Excerpt from the Triticale Manual
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Triticale Production and Utilization Manual 2005

Spring and Winter Triticale for Grain, Forage and Value-added

Alberta Agriculture, Food and Rural Development

Part 4. TRITICALE FOR FORAGE

Triticale forage productivity and use

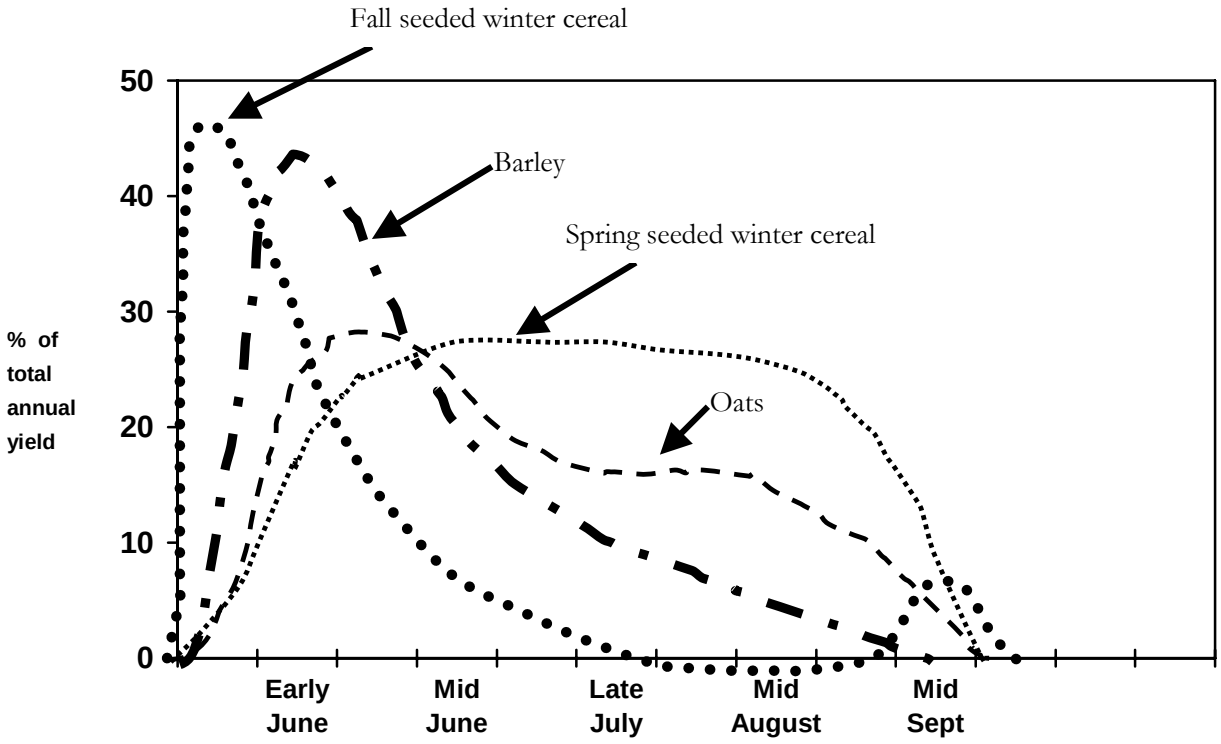
Annual cereals can provide an excellent source of supplementary forage, offering an extended grazing season and diversity in crop rotations (Figure 4). Due to its superior silage yield potential, triticale has proven to be very competitive with other cereals for yield and quality.

An advantage of growing winter triticale is its extension of early spring and late fall grazing.

In these applications, forage triticale has much to offer in helping diversify Western Canadian cropping systems (Briggs, 2001; *The Growth Potential of Triticale in Western Canada*).

For detailed information on triticale forage production, refer to the AgDex '*Triticale Forage Manual*' (2005, in press).

Figure 4. Seasonal distribution of pasture yields of annuals



(adapted from A. Aasen, Western Forage/Beef Group, Lacombe)

Triticale silage

Some quick facts about triticale silage production and quality:

Spring triticale for silage

- Spring triticale for silage is competitive with other silage options in Western Canada and in other countries, both for quality and for yield. Under stress, including drought and high temperatures, excess moisture, acid soils or excess of soil nutrients, triticale will maintain its yield potential and straw strength compared to barley or oats. Barley or oats may have less drought tolerance and weaker straw than triticale.
- Best management practices for growing and harvesting spring triticale silage are different than for barley silage. The two crops develop very differently and have very different straw characteristics, with triticale stems being more lodging resistant.
- When harvested after heading, spring triticale generally ranks between oats and barley for quality. As with other cereals, earlier silage harvest (optimum soft dough) improves quality and protein content but at the price of potential yield.
- Depending on conditions, spring triticale intercropped with peas may yield as well as triticale does by itself. However, the pea content in the silage usually results in a significant increase in the protein content as compared to that found when triticale is grown alone.

Winter triticale for silage

- Fall-planted winter cereals such as triticale and rye provide a valuable source of forage when spring grazed prior to being harvested for silage or seed. Rotating winter cereals with barley silage crops offers breaks for disease and pest control.
- When winter triticale is grown in a spring seeded inter-crop with spring oats or barley, the silage yield may sometimes decrease. However, if the crop is left for late summer and fall re-growth, the silage plus pasture yield usually exceeds the yield of either mixture component grown separately. It also provides fall grazing.
- If using oat inter-cropped with spring-seeded winter triticale, the expected forage yield performance is mixture = oat > winter mono-crop. This is especially true when seeding early.

Spring and winter triticale silage quality

- In Alberta, overall protein expectation for protein content in annual silage crops is described as: oats (9 percent) < barley, spring rye and triticale (10 percent) < sunflower (12 percent) < field peas (18 percent) < fababean (20 percent +).
- Canadian feedlots occasionally report reduced intake and/or gain from triticale silage as compared to barley. These probably relate either to change of feed, or to samples being harvested at non-optimal stages, or to samples being inadequately chopped or packed. Further research is needed on this topic.
- Compared to other silage, reduced intake is often reported as an issue in feeding triticale. This does not always translate into reduced animal productivity or quality. Improved triticale silage management and processing (a short chop length) can reduce this problem. Varieties with rough awns should be avoided for green-feed or haylage, or should be cut earlier before awns become hard and thick. The winter triticale 'Bobcat' is the first semi-awnless variety specifically bred to reduce this problem.

Reduced awn triticale

The reduced-awn characteristic of the winter triticale Bobcat is a very desirable trait. The lack of awns may reduce mouth irritation and sores if the crop is harvested after the optimum maturity date for good quality silage.

A study on barley by Karren et al (1994) advised against using rough-awned semi-dwarf barley in cattle silage because it can cause mouth lesions if silage is harvested at mature stages or moisture content is too low. The semi-awnless variety Bobcat was released to address any potential problems with awns. Harvesting silage at the recommended stage will eliminate this problem.

