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Agronomic Management of Stockpiled Pastures

Stockpiling pasture is a form of deferred grazing. The producer stockpiles the forage grown during the spring and summer for use when the pasture is in short supply or when cows need fall or winter feed. This practice can mean savings for the producer:

- harvesting, hauling and feeding costs associated with conserved feed are eliminated
- manure does not need to be removed from feeding areas

Winter grazing on native range is common on the southern prairies. Depth of snow cover frequently limits winter grazing of standing forage in the Parkland and Boreal forest regions. However, the grazing season may be extended by several weeks by using stockpiled forage in late fall and early spring.

Stockpiled forage for pasture can mean savings for the producer

There are several important considerations in developing a successful stockpiled forage grazing system:

- species selection
- accumulation or rest period between grazing or cutting
- soil nutrient management

Stockpiling systems

Forage may be stockpiled for a full growing season, for a single-graze system or the regrowth may be stockpiled following an early hay/silage harvest or grazing.

The single-graze system is suited to the drier prairie regions where low summer rainfall prevents good regrowth. As some of the native species in these areas mature, they retain their quality better than tame species.

Winter grazing on the prairie works best with little or no snow cover. Supplemental feed is needed if snow cover is too deep and forage yields are low.

In the Parkland and Northern areas, a multi-pass system where the second or third cut or regrowth from pastures is grazed in late fall or winter makes more efficient use of the land and is generally economical. Forage quality of the regrowth is higher than that of the stemmier first growth, especially if it is saved until fall or winter. Winter grazed cows are often required to forage through more than 30 cm (12 in.) of snow, so stockpiled forage plants must be tall.

Species selection

Species selection depends on the system being used. Ideally, in cut-and-graze or multi-pass rotational grazing systems, a species used for stockpiling should be able to do the following:

- regrow rapidly following early harvests to provide at least 2,000 kilograms (kg) of forage per hectare (1,785 lb./ac) for good fall grazing
- maintain high quality following fall frosts

If grazing is to occur after snowfall, forage mass needs to be higher as grazing efficiency is reduced and grazing losses increase. Using an erect species makes it easier for cows to get at the feed under the snow.

In a single-pass system, a species that maintains its quality as it matures is a good choice.

Selecting grasses for yield

Perennial species

Climatic conditions and the grazing system used will determine which species are best adapted.

Under a single-graze system, creeping red fescue and Kentucky bluegrass have many basal leaves and few floral stems, and so retain nutritive quality as they mature better than species like crested wheatgrass or smooth bromegrass. Under average moisture conditions in the Parkland region, cut-and-graze or multi-pass grazing systems are possible, and some tame grass species with superior regrowth capabilities are well adapted for this system.

With a long rest period between early harvest and stockpile grazing, smooth and meadow bromegrasses have ranked high for yield over a range of summer and fall moisture conditions; however, smooth bromegrass has high overwinter dry matter loss.

Orchardgrass, quackgrass and timothy are high yielding under good moisture conditions, but orchardgrass and timothy lose more dry matter over winter than meadow bromegrass. Quackgrass retains dry matter well over winter but may be undesirable for reasons other than its forage value. Creeping red fescue and Kentucky bluegrass produce relatively low stockpiled yields, and creeping red fescue has shown above average dry matter loss over winter.

Research done at Lacombe showed the following:

- the regrowth of an old grass pasture consisting of 30 to 35 per cent Kentucky bluegrass and 65 to 70 per cent quackgrass and smooth bromegrass had a carrying capacity of 3.68 animal unit months/hectare (AUM/ha) or 1.49 AUM/acre (ac)
- a meadow bromegrass (20-40 per cent) – alfalfa (60 - 80 per cent) mixture provided 7.76 AUM/ha (3.14 AUM/ac)
- an early spring seeded mixture of oats and winter triticale provided 7.86 AUM/ha (3.18 AUM/ac)

All pastures were fertilized identically, and initial harvests occurred in early July. Pastures were grazed from mid-September to the first of November (Figure 1).

