AGRI-FACTS
Practical Information for Alberta's Agriculture Industry

September 2008 Adgex 420/56-3

Agronomic Management of Swath Grazed Pastures

Feed, feeding, cow management and manure disposal can account for up to two-thirds of the total cost of production in a cow-calf operation. Systems that can extend the grazing season and reduce these costs are of great interest to cow-calf producers. One of these systems is swath grazing.

Swath grazing

Swath grazing occurs when annual or perennial forage crops are swathed and left in the field for cattle to graze in late fall and winter. The practice eliminates associated costs:

- baling or silaging
- feed hauling and storage
- equipment operation for winter feeding

Labour costs may also be cut by a third compared to conventional winter feeding, and manure disposal costs will be reduced as less manure will accumulate in a bedding pack as cows are grazing in the fields.

Swath grazing has advantages over grazing stockpiled standing crop. Problems with grazing stockpiled standing crop:

- Grazing time and dry matter intake are reduced when cows graze standing forage during cold or stormy periods in the winter.
- Snow cover can be a problem with grazing standing forage. Cows will graze standing forage through up to 0.5 m (1.5 ft) of snow, but only if a large amount of biomass is available.
- Grazing efficiency is poor for standing crops as cattle wander throughout the pasture eating the heads first and trampling much of the rest of the crop in the process. Swathing consolidates the crop and can make it more accessible, increasing dry matter intake and improving grazing efficiency.

Many factors come into play to determine forage quality, quantity and unit cost of production in a swath grazing system. Some of these factors, such as weather, are uncontrollable, but beneficial management practices can reduce the risks and increase the benefits of swath grazing.

Understanding the risks associated with swath grazing and the strategies developed from more than a decade of research will help producers get the greatest benefit from a swath grazing system.

Species and variety selection

When selecting the crop to grow, choose a species with good dry matter (DM) yield potential that provides a palatable forage with quality characteristics suitable to the livestock who will be grazing it. There are both annual and perennial species that fit these criteria.

Grazing swaths

Alberta

Annual monocrops

Oats and barley have traditionally been used for forage and are baled as greenfeed or conserved as silage for winter livestock feed. These species continue to be the most used crops for swath grazing. Other potentially useful species:

- spring and winter triticale
- spring and winter wheat
- peas and ryegrass

Research has shown that oats will outyield other spring species on Black and Gray Wooded soils, although these differences are extremely variable from year to year.

- on the Black soils at Lacombe, oats have yielded 0 to 30 per cent more than barley
- on the Gray Wooded soils at Bluffton, oats produced 70 to 150 per cent more than barley
- barley has produced greater dry matter yields than oats in the Dark Brown and Brown soil zones

Later maturing annual crop varieties generally produce higher dry matter yields than early maturing varieties. There is likely to be as much or more variability for yield within a species as there is between species.

For example, in oat trials, yield differences ranging from 15 to 30 per cent are common. Since yield is a major determinant of cost per unit of production, it is important to choose an adapted high yielding variety rather than simply using whatever seed the producer or a neighbour may have had left over after seeding a grain crop.

Varieties that produce high grain yields usually also produce high forage yields.

Most of the published information on variety comparisons is based on grain production; data on forage yield is scarce. It may be helpful to do some on-farm comparisons to find the variety best suited to your area and production practices.

Monocrop peas produce lower dry matter yields than oat or barley on Black soils. They are equal to or better than barley but inferior to oats on Gray Wooded soils.

Peas have an input cost advantage over cereals due to a lower nitrogen fertilizer requirement. However, this advantage is at least partially offset by higher seed and herbicide costs. Production costs are discussed in more detail in a later section.

On the downside, pea swaths are particularly attractive to deer and other wildlife. This feature can be a major source of feed loss, and wildlife in the fields may pull down electric fences. Another disadvantage to monocrop peas is the potential for the wind to scatter the swaths due to their light and bulky nature.

When seeded as monocrops, spring-seeded winter cereals and ryegrass generally produce lower yields than spring cereals.

Mixtures of annual crops

Although mixtures of spring cereal crops do not have a consistent yield advantage over their respective monocrop components, barley-oat mixtures appear to offer more yield stability. When grown as a monocrop, the yield of the mixture will generally be as good as the higher yielding component.