Reduced awns will be a feature found in future triticale varieties bred for forage use. It is anticipated that more reduced awn spring triticale varieties will be registered in 2005.

Triticale silage yield

In Alberta trials, triticale silage productivity is usually rated as being better than barley. Extension information from Manitoba does not support this superior rating.

In silage yield comparisons between 20 registered barley and triticale varieties and experimental lines grown at Lacombe, Alberta between 1998-2000, researchers found that:

- The dry silage yield of triticale averaged 14,324 kg/ha (minimum 12,812 kg/ha; maximum 16,137 kg/ha.
  This converts to 12,758 lbs/ac (min. 11,411 lbs/ac to max. 14,373 lbs/ac).
- The barley silage yield averaged 13,346 kg/ha (minimum 10,903 kg/ha; maximum 14,675 kg/ha).
  This converts to 11,887 lbs/ac (min. 9,711 lbs/ac to max. 13,070 lbs/ac.

Table 17. Silage composition of farm samples, Alberta data, 1984 -1994

	Triticale	Barley hulless	Barley 6-row	Barley 2-row	Alfalfa
Moisture %	66.9 (7.7, 14)	61.2	63.7 (7.4, 882)	62.2 (6.4, 62)	60.0 (9.6, 309)
Protein %	11.0 (2.1, 14)	12.8	11.0 (2.7, 867)	11.3 (2.5, 62)	16.7 (3.2, 308)
Calcium %	0.36 (0.13, 14)	0.30	0.49 (0.22, 863)	0.42 (0.19, 62)	1.64 (0.54, 304)
Phosphorus %	0.26 (0.07, 14)	0.28	0.26 (0.07, 863)	0.25 (0.06, 62)	0.23 (0.07, 305)
Acid detergent fibre %	34.5 (4.9, 14)	26.1	32.0 (6.2, 863)	31.0 (4.3, 61)	36.0 (5.9, 304)
Selenium mg/kg	0.14 (0.04, 5)	-	0.14 (0.12, 210)	0.08 (0.04, 5)	0.23 (0.25, 91)
Sulphur %	0.20 (0.02, 4)	-	0.24 (0.10, 65)	0.23 (0, 1)	0.30 (0.09, 26)
Neutral detergent fibre %	-	-	53.6 (4.9, 9)	-	34.8 (13.1, 10)
Lignin %	-	-	0.0 (0.0, 0)	-	0 (0, 10)
Iron mg/kg	287 (243, 6)	-	300 (596, 136)	134 (48, 4)	355 (450, 48)
Copper mg/kg	5.5 (3.5, 6)	-	4.9 (2.0, 155)	3.6 (1.7, 4)	6.7 (5.7, 73)
Manganese mg/kg	39 (10, 6)	-	38 (20, 156)	29 (12, 4)	39 (15, 69)
Zinc mg/kg	24 (10. 6)	-	31 (12, 159)	31 (6, 4)	27 (12, 70)
Magnesium %	0.15 (0.02, 6)	-	0.21 (0.06, 155)	0.18 (0.04, 4)	0.33 (0.09, 67)
Potassium %	2.31 (1.13, 6)	-	1.61 (0.44, 151)	1.39 (0.24, 4)	2.15 (0.88, 62)
Sodium mg/kg	31 (35, 6)	-	978 (1257, 121)	1562 (1096, 4)	344 (814, 46)
Molybdenum mg/kg	3.2 (3.0, 4)	-	1.9 (1.6, 77)	0.6 (0.8, 2)	2.3 (1.8, 30)
Cobalt mg/kg	6.7 (3.5, 4)	-	1.8 (2.8, 61)	0.4 (0, 2)	1.5 (1.9, 20)

Average analysis of silages
AAFRD web sources, 1984-1994
Silages had >60% contribution from the crop listed.
Mean, (standard deviation and number of samples)

Interpretation: Variability exists between crops, samples and varieties, but triticale silage quality is comparable to that of other cereals used for silage, perhaps with lower protein content

Triticale silage quality composition

Alberta trials have shown equal or better productivity when beef and dairy herds are fed triticale silage compared to other silages. In some studies, productivity was equal to or better than other silages despite lower intake of triticale silage compared to other forage silages such as barley and alfalfa.

Triticale is particularly well adapted for high forage yield production on heavily manured fields, where it is also an efficient remover of excess soil nutrients. Harvesting protocols and timing must be adjusted to accommodate the differences between triticale and barley in these situations. In high productivity systems where lodging is a problem, triticale should be compared to semi-dwarf barley, which also has special adaptation to high fertility conditions.

Using book values to determine nutritive value of cereal silage should only be used for comparison, as nutritional values are best determined by feed testing. This is because of:

- Quality variation affected by harvest date (in green-feed and for silage).
- Variable mixture compositions, when results from different crop mixtures are reported.

Due to variation in harvest dates, crop type and environmental conditions, nutritional value can only be determined by appropriate sampling and feed analysis. Typical compositional values for Alberta-grown silages are indicated in Table 17.

In silage, an acid detergent fibre (ADF percentage) level exceeding 39 percent would be rated as fair or poor. In multiple farm trials by Alberta Agriculture, Food and Rural Development in 1999-2002, no value for triticale ever exceeded 37 percent. This confirms the high energy potential of triticale as a forage source (Table 18, Figure 10).

In a Canadian study, Zobell et al (1992) compared barley and triticale silage fed to 120 steers as 25 percent of the ration, combining it in the diet with either barley or high-moisture barley.

No differences in weight, daily gain, dry matter intake or feed efficiency were found between the two diets. They concluded that "triticale silage can be fed to replace barley silage at moderate levels in growing steer rations containing barley grain."

Table 18. Silage yield and quality at Lacombe, Alberta, 1993-1995

	Pika winter triticale	Wapiti spring triticale	Prima fall rye	Tukwa semi-dwarf barley	Virden standard barley	Cascade spring oat
Harvest date	July 28	Aug 20	July 14	Aug 2	Aug 6	Aug 13
Yield t/ha	14.3	14.4	14.0	11.1	11.5	13.1
Dry matter %	41.3	37.0	40.0	32.0	34.0	31.0
Crude protein %	9.0	9.7	8.2	11.0	9.5	9.0
IVDOM %	61.0	66	63	68	60	62
NDF	57	48	53	49	59	55
ADF	33	29	30	27	34	34

IVDOM = In vitro digestible organic matter; NDF, ADF = Neutral or acid detergent fibre
Mean values averaged over three years.
(Baron et al 2000)

Interpretation: Triticale produced excellent silage yields and quality in the same range or sometimes better than other cereal forages

Silage mixtures and harvest stages

In Alberta, forage-clipping studies by Juskiw et al (2000) estimated potential silage productivity at different harvest dates. The researchers tested Wapiti spring triticale in mixtures at various seeding rates with Noble barley and AC Mustang oat.