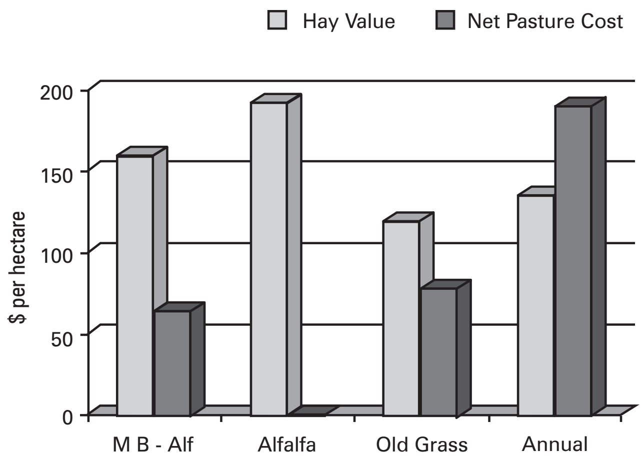

Figure 1. Net hay value (value minus harvest and hauling cost) of the first cut and resultant net pasture costs for four pasture types in a cut-and-graze stockpiling system at Lacombe

Annual species

Spring or winter cereal crops can also be used for stockpiled grazing. If seeded in early to mid May, winter cereals can provide early grazing before the regrowth is stockpiled.

Mixtures of spring and winter cereals or spring cereals with ryegrass provide a silage or greenfeed harvest before stockpiling regrowth. For these mixtures, generally the higher the proportion of spring cereal in the mixture, the greater the first cut yield and the less the regrowth and vice versa.

When sufficient winter cereals are in the mixtures, this system is an excellent way to extend the grazing season in the fall, and if the winter cereal overwinters, provides early growth for spring pasture. This system offers the producer flexibility from year to year in deciding whether to focus on first cut or regrowth. The first cut or grazing is a management tool to optimize season-long production and feed quality.

Spring cereals can also be seeded late (July or early August) for fall grazing. This practice tends to be a high cost pasture as production is low, and too few grazing days are available to offset the high cost of annual establishment.

Fall-seeded winter cereals intended for grain or silage production are occasionally grazed in the late fall, but yields are low unless the crop is seeded earlier than recommended for a grain crop (August 21 – September 15).

Winter cereals grown alone for fall pasture should be seeded by August 1 to produce adequate yields, but this approach may affect the winter hardiness of a crop such as winter wheat.

Annual pastures are usually more costly per unit of production than perennial pastures for several reasons:

- annual establishment costs for tillage (if required)
- seed, seeding and herbicide for weed control
- potentially greater fertilizer requirements

However with intensive management, annual pastures can be highly productive (Table 3 and Figure 2).

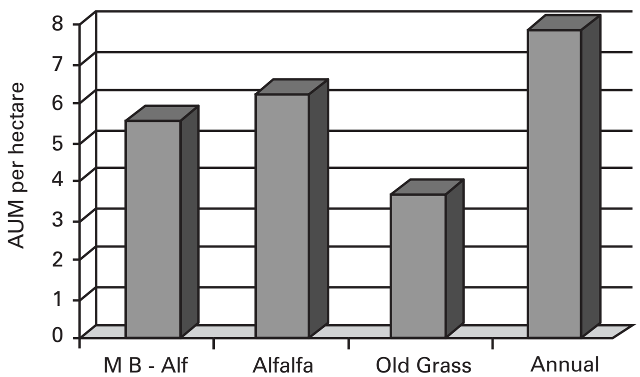

Figure 2. Carrying capacity of four cut-and-graze stockpiled pastures at Lacombe

Selecting grasses for forage quality

Speargrass and rough fescue are suitable for grazing when native range is stockpiled for fall/winter grazing in a single-graze system. These grasses cure on the stem, which makes them more resistant to weathering. They also have good standability in the snow.

In the Parkland region, several tame species are better suited to a multi-pass system because they have superior regrowth ability compared to native species. Meadow bromegrass and creeping red fescue retain quality through winter better than most other species (Table 1).

Forage quality during winter grazing is affected by the quality of the grasses before freeze-up. Fall forage quality will be affected by the preceding soil moisture and nutrient conditions. Live green leaves have higher quality than dead leaves. Plants that have gone into dormancy due to dry conditions before frost and snowfall will have leaves with lower protein, mineral and sugar content, and higher fibre content than leaves in the middle of the growing season under good climatic conditions.

Perennial forages store nutrients in the roots and crowns as they mature and prepare for winter. Regrowth of tame forage grasses in the Parkland region is normally green going into winter. The green leaves can survive a few degrees of frost, and if snow arrives while the leaves are unfrozen, they remain green and viable most of the winter. Protein levels remain adequate for grazing dry cows, and fibre levels are lower than if the leaves had died before snowfall.

Research at Lacombe shows that some species such as creeping red fescue (and to a lesser extent meadow bromegrass) have relatively high sugar content in the fall. The sugars, which are soluble in water, are stored within the plant cells. They are used as energy to maintain live leaves and growing points during the winter.

