = \frac{\text{seeds/ft}^2 \times \text{ft}^2\text{/acre} \,/\, \text{PLS}}{\text{seeds/lb.}}$$

Eg. $\text{PLS} = 90\% \times 90\% = 81\%$

$$\text{Seeding rate} = \frac{40 \times 43{,}560/0.81}{200{,}000} = 11 \text{ lb./acre}$$

Figure 2: Seeding rate formula

When selecting equipment to seed forages, be sure equipment can accurately and consistently control seeding depth. Double-disc press drills, hoe drills, broadcast applicators, air drills and air seeders can all be used to seed forages.

Broadcast seeding is often less satisfactory, but with good moisture conditions and slightly higher seeding rate, excellent stands can be established. Harrow the broadcast seed immediately behind the seeder to bury the seed just below the soil surface to avoid damage to the inoculant by the sunlight. When a cover crop is seeded, plant the cover crop first to firm the seedbed. Seed the alfalfa with a second pass at an angle to the first direction of travel used for the cover crop. This two-pass approach to seeding allows each crop to be sown at its preferred seeding depth. The alfalfa seedlings will not compete as directly with the cover crop during establishment because they are not in the same seed row.

Irrigation for germination

The objective of irrigating seedling alfalfa is to maintain the soil in the top 30 cm (1 foot) above 70 per cent of field capacity. Care must be taken to prevent excessive irrigation which may wash out the seeds or seedlings and erode shallow channels on the field. One irrigation of 2 to 3 cm (.75 to 1.2 inches) two or three days prior to seeding followed by frequent light irrigations after germination will promote vigorous germination and early growth of the alfalfa seedling. Once the stand is well established, usually six weeks after seeding, the stand should be irrigated to maintain the top 60 cm (2 feet) of soil above 50 per cent of field capacity. For more information, see the Irrigation section below.

Weed control in seedling alfalfa

Weed control should begin at least one year prior to planting alfalfa. Perennial weeds such as quackgrass, Canada thistle, sow thistle, and dandelion need to be eliminated from the field if at all possible. One of the most effective control measures for annual weeds is to cut the field for forage before the weeds mature. This approach prevents injury to the growth of alfalfa. Good management will result in healthy growth without weed competition in the establishment year and will minimize weed problems for the length of the stand Twenty herbicides are listed in the Guide to Crop Protection for seedling or established alfalfa. Some of these are restricted to seed alfalfa or forage alfalfa in the establishment year when the straw is not used for feeding. Refer to this publication for further information.

Stand Maintenance and Production

Fertility

Nutrient removal from the soil of an alfalfa field is two to three times the typical nutrient removal for annual crops (see table). Alfalfa forage yields will be limited according to Liebig's Law of the Minimum (see figure below) which compares the yield potential of a crop to a barrel with staves of unequal length. The capacity of the barrel (alfalfa forage production) is limited by the length of the shortest stave and can only be increased by lengthening that stave. When the limiting stave is lengthened, another one becomes the limiting factor.

Table 1: Plant Nutrients Used By Crops

		Nitrogen (N)	Phosphorus (P_2O_5)	Potassium (K_2O)	Sulphur (S)
Wheat	Seed	60	24	16	4
2690 kg/ha	Straw	25	5	48	6
40 bu/acre	Total	85	29	64	10
Alfalfa 9.0 tonnes/ha 4 tons/acre dry matter		240	40	190	20

Source: Western Canada Fertilizer Association

Table 1: Plant nutrients used by crops (Western Canada Fertilizer Association)

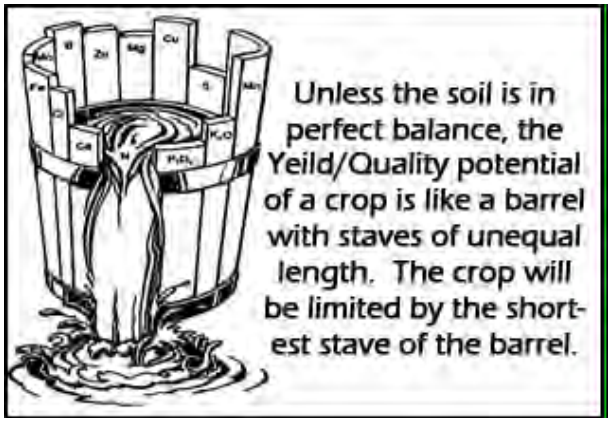

Figure 3: Liebig's Law of the Minimum (www.t-link.com.au/images/diagram/lawofminimum.jpg)

The nitrogen required by properly inoculated alfalfa is met by the fixation of atmospheric nitrogen.