They found that:

- Forage yields of the mixtures were generally in the middle of the yields of the components, or not different from one or the other component.
- The date for optimum harvest was generally in the middle of the dates of the components, or not different from one or the other component.
- Forage quality of the mixtures was also generally intermediate, with higher sample quality from higher amounts of leafy tissue in the sample, and with an earlier harvest.
- Higher seeding rates tended to increase forage yields. Seeding rates are dependant on soil type and moisture conditions. For example, for black and grey wooded soils with adequate moisture, 25 to 28 plants per square foot or 250 to 280 per square metre is optimum.

The Ontario Ministry of Agriculture, Food and Rural Organizations (OMAFRA) website describes similar findings for Ontario conditions. The site also says that harvesting at the soft dough stage results in the highest energy production per acre.

Triticale:pea silage mix

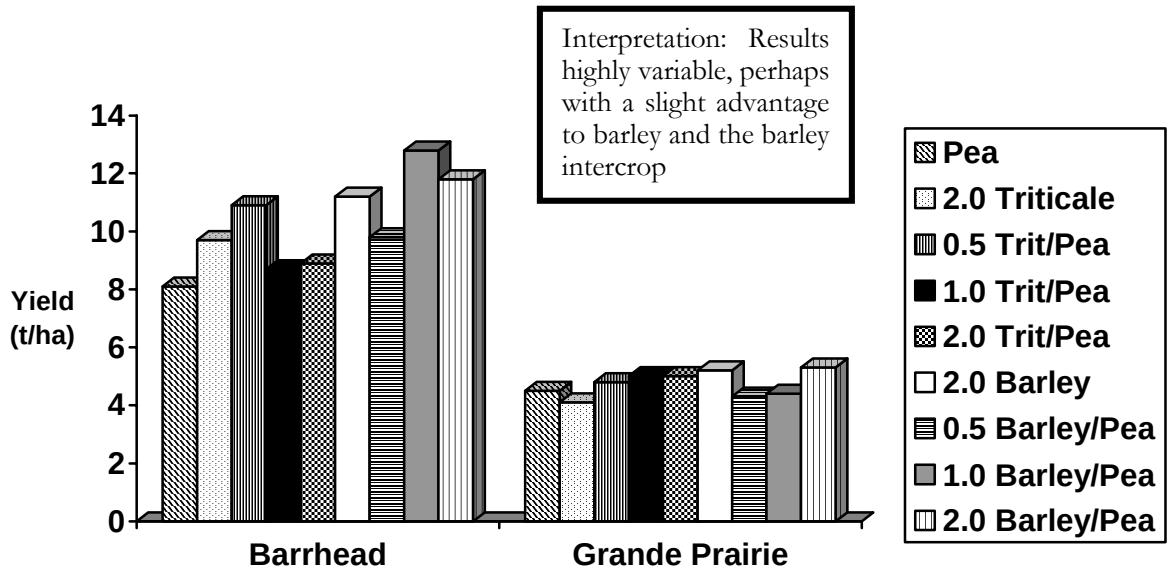
Spring triticale can be grown as an admixture with peas to raise the protein content. However, trials at Lacombe from 1981-1983 (Berkenkamp and Meeres, 1992) found that in comparison to pea mixtures with other spring cereals, the yield potential (t/ha) by crop was ranked as:

- Oat (12.0 t/ha)
- Wheat (8.8 t/ha)
- Barley (8.2 t/ha)
- Triticale (6.6 t/ha)

In these studies, the mixtures were seeded at 90 kg peas plus 20 kg per hectare cereal. None of the mixtures exceeded the yield of mono-cropped oats.

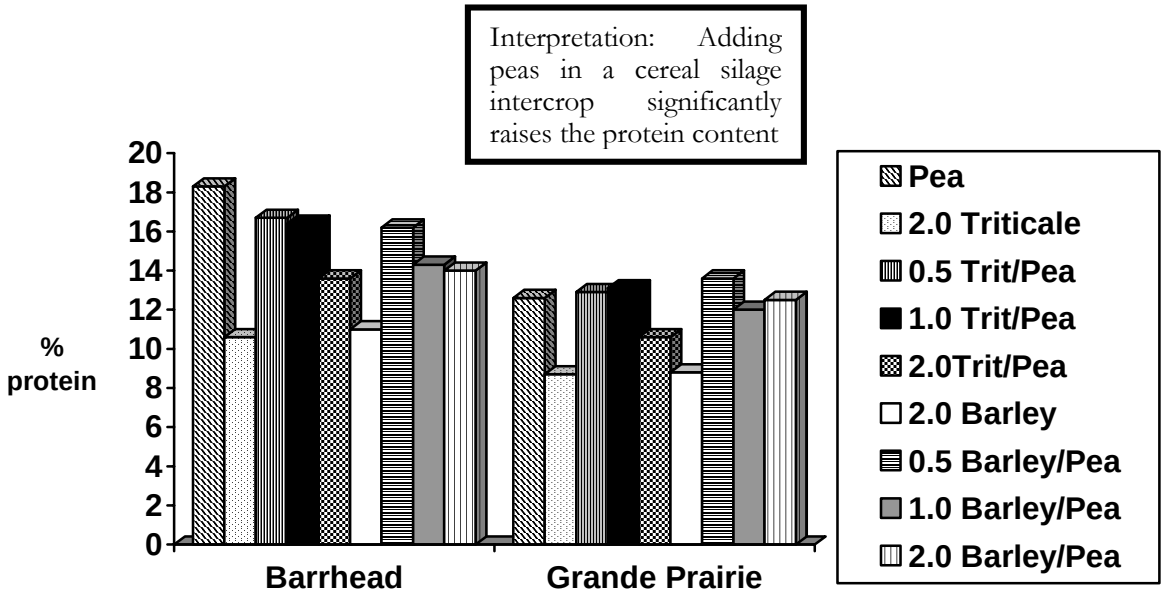
Studies by Blade and Lopetinsky (2002) at four locations found variable yield performance for barley and triticale in mixtures with peas. Yields depended on location and site yield potential (Figure 5). Although results were variable at different locations, including peas in the mixture usually increased the protein content in the harvested silage; this sometimes came at the expense of silage-yield-per-unit-area (Figure 6).