Table 1. Changes in digestibility and yield of perennial forage regrowth from early fall until the following spring

Species	Harvest date			April yield as a % of September
	September 15	October 15	April 15	
	Digestibility (%)			
Alfalfa	59.3	56.4	34.8	52
Meadow bromegrass/alfalfa	61.6	56.0	45.6	62
Meadow bromegrass	64.8	57.9	50.5	78
Smooth bromegrass	58.3	55.3	37.3	60
Orchardgrass	61.2	57.2	42.7	78
Timothy	61.0	55.8	40.9	97
Crested wheatgrass	62.8	58.3	47.5	65
Kentucky bluegrass	59.1	52.8	44.0	90
Creeping red fescue	62.9	59.7	52.5	82
Quackgrass	60.8	55.1	40.5	75

These sugars decline during winter as they are used to fuel the plant processes. Leaf death occurs when the energy source is depleted. When the leaves die, the cell membranes allow the cell contents to leak out. Thus, as winter proceeds, increasing numbers of leaves die, and sugars depart the leaves either before death or leach out due to freezing and thawing as well as rain and snow melt. With lower sugar content, fibre increases and digestibility decreases. Protein may or may not decline.

Timing of use for grass

As forage yield and nutritive value decline over winter (Table 1) due to leaf loss, grazing stockpiled grass in the fall rather than in the winter or spring makes the best use of the forage.

When the stockpiled grass is regrowth from an earlier cutting or grazing, most of the tame grasses and western wheatgrass (with the exception of smooth bromegrass, timothy and crested wheatgrass) retain adequate forage quality to produce gains in excess of 0.5 kg (1 lb.) per day on dry pregnant beef cows. These grasses would also be suitable for cows with calves if used in the fall. In mid-September, weaned calves or stocker cattle could gain 0.5 to 0.75 kg (1 - 1.5 lb.) per head per day with good management. By mid-October, forage quality drops to maintenance levels for these classes of animals.

Winter annual or ryegrass regrowth is very high quality in the fall and suitable for any class of cattle. Stocker cattle grazing this type of stockpiled pasture have achieved gains approaching 1.35 kg/head/day (3 lb./head/day), and it would be feasible to grass-fatten feeder cattle on this quality of pasture. Lactating cows produce very well, and weaned calves or dry cows would be expected to gain more than 1 kg (2 lb.) per head per day.

Research at Lacombe shows some loss of yield and quality of stockpiled perennials between mid-September and mid-October. Digestibility declined about 5 per cent, and neutral detergent fibre increased about the same amount during that period. These changes decrease forage intake and digestibility.

Forage quality in October was still well above maintenance levels for dry beef cows in the second or third trimester of gestation. Predictions of cow performance based on forage quality indicated weight gains approaching 1 kg/hd /day (2 lb./hd/day) could be expected. Dry matter losses due to weathering were about 13 per cent during the September to January period.

During the winter, the nutrient requirements of the cow change with advancing pregnancy and with changes in air temperature (including wind chill). As pregnancy progresses from the second trimester (3-6 months) to the third trimester (6-9 months), the net energy requirement of a 635 kg (1,400 lb.) cow for body maintenance will increase by about 1.3 megacalories per day. Approximately 0.7 kg / d (1.5 lb./d) of barley would be required to provide this amount of energy. An average producing cow in early lactation would require an additional 0.7 kg/d of barley.

The effect of temperature on the cow's energy requirements can be great and can fluctuate quickly. If forage quality is relatively constant, the forage may meet the cow's needs today, but not tomorrow or next week.

For example, consider meadow bromegrass grazed in January (Table 2). The barley requirement is based on the assumption of a mean daily air temperature of -15° C. The cow's energy requirement increases approximately 10 per cent as the temperature decreases from 0° C to -15° C. In the meadow bromegrass example, if the temperature was 0° C, no barley supplement would be needed.

However, if the temperature dropped to -30° C, 1.5 kg (3.3 lb.) of barley would be required. In the absence of energy supplementation, cows could lose more than 1 kg (2.2 lb.) per day. If extreme cold conditions are short term, energy deficiencies will have little adverse affect on cow condition, but over an extended period, the deficiencies become significant to both cow body condition and the development of the fetus.

Table 2 shows the daily barley supplementation required to meet the energy requirements of cows in addition to grazing stockpiled pastures of various species or swathed barley at prevalent temperatures and expected stages of pregnancy or lactation in October, January and April at Lacombe.