Spring cereal-pea mixtures yield less than spring cereals seeded alone. This result is more pronounced with barley than with oats. The yield of the mixture is generally greater than that of peas alone. In mixtures with cereals, peas increase the protein concentration of the forage, and protein production per unit area may be greater than from a spring cereal grown alone. When peas are a high proportion of the mixture, fibre concentration decreases.

Winter and spring cereals in mixtures increase both protein concentration and digestibility. The fibre content decreases, but yields are also reduced by up to 15 per cent. Unless the producer is planning to use the forage for swath grazing calves or some other class of livestock requiring more protein in the ration than pregnant beef cows, mixtures of peas or winter cereals with spring cereals are probably not cost effective. The reduced yields, higher seed costs than for monocrop spring cereals and possibly higher seeding costs if two operations are required all increase the cost/ton of forage produced.

The cost of production section gives some examples of the effect of crop choice on cost of production.

Perennial crops

There has been very little research done in Western Canada on swath grazing perennial forage crops. Much of the research done in this area comes from the United States and was done primarily using grass species. Results have been mixed, but some studies show cost saving benefits similar to those seen in Alberta using annuals.

Some results from trials involving stockpiling perennial forage for late fall or winter grazing may be applied to swath grazing. In most cases, a perennial crop swathed for grazing would be regrowth following a first cut harvested as hay or after an early grazing. Alfalfa or mixtures containing a high percentage of alfalfa have better regrowth following an initial harvest than grasses, but yields will be less than oats or barley. Regrowth produces a high quality forage suitable for weaned calves, stocker cattle or yearling bred heifers.

It is unlikely that a producer would grow a perennial crop specifically for swath grazing because with advancing

maturity, first cut quality declines and dry matter losses increase. This result is more pronounced with legumes than with grasses. Among the grasses, the following may be deficient in protein, and digestibility may be too low to sustain dry pregnant beef cows when first cut is used for swath grazing:

- mature timothy
- crested wheatgrass
- smooth bromegrass

Alfalfa stems are similarly lacking in forage quality, and leaf loss can account for 10 to 20 per cent reduction in dry matter yield.

Yield expectations for regrowth are less than for an annual cereal. However, when full-season production of a perennial is considered, it may be less costly per unit of dry matter produced than an annual due to lower fertilizer costs and no annual costs for tillage, seed, seeding or herbicide.

When grazed, the usefulness of stockpiled regrowth is highly variable. The utilization of some perennials, such as alfalfa, may be poor if the crop is not grazed until late fall or winter following hard frosts for several reasons:

- stems become unpalatable
- dry matter losses are high
- quality declines markedly as leaves dry and drop off the stems

Swathing before or immediately after a hard frost can have benefits:

- reduce much of the leaf loss
- help retain nutritive value
- improve utilization rates

If sufficient regrowth is available, swath grazing may be a viable option to conventional harvesting and feeding. Swathed forage will also be more accessible after snowfall than will standing perennial forage.

Seeding date

Yield effects

Spring cereals are frequently seeded in mid-to-late June for swath grazing. Late seeding of barley results in up to 25 per cent less yield as compared to early-to-mid May seeding (Figure 1). This outcome may be due to the early seeded crop:

- taking advantage of more abundant early spring moisture and/or
- being more advanced and therefore less susceptible to the drought conditions common in July and early August

Research at Lacombe (Figure 1) shows that oats and triticale appear to be more tolerant of later seeding than barley, with no significant yield loss up to the June 10 seeding date. Later seeding of oats produced only 90 per cent of the average dry matter yield of seeding dates between May 12 and June 10.

In comparison, triticale seeded at this time yielded 84 per cent of that from earlier seeding dates. Data from experiments where peas were grown to maturity show higher seed yields from late April seeding than from mid-May seeding. Whole plant yields would likely show similar results.