The majority of Saskatchewan soils have low supply rates of phosphorus and annual application of at least 60 kg P_2O_5/ha (53 lb. P_2O_5/acre) is recommended to sustain high productivity. Banding of phosphorus into the soil with a coulter-type applicator will minimize damage to established plants and provides for efficient uptake as described in the Fertilizer section above. If access to a banding unit is not possible, broadcast application of phosphorus will benefit alfalfa production but 20 per cent higher rate of P will need to be applied.

Banding fertilizer into an established crop using methods which create significant soil disturbance should be avoided. The mechanical damage to the alfalfa will cause yield reduction for at least one year and under some conditions the field will never fully recover.

Generally, Saskatchewan soils have adequate levels of potassium. Exceptions include coarse-textured soils, soils that have been levelled to assist in flood irrigation and the grey soils of the northeast part of the province. Soil testing less than 270 kg/ha (250 lb./acre) for a 15-cm (6-inch) sample should receive annual applications of potassium up to 100 kg/ha (89 lb./acre).

Sulphur needs are usually met through dissolved sulphate in the irrigation water. In cases where the land has not been previously irrigated, additional sulphur may be recommended.

To ensure maximum production, fertility levels should be monitored throughout the life of the stand by soil and tissue analysis. Plant tissue analysis provides information on the fertility status of established alfalfa and, combined with soil analysis, will assist in the design of a suitable plant nutrient plan. Plant tissue samples should be collected at the bud stage. Select 25 to 30 representative plants and collect the top third from each of them. Brush off any dust and dirt on the sample but do not wash. Allow the sample to dry at normal room temperature. Place in a paper bag and provide details of the field. Avoid contamination of the sample with soil, do not heat to dry and do not place in a plastic bag. For optimum production, alfalfa plants at bud stage should contain approximately three per cent nitrogen, two per cent potassium, 0.2 per cent phosphorus and 0.2 per cent sulphur.

Irrigation

Alfalfa responds very well to irrigation. Poor fertility, weed competition, thin stand, disease and insect pests will reduce the yield response. Moisture stress at any stage of growth will reduce yield but no single growth stage has been identified as being more susceptible or more tolerant than another.

When a multi-cut harvest is planned, adequate moisture must be available to the plant early in the spring and immediately after each cut to promote and maintain rapid growth. Irrigation scheduling for alfalfa is dependent on the following factors:

- Soil texture and the water holding capacity of the soil;
- Daily crop water use; and
- Time required to apply one irrigation to the field.

Soil texture and water holding capacity of soil

Soil texture refers to the relative proportion of sand, silt and clay size particles in a given soil. It influences the rate at which water infiltrates the soil, the amount of moisture it can hold and the natural fertility and nutrient supplying ability of the soil.

Water holding capacity is an expression of the soil's ability to hold water and is related to the soil structure or arrangement of soil particles into aggregates and the soil texture. Generally, coarse-textured soils have lower water holding capacity than finer-textured soils. A soil is considered to be saturated when the entire pore volume is filled with water. When the soil pores are full to capacity, water cannot be retained by the soil as the water will drain quickly through large pores. The term "field capacity" refers to the amount of water that can be held by the soil after the effects of gravity cease. This period will vary depending on the texture of the soil with lighter-textured soils draining faster than heavier-textured soils.

Wilting point or permanent wilting point is the soil water content at which the plant can no longer extract water from the soil. Although there is still water in the soil at this point, the water is held too strongly by the soil for its use by the plant. The amount of water the soil holds between field capacity and wilting point is referred to as available water or available moisture. It is the water considered as available for crop consumption. However, not all available water is able to be utilized equally by the plant. As the amount of water in the soil gets closer to wilting point, it becomes increasingly difficult for a plant to extract the available water. The water most easily used by the plant is termed readily available water.