Figure 5. Cereal/pea silage biomass yield (ton/ha) at two sites in Alberta, with high (Barrhead) and low (Grande Prairie) yield potential



2 year means from 2 of 4 sites reported, using Performance 4010 pea variety; Peas seeded at 7 plants/sq.ft. in all treatments; Cereal seeding rates are listed in bu/acre
(Blade and Lopetinsky 2002)

Figure 6. Cereal/pea silage protein % at two sites in Alberta, with high (Barrhead) and low (Grande Prairie) yield potential



2 year means from 2 of 4 sites reported, using Performance 4010 pea variety. Peas seeded at 7 plants/sq.ft. in all treatments; Cereal seeding rates are listed in bu/acre
(Blade and Lopetinsky, 2002)

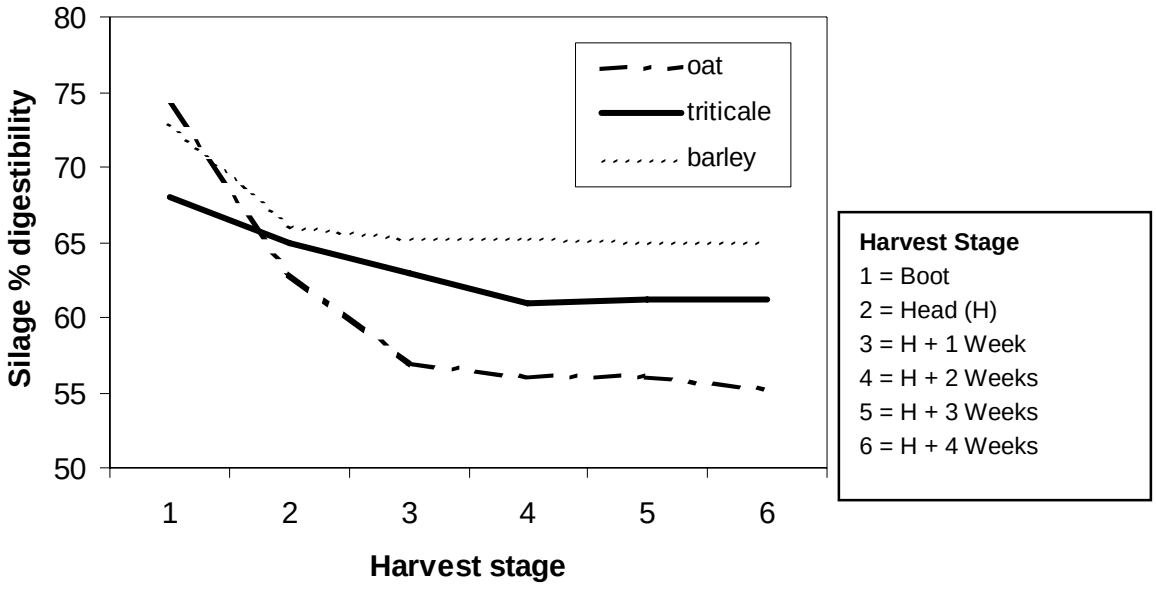
Silage harvest stage for dairy cattle

In recent Canadian work, Kennelly and Khorasani (2000) compared barley, oat, triticale and an inter-cropped triticale/barley silage, and monitored the effect of harvest date on silage quality. They recommended that the optimum time for harvest was at the soft dough stage in order to best balance potential quality and yield.

Data from Baron (Figure 7) clearly show that triticale silage quality is midway between barley and oat for all likely silage harvest dates.

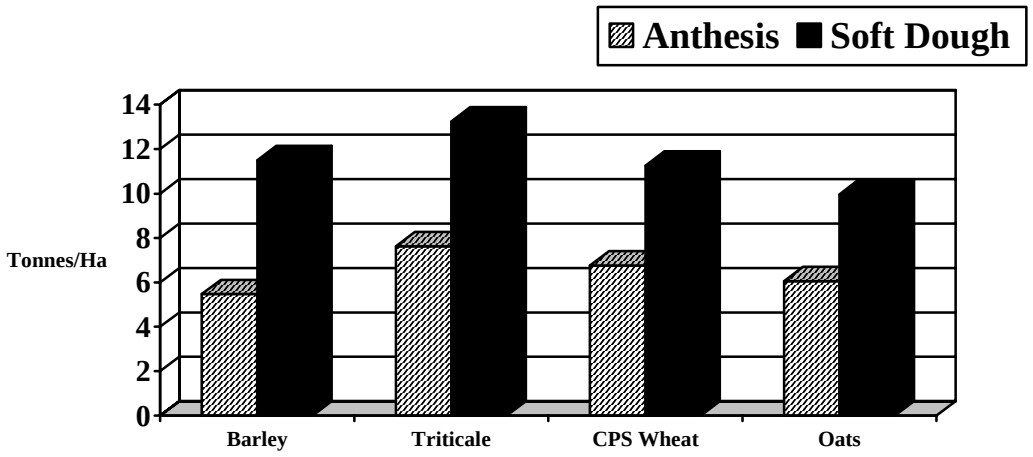
Figures 8 to 10 show comparisons of silage yield, protein, NDF and ADF of various cereal silages cut at anthesis (flowering) and at soft dough stages of growth.

Figure 7. Silage digestibility of cereals at different harvest stages



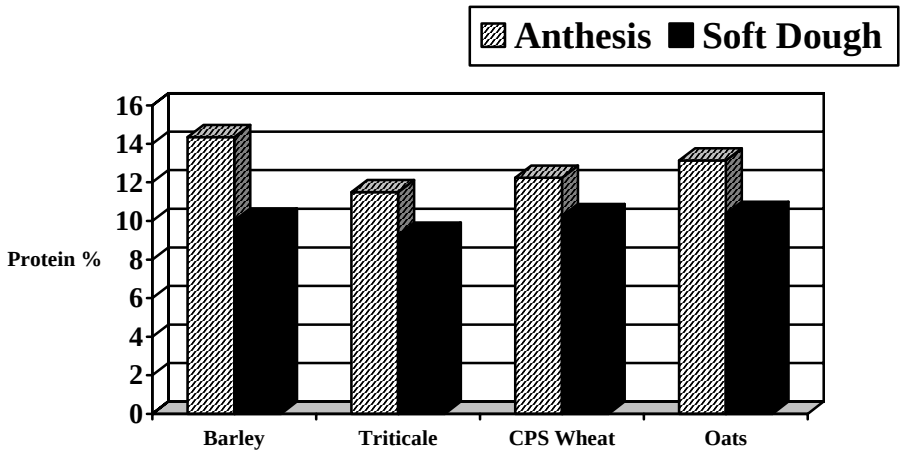
From AgDex 118/20-1
(Baron, AAFC, Lacombe)

Figure 8. Comparison of silage yields at anthesis and soft dough stages of growth for barley, triticale, CPS wheat, and oats at Lacombe, 1996 crop year.