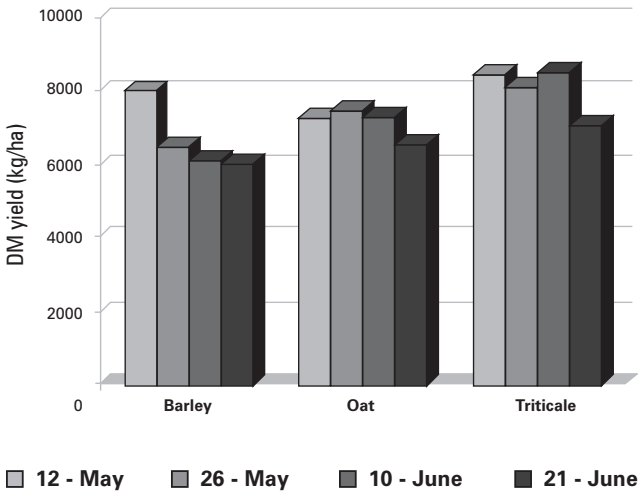


Figure 1. Whole plant dry matter yield of spring barley, oat and triticale seeded at four dates at Lacombe, Alberta

Note: To convert yield values to lb/ac, divide by 1.12 or to convert to ton/ac, divide by 2,240.

Risks of early and late seeding

Early seeding means an early harvest. If swaths are exposed for longer periods (particularly during periods of higher temperature and moisture, which are more likely to occur in early to mid-August than in mid-September) the potential for yield and quality loss due to leaching and mold growth increases. The severity of these losses is unpredictable, varying from year-to-year depending on weather. Choosing a long-season species and variety allows a producer to seed early and reduce the problems associated with early swathing.

Seeding rate

Increasing seeding rates improves palatability and digestibility in several ways:

- decreasing crop height
- reducing stem thickness
- reducing whole plant fibre concentration

Higher crop densities in conjunction with appropriate herbicide use are frequently more effective in reducing weed populations and increasing crop yields. Alberta Agriculture and Rural Development recommends a seeding rate of 3 bu/ac for oats and barley (160 kg/ha or 144 lb/ac for barley and 114 kg/ha or 102 lb/ac for oats).

Mixtures of spring and winter cereals, grown as an intercrop, should be seeded at 75 per cent of the rate used for each component if it was seeded as a monocrop. Mixtures of peas with spring cereals tend to show an inverse relationship between:

- yield and protein concentration
- the proportion of peas in the mixture and yield

Therefore, as the proportion of peas increases, the protein concentration of the forage increases and yield decreases.

Since protein is unlikely to be limiting for pregnant beef cows in a spring cereal harvested at the dough stage, peas should only be grown with spring cereals for forage when higher quality forage is required. High rates of peas and low rates of cereals must be seeded in these mixtures to ensure there will be sufficient levels of peas in the forage to influence the quality. In cereal:pea mixtures:

- peas should be seeded at 75 to 100 per cent of the normal rate (75 plants/m^2 or 7 plants/ft^2)
- cereals should be seeded at 25 per cent of the normal seeding rates for grain in pea mixtures

When peas are seeded at lower rates and/or the seeding rates for cereals are higher in a mixture, the quality of the forage decreases considerably.

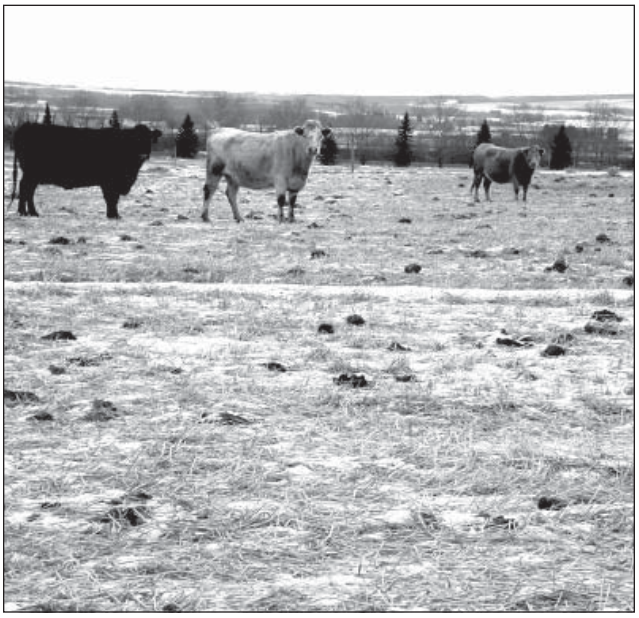
Fertility

As cattle spend a good part of their time in the field grazing, a lot of the nutrients they consume are returned to the field. Fields may require less chemical fertilizer if used for swath grazing for several consecutive years.