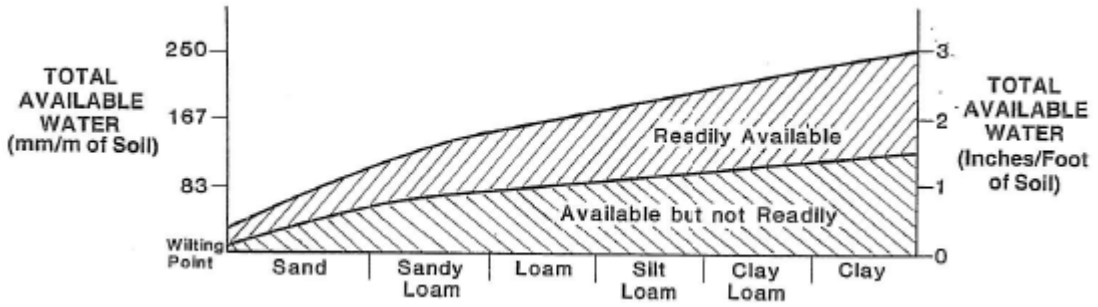

Figure 4: Estimated available moisture for various soil textures

Daily crop water use

The amount of water used by a crop relates to the type of crop grown, selected variety, development stage, target yield, crop management and climatic conditions. Figure 5 shows the approximate daily use of an alfalfa stand from May 1 until Oct. 1.

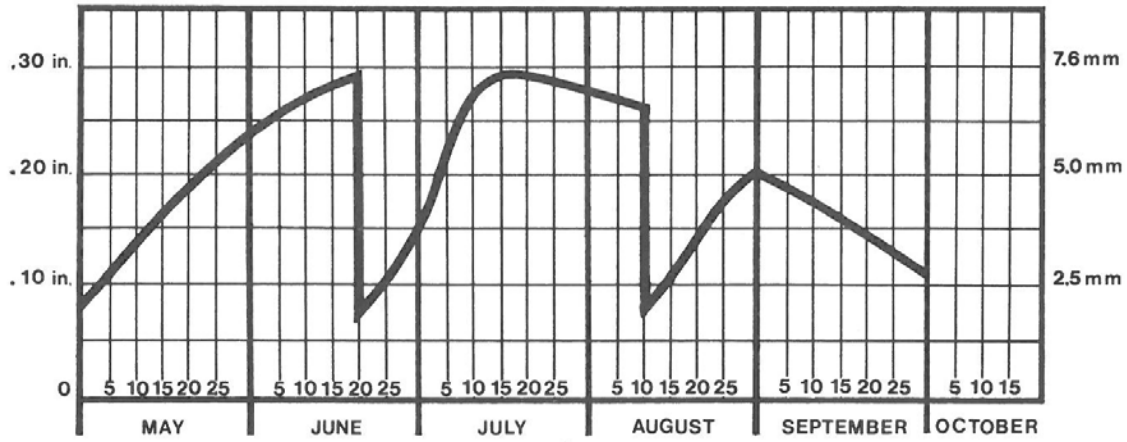

Figure 5: Typical water-use curve of alfalfa, considering cutting.

Alfalfa up to 30-cm (12-inches) tall will average about 3 mm (0.12 inch) of water use per day, given adequate soil moisture. From 30 cm in height until first bloom, the crop will average close to 6 mm (.24 inch) per day. Hot, dry weather will increase this amount while cool, moist conditions will result in lower water use. Maximum daily water use may exceed 8 mm (0.31 inch). This adds up to approximately 230 mm (9.0 inches) for the first cut and because of warmer weather, 280 mm (11 inches) for second cut. An additional 150 mm (5.9 inches) will be used for re-growth after the second cut, giving a total yearly consumptive use of 660 mm (26 inches). The above figures will be fairly accurate for the Brown soil zone but water use will be 10 to 20 per cent lower for the Dark Brown and Black soil zones.

Irrigation scheduling assistance can be attained from Saskatchewan Ministry of Agriculture agrologists located in Outlook, SK. The publication Irrigation Scheduling Manual is available from the Ministry of Agriculture and an electronic copy is also available on the website at www.agriculture.gov.sk.ca or the Irrigation Saskatchewan website at www.irrigationsaskatchewan.com.

Cutting management and stand persistence

The persistence and longevity of an alfalfa stand is heavily influenced by variety hardiness, growing conditions and management. Alfalfa stand persistence is determined by crown survival following winter. Maximum productivity of an alfalfa stand can be maintained for three to five years. Stands that have been established for more than five years typically do not maintain their productivity.

The relative hardiness of alfalfa varieties is determined by fall dormancy ratings. Variety dormancy ratings are based on the onset of senescence in the fall. Winter hardy varieties enter dormancy early. As the dormancy rating decreases, winter hardiness increases. In Saskatchewan, a dormancy rating of 5.0 or lower is recommended.