If spring grazed, meadow bromegrass and creeping red fescue, which retain quality over winter better than other species, may not meet the protein and energy requirements of cows in late pregnancy and would not meet the needs of lactating cows. All other species would require energy supplementation if spring-grazed (Table 2).

Smooth bromegrass, timothy and crested wheatgrass may not meet the protein requirement of dry cows in mid-pregnancy in late fall and are unsuitable for growing calves or yearlings.

Forage quality of stockpiled grass in the following spring is generally not appropriate for stocker cattle. If left for spring grazing:

- only meadow bromegrass and creeping red fescue should provide adequate nutrition for dry pregnant cows without supplementation
- only creeping red fescue should provide adequate nutrition for lactating cows (Table 2)

Table 2. Required daily barley supplementation			
	October	January	April
Species	Cows in 2nd trimester	Cows in 3rd trimester	Cows lactating
	kg (lb.) per day barley required		
Alfalfa	0	2.4 (5.3)	4.4 (9.7)
Meadow bromegrass	0	0.6 (1.3)	1.5 (3.3)
Timothy	0	0.8 (1.8)	1.6 (3.5)
Creeping red fescue	0	0	0
Swathed barley	0	0	1.3 (2.9)

Notes: October requirement is based on mean daily temperature of 5° C, January -15° C and April 0° C.

These values are based on the particular quality of the forage in the tests cited. Individual producer forage quality may vary, so forage testing is advisable.

Overwinter dry matter losses of stockpiled forage ranges from less than 10 per cent for Kentucky bluegrass and timothy to over 30 per cent for smooth bromegrass and crested wheatgrass (Table 2). Meadow bromegrass and orchardgrass may lose between 20 and 25 per cent of the original yield.

When grazing season-long stockpiled grasses, mid-September quality is adequate for maintenance of dry pregnant beef cows, and this nutritional value is retained until mid-October. Spring forage quality under a single-graze system is generally inadequate for maintenance of dry pregnant cows. Both energy and protein supplementation would be required.

Selecting legumes for yield

Adapted species include the following:

- alfalfa
- cicer milkvetch
- red and alsike clovers
- sanfoin

Under drier conditions, alfalfa produces greater yields than cicer milkvetch or the clovers.

Dryland alfalfa types generally regrow more slowly than standard types and are expected to produce lower regrowth yields, but with rest periods longer than eight weeks, yields of the two types have been similar at Lacombe.

Early in the life of a stand, standard type alfalfa yields have been substantially greater than the dryland type when the accumulation period starts August 1 or later. This yield advantage disappeared later in the life of the stand. With longer accumulation periods there is little difference between the alfalfa types.

Information on relative regrowth rates of varieties is available on Alberta Agriculture and Rural Development's website (http://www.agric.gov.ab.ca/).

Selecting legumes for quality

Leaf loss is what limits the usefulness of most legumes for stockpiling and grazing in late fall or winter. Although leaf retention time is variable, legumes tend to lose their leaves quickly following hard frosts and with advancing maturity. Since the leaves are the most nutritious part of the plant, forage quality declines rapidly with leaf loss and dry matter losses are large.

Cicer milkvetch is superior to alfalfa for leaf retention and is suitable for grazing somewhat later in the fall than alfalfa, but by spring, neither is suitable for grazing. As such, timing of grazing is critical for legumes.

Timing of use for legumes

Leaf loss following frost or with advancing maturity is the primary contributing factor to declining quality of stockpiled legumes. Dry matter losses between September 15 and October 15 are approximately 10 per cent. Alfalfa should be used in September, although the current recommendation for harvest of second-cut alfalfa is to avoid the period from mid-August to mid-September.

Trials have shown no problems with winterkill of stockpiled alfalfa when grazing begins after September 1. Cicer milkvetch retains leaves and quality into October and can be grazed longer than alfalfa but generally not later than late October or early November.

If a producer has legume regrowth available and is looking for another option to traditional hay or silage harvest, swathing before leaf loss and grazing the swaths may be a good alternative to preserve feed quality and quantity while reducing harvest and feeding costs.

Since nearly all leaves are lost over winter, dry matter losses for legumes are very high, exceeding 40 per cent for alfalfa, and spring quality is very poor. These factors reduce the value of stockpiled legumes for spring grazing.

Accumulation period

In the absence of snow, grazing efficiency decreases as forage yield falls below 2,000 kg /ha (1,785 lb./ac), so it is desirable to have a stockpiled yield greater than this amount. To make grazing through snow as easy as possible for the cow, high yields are needed.