The nutrient status of the soil is affected by grazing management and by the location of bedding and watering sites. Separate soil sampling and testing of areas adjacent to these sites is needed to monitor nutrient accumulation and avoid possible nutrient overload.

To some extent, the problem of greater concentrations of manure in some areas can be addressed by changing the location of bedding sites from year to year. This change is relatively easy if portable windbreaks are used. It may be necessary to adjust application rates and formulations of chemical fertilizers applied to these areas or to avoid them entirely.

If bedding is not provided, cattle spend more time in the field and manure is distributed more widely. However, animals are more inclined to bed in the swaths, and feed wastage may increase quite dramatically. Research has shown 10 per cent waste where bedding was provided and 25 per cent where it was not.



Manure distribution in swath grazing and bedding packs

Rotating fields used for swath grazing can largely eliminate problems associated with manure distribution variability and excessive nutrient accumulation. Within fields, changing the direction of swathing from year to year or ensuring that swaths are not laid in the same location year after year can also improve the distribution of nutrients. This change in direction can be achieved by simply marking the location of the first swath in a fenceline. If using global positioning system (GPS) mapping, it is a simple matter to record and store swath location and use the information the following year.

When manure and urine are deposited on frozen soil, fields that tend to have high spring runoff due to moderate to steep slopes will be at risk of high nutrient loads in the runoff. Buffer strips of perennial forage can help lessen this problem. Environmental risk from either nutrient leaching into groundwater or nutrient loading of runoff is increased with high soil concentrations of nutrients.

It is important to monitor soil nutrient status by soil sampling and analysis when nutrient cycling under grazing management. If a producer fertilized for nutrient removal, as is fairly common for cereal grain production, nitrogen and phosphorus would accumulate over time. High nitrate concentrations in the crop may result and may be more difficult to manage when grazing than when feeding conserved feed because it is much more difficult to provide alternative low nitrate feeds for grazing livestock.

Weed control

When spring cereals are used for swath grazing, weeds can be controlled by chemical means using many of the same herbicides used for grain production. A pre-seeding burn-off of perennial and spring-germinated annual weeds may be all that is needed.

For in-crop treatment, label grazing restrictions must be followed. With higher seeding rates for cereal crops (see "Seeding rate") acceptable reduction of weed biomass has been achieved with in-crop herbicide rate reductions of up to 25 per cent.

In-crop chemical options are limited in certain situations:

- pulse crops are used by themselves or in mixtures, or
- if winter annual cereals are used in mixtures with spring cereals

Rotation of fields used for swath grazing can help prevent the buildup of weed populations adapted to the system. As well, rotating herbicides is important to prevent potential herbicide resistance. When crops used for swath grazing are cut before weed maturity, weed seed load in the soil will be reduced.

Harvest stage

Yield effects

Maximum dry matter yield for barley occurs about four weeks after heading, and it is assumed that other spring cereals would show a similar relationship between yield and maturity. This time is at approximately a soft dough stage of kernel development and is ideal for harvest as silage, but may be more advanced than is wanted for swath grazing.

Quality effects

Cereal crops maximize whole plant dry matter yield at 40 to 45 per cent dry matter (55-60 per cent moisture), which is a firm dough stage of kernel maturity. Nutritive quality of cereal crops (digestible dry matter and protein concentration) generally declines with advancing maturity, so there is a trade-off between yield and quality. There is also an issue of decreasing palatability of the straw as maturation progresses, which leads to cattle selectively eating heads first and leaving straw residue as waste.

Unless rotations are kept short and cattle are forced to clean up residue, grain overload and high levels of waste are potential problems if crops are allowed to mature. Although yield will be reduced 10 to 15 per cent, it may be best to swath the crop at the milk stage as doing so will retain more leaf material with the stalks, improve palatability and digestibility of the whole plant and reduce waste.

High nitrate concentrations can be a problem in spring cereals grown on soils with high nitrogen levels. Danger signals are a very lush growth with lodging and delayed maturity. If you see these signs, you should sample and test the feed for nitrate concentration. For an excellent discussion on nitrates in annual forages, go to the Alberta Agriculture and Rural Development website: www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex851

Grazing management

As mentioned previously, a number of factors influence forage waste during swath grazing. These include crop palatability and availability of bedding. However, the overriding factor influencing forage waste is the amount of forage available to the cattle on a daily basis.