Improper cutting management can hinder alfalfa stand persistence and decrease stand longevity. To avoid improper cutting dates, it is important to understand alfalfa plant physiology. Alfalfa stores energy in its roots and crown and uses these reserves for growth during early spring, re-growth following cutting and plant maintenance over winter. After cutting, root reserve levels are drawn upon until the plant reaches 15-20 cm (six to eight inches) in height at which point it begins to maintain its energy needs and replenishes its root reserves through photosynthesis in its expanding leaf canopy. The physical act of removing plant material, by cutting or grazing, does not deplete reserves but the subsequent re-growth does.

The last cut of the year should be planned to occur four to six weeks prior to the first fall killing frost. Harvesting outside of this critical four-to-six-week period ensures that adequate time has passed to allow for plant re-growth and re-supply of carbohydrate reserves. Harvest of the end of season growth can occur later in the season, if re-growth potential is minimal.

Fall irrigation of an alfalfa stand is recommended, but a producer is cautioned to not over-irrigate and saturate the soil. Soil saturated with moisture may cause the alfalfa to break from dormancy resulting in increased incidence of winter injury or winter kill.

If a late season cut is taken four to six weeks prior to the first killing frost, leave a minimum of 10 cm (four inches) of stubble. This provides a snow trap that insulates the alfalfa from low temperatures and provides extra moisture in the spring. Snow trapping is particularly important with some less winter-hardy varieties but will benefit all varieties.

Alfalfa stand assessment

Spring alfalfa stand assessments are necessary to examine and evaluate the extent of winter damage. During a stand assessment, a producer should look for symptoms of winter kill and winter injury. Plants suffering winter injury will likely survive but with decreased productivity.

The stand assessment is a two part process:

1. Inspect the above-ground plant material. Count the number of shoots and symmetry of the shoots around the crown. Smaller crown, fewer shoots and poor symmetry indicates winter injury.

2. Dig up plants from three or four representative field locations. Inspect the health of the crowns by cutting the root lengthwise and looking for indications of discoloration or rot in the crown or root. Healthy crown and roots appear firm with an off-white to pale yellow color. Little or no sign of discoloration or evidence of rot appears. An unhealthy crown has significant rot and root discoloration (see figures below). If rot affects more than 50 per cent of the root diameter, the plant will likely not survive the following winter.

A healthy alfalfa stand will have less than 30 per cent of the plants exhibiting significant crown discoloration or rot. Healthy crowns have multiple branches and little or no evidence of splitting. Crowns weakened by splitting are more susceptible to winter injury (Figure 6). Healthy roots will be uniformly off-white or have less than one-third of their diameter discoloured. Roots of weakened alfalfa plants will have more than one-third of their diameter discoloured and will likely not survive the next winter (Figure 7).

Courtesy of Dan Undersander, Wisconsin Cooperative Extension Service www.uwex.edu/ces/forage)

Figure 6: Healthy alfalfa crowns (left) and crowns weakened by splitting (right)

Courtesy of Dan Undersander, Wisconsin Cooperative Extension Service www.uwex.edu/ces/forage)

Figure 7: Healthy alfalfa roots (left) and roots of weakened alfalfa plants (right)

Alfalfa stand termination

As an alfalfa stand ages, productivity and quality decline as alfalfa plant population decreases and undesirable plant species invade and begin to dominate the forage stand. The choice to terminate an alfalfa stand depends on how the land is valued. If the purpose of the alfalfa crop is for long-term use and conservation reasons, then a decline in productivity will likely not create cause to terminate the stand within three to five years.

If the alfalfa is grown as a cash crop in rotation with grain crops, the choice to terminate the stand after three to five years of production may be made to maintain profitability and competitiveness. If the alfalfa is grown for livestock feed supply and an alternate feed source is not readily available, the choice may be to maintain the stand for some additional years.

An alfalfa stand reaches its greatest productivity during the second and third years of production and reaches stand maturity within three to four years. After four years, stand productivity begins to decline and stabilizes at a level supported by the agronomic management of the field.

The timing and methods of termination will influence the success of removing the stand and the amount of nitrogen benefit provided to the following crops. Termination of an alfalfa stand is best achieved in late summer or early fall. In a two-cut system, the first cut is harvested and the stand is terminated after the first cut harvest. If a three-cut system is managed, the first two cuts could be harvested by mid-August and then the stand terminated. To remove an alfalfa stand, a producer can choose to use tillage, herbicides or a combination of both. In conventional farming systems, a herbicide-tillage system is a common choice. Use of a non-selective herbicide, such as glyphosate, is recommended. For improved kill of alfalfa and other weeds, the addition of a group 4 or group 6 herbicide such as dicamba or 2,4-D is advised.