At Lacombe when the rest period starts July 15, meadow and smooth bromegrass, orchardgrass and standard type alfalfa consistently produce more than 2,000 kg/ha (1,785 lb./ac) by mid-September. Meadow bromegrass is the only tame grass species that produces or exceeds this amount consistently when the first harvest is not until August 1. The standard type alfalfas will also produce at this level (Table 3).

Other tame species including smooth bromegrass, orchardgrass and Kentucky bluegrass achieve this level of production two-thirds of the time while creeping red fescue only achieves it one-third of the time. The extra two weeks of growing season produce increased yields ranging from approximately 50 to 150 per cent depending on moisture conditions. Creeping red fescue and Kentucky bluegrass require rest periods beginning July 1 to consistently exceed the desired yield threshold.

Among perennial grasses, the longer the accumulation or rest period, the fewer differences in yield among species. Longer rest periods are necessary as stands age and seeded species decline, and species such as bluegrass, creeping red fescue and smooth bromegrass invade. Declining soil fertility and limited rainfall also affect the length of rest period needed.

Winterkill

Most legumes are susceptible to stand thinning, usually from winterkill. Generally, alfalfa varieties that are very winter hardy have lower regrowth yields.

The dryland alfalfa types are winter hardy and relatively grazing tolerant, but do not regrow during accumulation periods in two-cut systems as well as do standard alfalfa types. The dryland types are more suited to once overgrazing. The standard types can be grazed twice or cut and then grazed successfully so long as the critical period for grazing is observed.

Table 3. Stockpiled yield of annual and perennial forages with rest periods beginning July 15 and August 1 at Lacombe

	Rest period	
	8 week (July 15 start)	6 week (August 1 start)
Species	kg/ha (lb./ac)	kg/ha (lb./ac)
Winter-spring mixture[1]	5,645 (5,040)	no data
Algonquin alfalfa	3,925 (3,505)	2,950 (2,635)
Meadow bromegrass	4,900 (4,375)	2,560 (2,285)
Orchardgrass	3,655 (3,265)	1,925 (1,720)
Creeping red fescue	3,430 (3,065)	1,745 (1,560)
Swathed barley[2]	6,865 (6,130)	

Notes: All data from trials at Lacombe

1 Winter-spring mixture was oats mixed with winter triticale seeded early May. Rest period started July 1.

2 Barley seeded between May 7 and May 15.

For most of the Western Parkland region, grazing during the last week of July and early August reduces winter hardiness of alfalfa. When pastures containing standard type alfalfa were grazed at Lacombe during August, alfalfa content declined to less than 10 per cent in two years. When cut as hay in July and then grazed from September 15 until November, alfalfa content remained greater than 50 per cent for several years. Grazing alfalfa in the late fall and early winter does not seem to affect stand longevity.

Flemish varieties are not well suited for grazing since they are more susceptible to winterkill and have higher crowns that can be damaged during grazing.

Forage quality

While long rest and accumulation periods are important for stockpiled pasture yield, they usually result in lower forage quality. Generally, the earlier the rest period begins, the more leaf content decreases and leaf death increases in grasses while alfalfa becomes stemmier. This situation may result in stockpiled pastures being more suitable for cows than for stocker cattle or calves, particularly later in the fall and during early winter.

Fertility requirements

Several factors determine the fertility requirements of stockpiled pasture. Pasture species is important as grasses require added nitrogen for optimum productivity while properly inoculated legumes fix their own nitrogen. Legumes use more phosphorus, potassium and sulphur than grasses. Soil tests are required to determine soil nutrient status and the amount of supplemental fertilizer required to produce desired yields.

The stockpiling system also affects fertility requirements. A cut-and-graze system removes more nutrients from the pasture than a multi-pass grazing system or a single-graze system and so requires more supplemental fertilizer.

Moisture is a limiting factor to the productive potential of forages in Alberta. Soil test results include probabilities of receiving a given amount of precipitation for an area and the expected crop response to various levels of fertilization. The producer then must decide what level of risk they wish to assume in applying fertilizer.

If moisture for regrowth is expected to be adequate for high yields, split applications of nitrogen fertilizer may be beneficial.

Cost of production

Where feasible, a two or multi-pass system is more economical for perennial forages than a single-graze system because costs are spread over multiple growing cycles. For example, hay may be harvested and sold from the first cut, and the proceeds will help defray grazing and fall pasture costs (Tables 4a, 4b).