Allowing unlimited access to forage can result in high levels of waste as cattle scatter swaths by wandering throughout the field. This practice also encourages bedding in the swaths, which increases waste as forage is fouled by manure and urine.

Limiting available forage to no more than three to four days worth (forcing animals to clean up straw before moving to fresh swaths) can keep waste to acceptable levels. Using this system has several outcomes:

- on the first day, the cattle consume very high quality feed consisting of a high proportion of heads along with some straw
- feed on the second day consists of the balance of stalks with heads and a greater proportion of straw
- the third day is essentially residue cleanup

Allowing more than three or four days of swaths may create grain overload if the crop is too mature. The practice may result in too poor a quality of feed if the cattle are forced to clean up straw for more than one or two days, which may be a problem during extremely cold weather.

Temporary electric fencing is the most practical way of restricting access to feed. To find out more about this management tool, see Alberta Agriculture and Rural Development's factsheet *Swath Grazing in Western Canada: an Introduction* (Agdex 420/56-2) available at the website: www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9239

Variable costs of production

A producer's choice of crop will dictate different input costs for seed, fertilizer, herbicides and field operations if two passes are required to seed a mixture. Table 1 gives some examples of these differences.

Table 2 contains a partial budget allowing the calculation of cost of production per unit of dry matter and feed cost per cow per day. These are only the variable costs associated with producing the feed. They do not include any overhead or costs associated with feeding.

Again, these numbers represent only one producer's costs and yield, but a producer can easily calculate his own costs by using the formula provided. A rental cost is included for land because even if the land is owned, there are ownership costs such as taxes, possibly interest, or opportunity costs if the land was rented out or used for some other purpose.

Table 1. A producer's variable input costs for production of cereal and pea monocrops and mixtures for swath grazing in 2007

Treatment	Variable inputs				
	Seed*	Seeding	Fertilizer	Herbicide	Total
	$/ha				
Barley	37.08	24.70	104.07	13.84	179.69
Barley/fall rye	50.43	49.40	104.07	13.84	217.74
Barley/oats	42.02	24.70	104.07	13.84	184.63
Barley/rye grass	55.12	49.40	104.07	13.84	222.43
Oats	38.10	24.70	104.07	13.84	180.71
Oats/fall rye	52.45	49.40	104.07	13.84	219.76
Oats/rye grass	55.17	49.40	104.07	13.84	222.48
Peas	72.81	12.35	37.95	70.87	193.98
Peas/barley	82.08	49.40	41.63	70.87	243.98
Peas/fall rye	96.62	49.40	41.63	70.87	258.52
Peas/oats	82.33	49.40	41.63	70.87	244.23
Peas/rye grass	99.16	49.40	41.63	70.87	261.06

To convert to $/ac, divide by 2.471

* Seed cost includes cost of inoculant for peas and pea mixtures.

Costs common to all treatments included fertilizer banding, herbicide application, harrow/packing, swathing and land rental which totalled $159.45/ha ($64.50/ac). Total production cost for each treatment may be derived by adding this value to the total variable costs above. For example, the total barley cost was $179.69 (variable inputs) + $159.45 (common costs) = $339.14/ha ($137.19/ac).

Table 2. A producer's partial budget for dry matter production costs for barley for swath grazing in 2007		
Machinery operations and costs	**Cost per operation**	**Your cost**
	$ ha-[1]	
Fertilizer banding	24.70	
Seeding	24.70	
Herbicide application	11.12	
Swathing	19.78	
Harrow/packing	9.89	
Subtotal 1	90.19	
Crop input costs		
Land rental ($/ha)	86.52	
Fertilizer[1] ($/ha)	106.91	
Seed[2] ($/ha)	30.90	
Herbicide ($/ha)	12.98	
Subtotal 2 ($/ha)	237.31	
Total (A) ($/ha)	327.50	
DM Yield (B) (kg/ha)	5,000	
Cost of DM C = A ÷ B (kg/ha)	0.066	
Cost per cow day[3] D = (C × 11)/.85 ($/ha-d)	0.85	

To convert to $/ac, divide by 2.471

1 66 kg N /ha (60 lb/ac) and 28 kg P2O5 / ha (25 lb/ac)

2 132 kg / ha 118 lb / ac

3 11 kg (24 lb)/cow/day DM intake and 85% feed utilization

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09/08/500