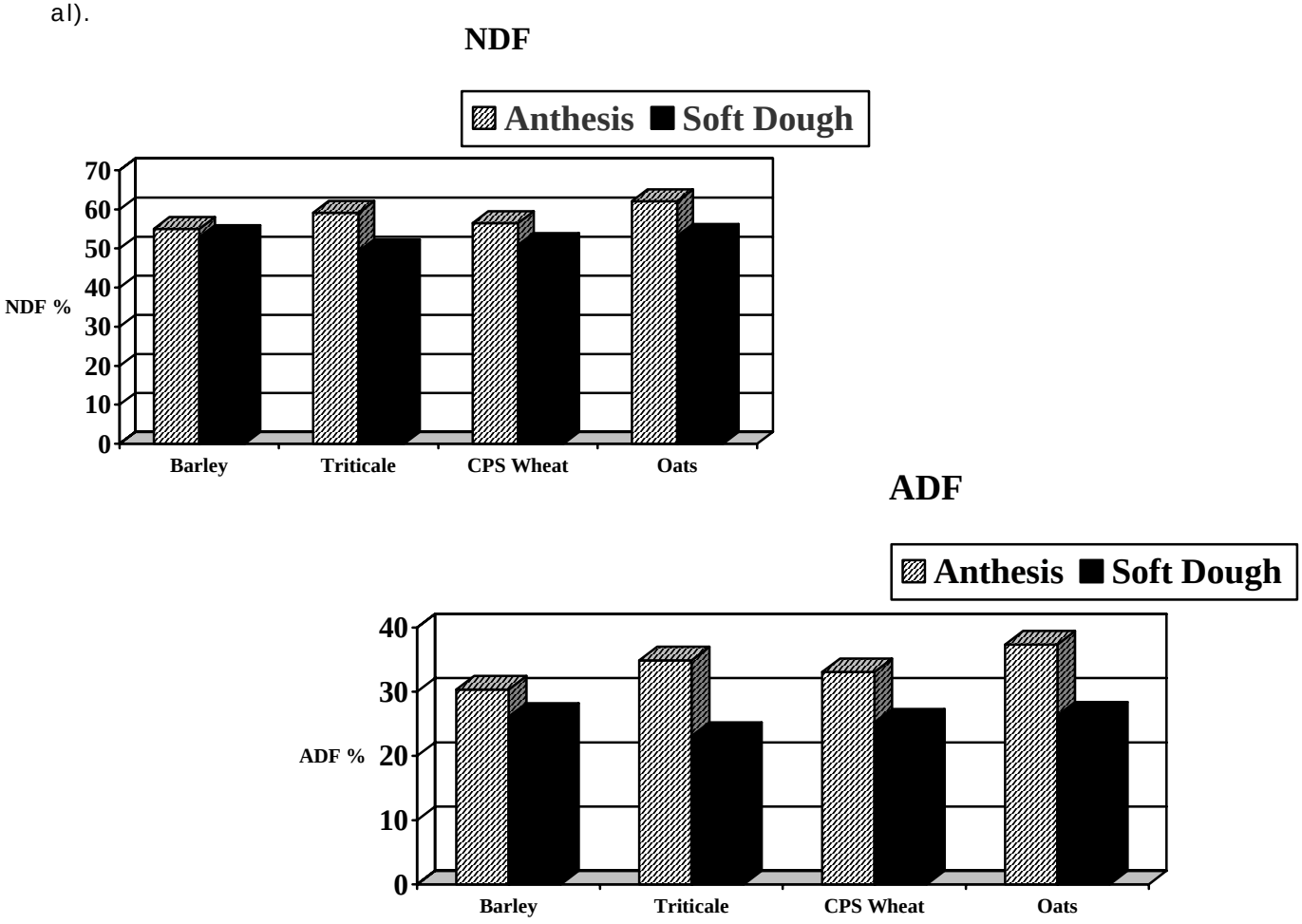
(Baron et al.)

Figure 9. Comparison of protein in silage cut at anthesis and soft dough stages of growth for barley, triticale, CPS wheat, and oats at Lacombe, 1996 crop year.



(Baron et al.)

Figure 10. Comparison of NDF and ADF of silage cut at anthesis and soft dough stage of growth for barley, triticale, CPS wheat, and oats at Lacombe, 1996 crop year (Baron et al).



Best management practices for ensiling triticale forage

- Use different crops and varieties to spread the timing for optimum harvest of silage in different fields.
- Use the varieties that have the highest grain yield. Grain yield and forage yield are highly related.
- Whether using horizontal silos, towers or plastic tunnel bags, harvesting should be completed before the standing crop reaches 60-65 percent moisture content. The soft dough stage is a good harvest target.
- Earlier harvesting improves silage protein but lowers potential harvestable yield and energy.
- Avoid harvesting after the mid-dough stage, as the higher fibre content negatively affects energy content.
- If you need high protein silage, harvest earlier than the mid-dough stage.
- Triticale stems are tougher than barley and may need more processing to get optimum feed acceptance. Slow down harvesting speed to compensate for chop length.
- Cut, chop triticale silage so that plant cells are damaged. Chopping reduces silage losses. The smaller the pieces, the easier it to is to exclude air when packing. Livestock also find smaller pieces more edible (.75 to 1.25 inches or 1.9 to 3.2 cm).
- Fill silos rapidly. Pack and seal them quickly to avoid exposure to air, and to promote bacterial action and lactic acid fermentation.
- Use silage additives when necessary to improve silage quality and utilization.

The following section includes tables and figures showing comparative silage quality and productivity from Canadian research trials. Interpretations from the data are also presented in abbreviated form.

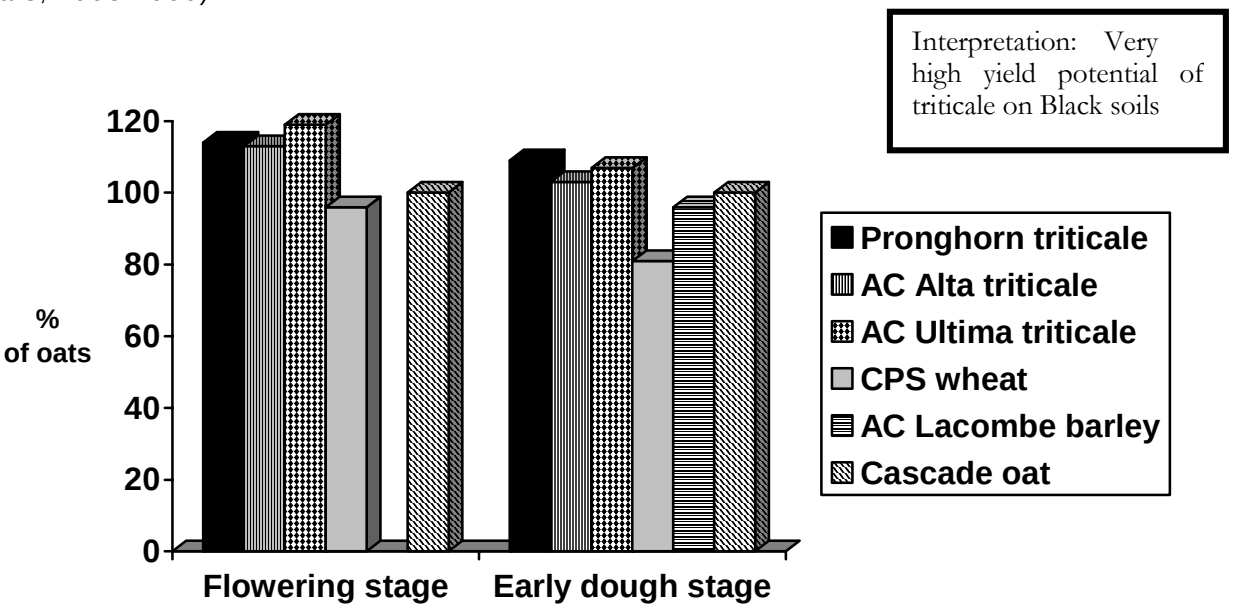
Table 19. Cereal silage performance on manured land, W. Canada 1998 -1999