The value of the hay from the alfalfa was greater than the pasture cost, creating a profit situation (negative net cost), or grazing was paid for in advance. Higher carrying capacity lowers the cost per animal unit month (Table 4a, 4b). Usually, the first cut or grazing accounts for 60 to 70 per cent of the whole season production for perennials, so it is difficult to graze at the same low costs on regrowth in late summer and fall as on the higher yields produced during June.

Tables 4a and 4b contain examples of costs for stockpiled meadow bromegrass, alfalfa, old mixed grass and annual pastures with and without the value of an initial hay harvest before stockpiling.

If all costs were charged to the pasture, the cost per AUM would range from $30.48 (alfalfa) to $54.13 (old grass) compared to the values shown in the tables. The yield achieved during the regrowth period is not sufficient to provide enough carrying capacity to make it economical. However, in this study, there was no season-long stockpiled treatment, and only regrowth forage was available for fall grazing. Full season stockpiling would produce more forage and therefore more carrying capacity.

Over a three-year period, the meadow bromegrass-alfalfa pasture provided a consistently high carrying capacity at a lower net cost than the other pasture types.

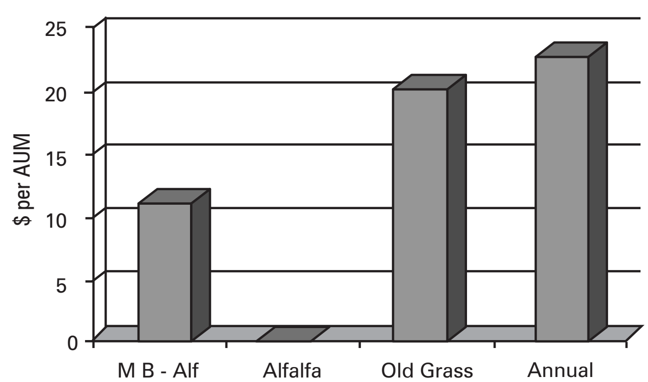

Figure 3. Net cost per AUM for four stockpiled pastures in a cut-and-graze system at Lacombe

Table 4a. Pasture costs for meadow bromegrass and alfalfa stockpiled pastures		
	Pasture species	
	Meadow bromegrass-alfalfa	**Alfalfa**
Fixed pasture costs	**$/ha ($/ac)**	
Rent, water, fencing	89.77 (36.31)	89.77 (36.31)
Pasture operating expense		
Fertilizer	109.44 (44.27)	46.18 (18.68)
Establishment cost (annualized)	26.00 (10.52)	52.73 (21.33)
Total cost (A)	225.21 (91.10)	188.68 (76.33)
Net value of hay (B)	159.74 (64.62)	192.32 (77.80)
Net Pasture cost (A-B)	65.47 (26.48)	-3.64 (-1.47)
Carrying capacity (AUM/ha/ac)	5.56 (2.25)	6.23 (2.52)
Net cost ($/AUM)	11.78	-0.58

Notes: Data is an average of three years from intensively managed pastures at Lacombe.

Establishment cost includes cost of cultivation, seed, seeding based on pasture renovation every eight years for meadow bromegrass-alfalfa and four years for alfalfa.

Net value of hay (B) is market value minus cost of harvesting and transportation (1 km).

Table 4b. Pasture costs for an old mixed grass pasture and an annual (oat-winter triticale mixed) stockpiled pasture		
	Pasture species	
	Old grass	**Annual**
Fixed pasture costs	**$/ha ($/ac)**	
Rent, water, fencing	89.77 (36.31)	89.77 (36.31)
Pasture operating expense		
Fertilizer	109.44 (44.27)	109.44 (44.27)
Establishment cost (annualized)	0.00	127.47 (51.57)
Total cost (A)	199.21 (80.59)	326.68 (132.15)
Net value of hay (B)	120.00 (48.54)	136.00 (55.02)
Net Pasture cost (A-B)	79.21 (32.04)	190.68 (77.14)
Carrying capacity (AUM/ha/ac)	3.68 (1.49)	7.86 (3.18)
Net cost ($/AUM)	21.52	24.26

Notes: Data is average of three years from intensively managed pastures at Lacombe.

Establishment cost includes seed, seeding, cultivation and herbicide as required.

No establishment costs were charged to the old grass pasture because it was a 30-year-old stand, and the intention was to continue to manage it as a long-term pasture.

Net value of hay (B) is market value minus cost of harvesting and transportation (1 km).

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