The success of stand termination using a fall herbicide application is greater than spring termination because the plant is preparing for winter and is increasing root energy reserves. Herbicide is effectively translocated to the root system, thereby killing the plant. In spring, plants are initiating new growth and moving nutrients to the new above-ground biomass, inhibiting the effective action of the herbicides.

Delay in termination decreases the amount and release of nitrogen for use by the following crops. When stands are terminated later in the season or the following spring, the nitrogen release is delayed and will not coincide with the following annual crop's peak nutrient needs. The earlier a stand is terminated, the greater the amount of organic nitrogen that can be mineralized to the available inorganic nitrate form.

The rate of nitrogen mineralization is affected by the termination method. Stands terminated with herbicide only have a slower mineralization rate and nitrogen release compared to tillage or tillage-herbicide systems. The nitrogen benefits received from an alfalfa crop are greatest in high-rainfall or irrigation areas. Adequate soil moisture is necessary to ensure that a healthy, productive alfalfa stand is maintained. A healthy, productive and adequately watered plant will fix more nitrogen than a stressed or moisture deficient plant. Also, high-rainfall or irrigation areas provide an opportunity to improve soil moisture conditions after termination, aiding in the breakdown of organic matter residues and microbial processes involved in nutrient mineralization.

Harvest management

The objective for harvesting alfalfa hay is to place in storage the maximum yield of high-quality forage. High-quality, high-protein alfalfa hay is marketable as a protein feed concentrate, similar to canola or soybean meal. If cut at the late bud stage and processed properly, alfalfa is an excellent supplement to use with lower-quality feed such as slough hay or straw.

Stage of cutting

The ideal time to cut alfalfa is at the late bud stage. Yield increases little after 10 per cent bloom, but protein and energy content drop significantly.

An alfalfa stand requires about 10 to 14 days to mature from late bud to full bloom. Water use is at maximum levels during this growth stage and may amount to 100 mm (3.9 inches) or more. By delaying harvest, the forage yield will increase only six per cent while water use could increase by as much as 30 per cent.

When irrigation is available, growers are able to harvest more than once per year. Two cuts, one in late June and one in early August, are commonly taken under irrigation. Growers wishing to optimize yield can use rapid re-growth varieties and take three cuts per year. The first two cuts are taken at the late bud stage at about June 15 and July 25. The third cut is taken after a killing frost (-3 C) or early October, by which time root reserves have been built up for next year's spring growth and soil temperatures are cool enough to minimize late fall re-growth. Growers should remember that intensive production generally reduces the longevity of the alfalfa stand to three or five productive years. Delaying cutting to over 25 per cent bloom will mean the second cut is not taken mid August and re-growth will not be sufficient to warrant a third cut.

Alfalfa as a feed source for beef cattle

Alfalfa is a valuable feed source for the beef cattle industry. It can be used as a base feed in wintering rations as it normally will meet or exceed protein and energy requirements of beef cattle. Alfalfa can also be used as a feed supplement in winter rations when feeding forages that are low in protein or calcium. Depending on stage of pregnancy, beef cows will require between eight and 12 per cent protein (see table). When winter feed rations consist of grass hay or straw, alfalfa can be an inexpensive protein source that will increase ration protein levels to meet nutritional requirements.

	Crude Protein (%)	TDN (%)
Cow mid pregnancy	8	50
Cow late pregnancy	9	54
Cow lactation	10-12	56-63

Table 2. Nutritional requirements of a beef cow (Cowbytes 4.6.8)

Alfalfa is also useful in winter feed rations to supplement calcium. Rations based on cereal crop green feed or silage are typically adequate in phosphorous but low in calcium. Beef cows require a minimum Ca:P ratio of 1.5:1. Alfalfa's calcium nutrient level makes it an ideal feeding supplement to increase calcium levels in winter rations.

	Crude Protein (%)	TDN (%)	Calcium (%)	Phosphorous (%)
Alfalfa hay early	18	59	1.41	.24
Alfalfa hay late	16	54	1.3	.22

Table 3: Nutrient levels of alfalfa hay (NRC Nutrient Requirements for Dairy Cattle and Feedstuffs May 17, 1993)

For more information on irrigated alfalfa production, contact the Regional Forage Specialist in Outlook, SK, at (306) 867-5559 or the Irrigation Branch offices at (306) 867-5500.