	Silage yield Metric Tonnes/acre	Protein %	Protein yield kg / ha	ADF %
1998 results:				
AC Certa triticale	6.3 c	11.4 b	709 b	29.3 c
AC Alta triticale	7.6 b	12.4 a	913 a	29.3 c
Pronghorn triticale	7.5 bc	11.6 b	851 ab	29.3 c
Triticale / barley mixture	8.5 ab	10.6 c	885 a	31.2 b
Taber CPS wheat	7.5 b	12.3 a	910 a	27.8 d
AC Lacombe barley	9.2 a	10.0 c	938 a	32.6 a
1999 results:				
Barley silage (1 cut)	7.1			
Triticale silage (1 cut)	8.1			
Winter triticale (1st cut)	8.2			
Winter triticale (2nd cut)	2.8			

1998 results – In a column, treatments with the same letter do not differ significantly

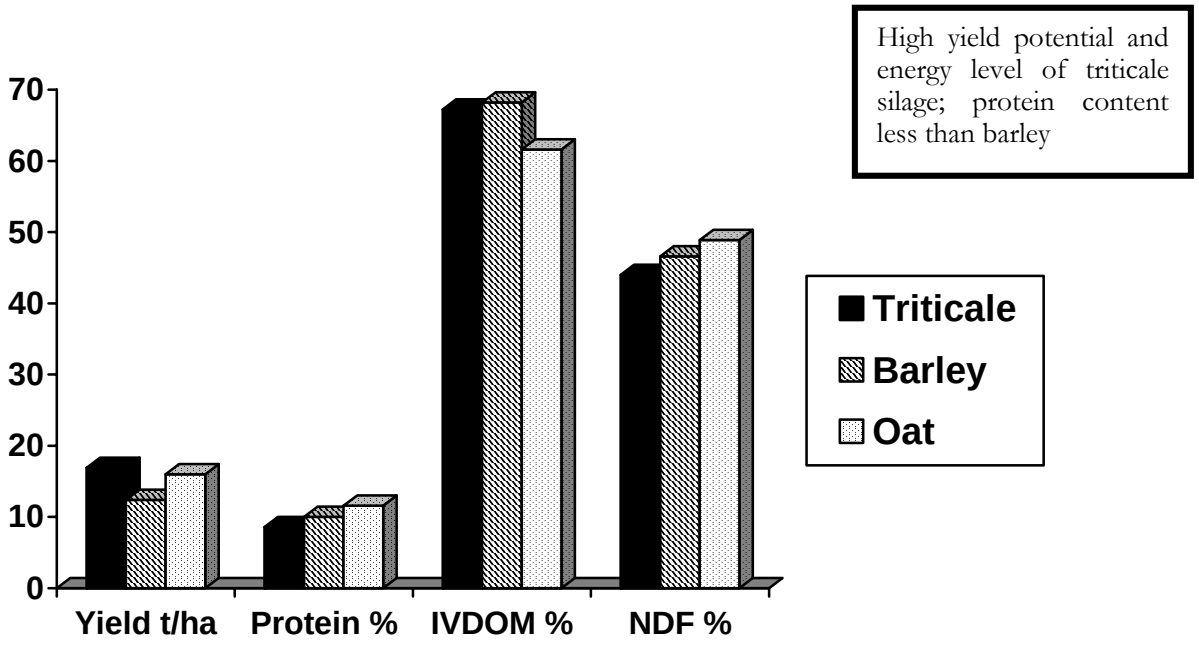
(Data from Highland Feeders Ltd., 1999 On-farm demonstration)

Figure 11. Cereal silage yields at two harvest stages, as a percentage of oats (Lacombe trials, 1995-2000)



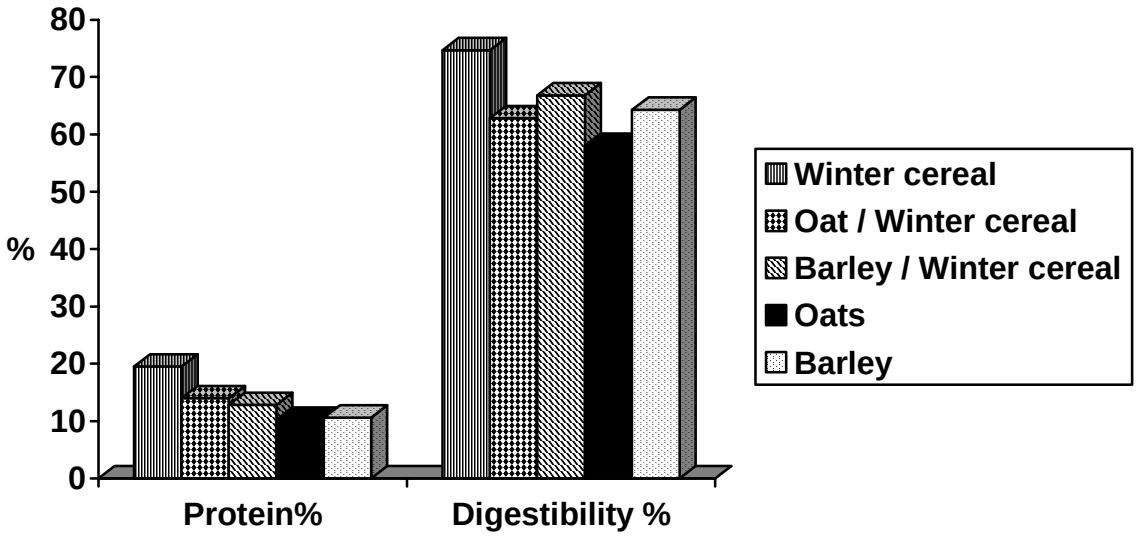
(AAFRD, 2000)

Figure 12. Yield potential and forage quality of spring cereals, early dough stage



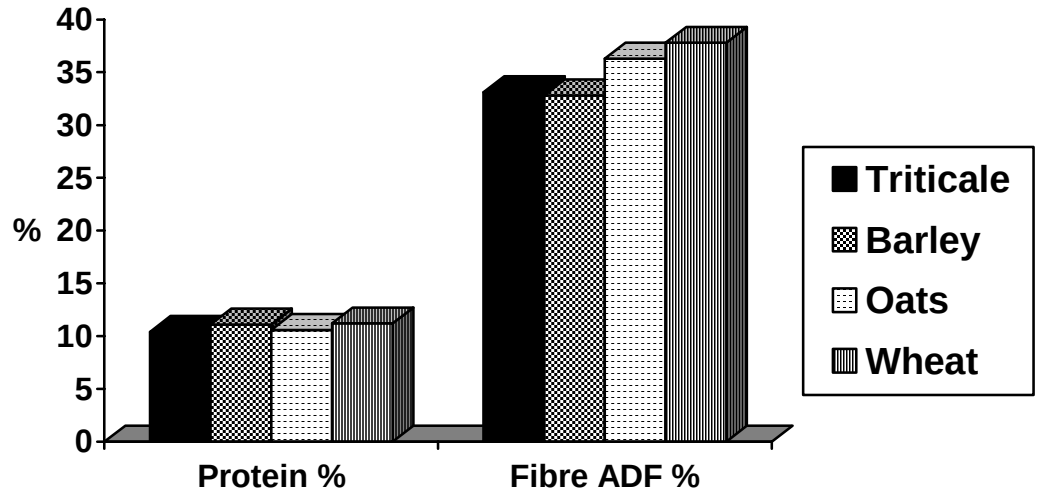
IVDOM % = In vitro digestible organic matter
NDF = Neutral detergent fiber
(Salmon et al, 1996)

Figure 13. Silage quality of inter-cropped winter triticale and other cereals



(Baron et al, AAFC Lacombe Research Station, cited in Aasen, 2004)

Figure 14. Cereal forage protein and ADF fibre content, % dry matter



Nutrient analyses - mean of Provincial samples of Alberta grown silage
(Alberta extension data: 2001)

Table 20. Triticale silage performance as feed for milk cows, Lacombe, Alberta, 2000

	Spring Triticale	Barley semi-dwarf	Barley standard	Winter triticale barley mix (Low yield)	Winter triticale barley mix (High yield)
Yield t / ha	14.6	11.2	11.7	9.4	11.7
Crude protein %	9.7	11.0	9.5	14.0	14.0
IVDOM %	66.5	67.0	60.0	68.0	68.0
NDF %	48.2	50.0	58.8	50.0	50.0
Milk yield kg / t	606	480	214	615	615
Costs $ / ha					
Production	205	193	193	198	198
Harvest	220	170	178	153	178
Total	425	363	371	351	376
Milk value over costs					
$ / ha	2553	1934	1737	1623	2059
$ / t	175	173	149	173	176

IVDOM = In vivo digestible organic matter NDF = Neutral detergent fibre
Silage yield, milk productivity and economic returns for milk production.
From >3 years of data in trials at Lacombe
(Baron and Dick, 2000)

Table 21. Silage productivity comparisons for milk production

	Silage component in the diet				
	Alfalfa	Barley	Oat	Triticale	SEM
Dry matter intake					
kg/day	19.6 a	18.6 a	16.7 b	17.2 b	0.42
% of body wt.	3.29 a	3.12 a	2.83 b	2.90 b	0.06
Milk, kg/d					
Yield	31.6	31.5	30.1	30.2	0.51
4% FCM	29.1	27.7	27.3	26.6	0.78
Fat	1.10	1.01	1.01	0.97	0.05
Protein	0.95	0.96	0.90	0.94	0.02
Lactose	1.47	1.50	1.42	1.43	0.03
Milk composition, %					
Fat	3.50	3.23	3.45	3.21	0.14
Protein	3.01 b	3.07 b	3.04 b	3.14 a	0.03
Lactose	4.67 b	4.80 a	4.76 ab	4.75 ab	0.03
Milk energy, Mcal/d	21.4	20.9	20.4	20.0	0.44
Gross efficiency, kg of milk/kg of DMI	1.61 c	1.69 bc	1.80 a	1.76 ab	0.03
Body wt., kg	596	596	590	591	4.9
Body wt. changes, g/d	-264	74	473	464	301

Means in the same row with different letters differ significantly (P<0.05)
SEM = Standard error
W. Canadian study
(Khorasani et al, 1996, J. Dairy Sci. 79: 862-872)

Interpretation: Milk yield from the triticale silage diet was slightly less than from alfalfa and barley, but milk productivity and quality were very similar

Triticale grazing productivity and quality

Some quick facts about triticale grazing productivity and quality:

- Spring-planted winter cereals alone or in mixtures with barley or oats (inter-cropping) provide an excellent source of pasture from mid-June until late in the fall (see *Winter Cereals for Pasture*, Agdex 133/20-1).
- Triticale grown for forage in cereal mixtures tends to offer the most positive traits related to survival and re-growth in a mixture, but will not always be the highest yielding annual forage solution.
- "Inter-cropping is the best alternative where annual forage is needed for fall season pasture, and extended ground cover is required to combat soil erosion for a longer portion of the year." (Baron et al, 1993)

Triticale, either in spring or winter form, offers an excellent potential for extending the spring and fall grazing seasons.

The use of winter cereals such as winter triticale can provide farmers with a valuable alternative to perennial forages and can be used to extend the traditional grazing season into the early spring and late fall.

Fall seeded winter triticale

Fall rye, winter wheat, and winter triticale can provide some fall grazing and provide earlier spring grazing the next spring (early to late May) compared to perennials.

If the winter crop is intended for seed or silage production, grazing should be discontinued once crop elongation begins.

In general, the order of regrowth of green material in the spring follows (first to last):

- Fall rye
- Winter triticale
- Winter wheat

In Florida, Bertrand and Dunavin (1974) showed that triticale alone, or in mixture with ryegrass and crimson clover, were equal to rye as grazing forage for growing beef calves.

In studies with winter triticale in Missouri, Miller et al (1993) studied the effects of simulated grazing (clipping) on subsequent grain yield when used in a double-crop situation, and compared these to when winter wheat was used alone.

In this comparison, winter triticale performed as well as the winter wheat. However, it was also apparent that:

- To keep grain yield potential, grazing should not be allowed beyond the first node stage.
- If the main goal is yield, then the amount of grazing would have to be adjusted to allow the grain to recover sufficiently during the post-grazing portion of the growing season.

Spring seeded winter triticale

When seeded in the spring, winter cereals (such as winter triticale) remain vegetative throughout the spring, summer and fall. There is no heading because seedlings do not receive the cold treatment, or vernalization, that would normally occur in the fall. Vernalization is required in order for heads to form the following summer (see box below).

Two options are commonly considered:

- Growing a mono-crop of winter cereal for grazing.
- Using a mixture of winter cereal and spring oat or barley.

The second option has a rapidly growing spring cereal, which allows for high grazing yield in the spring and early summer. It also allows the opportunity of using the blend for silage and subsequent grazing in the fall.

Seeding rates may be influenced by the intended end use. For example, if a blend or mixture of spring and winter cereals is intended for silage production and then fall grazing, seeding rates of 75% of the normal rates for each component in the mixture may be recommended. (Refer to the production section of this manual)

Mixing spring-planted winter triticale with tall varieties of oats or barley has been shown to be an effective source for spring and summer grazing as well as for silage. The barley and oat:

- Are very vigorous in the early growth stages.
- Dominate the canopy in the early stages of growth.
- Provide excellent forage quality.

> Vernalization is a physiological change in the seedling, usually received in the fall when seedling temperatures that are below 5-7^{o}C and low light intensity serve as triggers for the plants to develop heads the following year.

After the earlier season grazing or silage harvest, the winter triticale becomes more dominant in the mixture. It has the potential to provide vigorous re-growth and high quality forage in late summer and fall. This is at the same time as the re-growth potential for spring cereals and perennials decreases.

Aasen (2004) reported that adding a one-half bushel of oats or barley to a winter cereal for spring seeding increased spring growth in a mixture, and also made the graze available 10 days earlier than either component by itself. When managed in this manner, spring and fall grazing potential improves as compared to other grazing options.

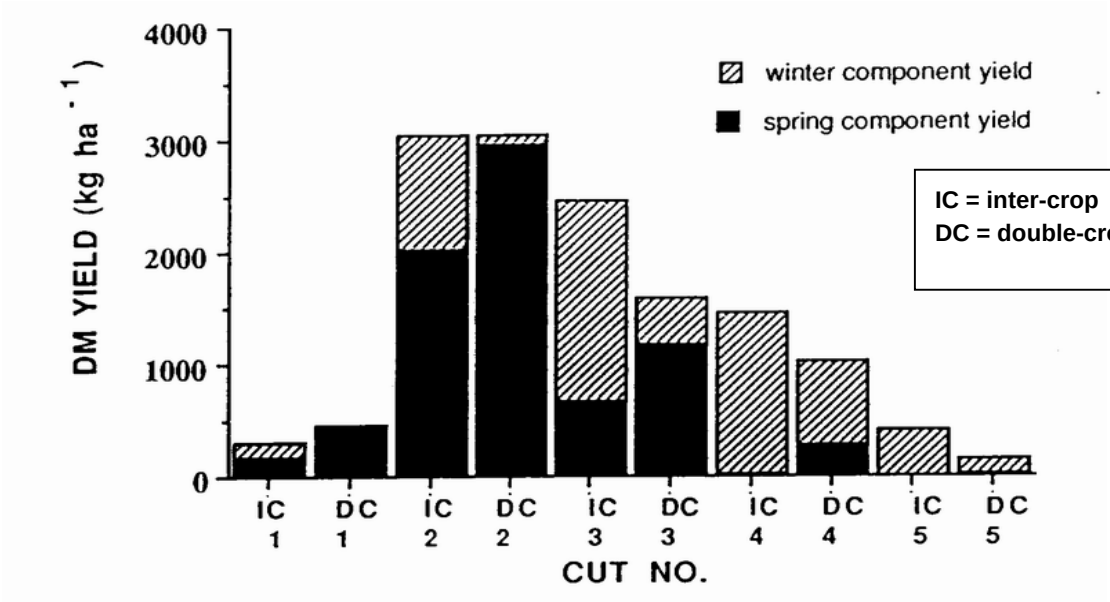
These effects are well illustrated by the results of a study at Lacombe from spring seeding a blend of winter and spring cereals. Researchers found that the spring forage yield came mainly from the spring cereal, and was taken over by the re-growth of the winter component later in the season (Figure 15).

General grazing recommendations

The following should be done to avoid problems when grazing cereals, especially when the growth is very lush:

- Avoid acidosis by providing a straw supply or access to grass stands in adjacent pastures to supplement the low fibre content in the graze.
- Avoid high applications of nitrogen sources as high nitrate levels can cause problems on spring cereals. Frosts and drought usually increase nitrate levels. Know the lab quality of the forage feed being used. Sample and submit for feed analysis.
- Use mineral supplementation to avoid potential for grass tetany.
- Supplement grazing livestock with straw or hay to add fibre, reducing runny manure problems.

Figure 15. Seasonal forage yield contribution from spring and winter components in inter-crop (IC) and double crop (DC) management systems



Note: cutting dates ranged from mid-June to mid-October or late October on average.
(Baron et al 1993)

Interpretation: The major yield contribution comes from the spring component in early season, and from the winter component in the late part of the season

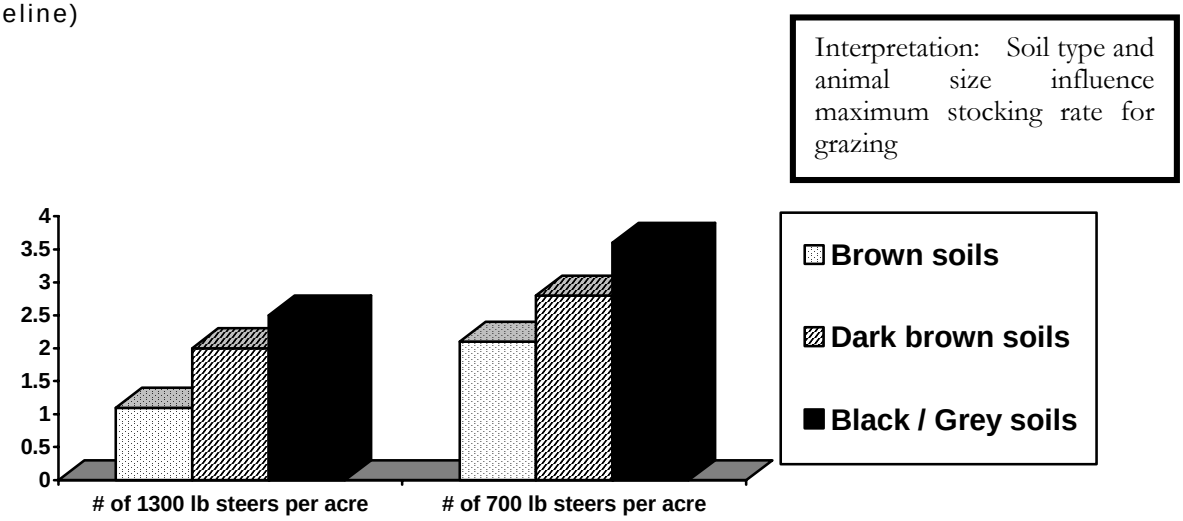
Stocking rates

Suitable stocking rates can only be determined from experience, and depend on the circumstances of each graze crop. Saskatchewan Agriculture (Figure 16) recommends maximum stocking rates per acre of 1.1 to 2.5 for 1300 lb cows, and 2.1 to 3.6 for 700 lb steers on annual pasture, depending on the soil type and its productivity.

Table 24 is an example of simulated stocking rates based on research conducted in Alberta.

Palatability is not often a problem, and is better for winter triticale and winter wheat than for fall rye.

Figure 16. Typical maximum stocking rates for annual pastures in Saskatchewan (a guideline)



Based on the website (sourced February 8, 2004)
http://www.agr.gov.sk.ca/docs/crops/forage_pasture/forage_management_production/annualsforforage.asp

Table 22. An example of grazing productivity in Alberta using triticale

	Triticale/barley Steers	Perennial grass Heifers
Rainfall (mm)	264	274
Grazing initiation date	July 1	May 29
Grazing completion date	Oct. 23	Sept. 9
Grazing days	115	103
Stocking rate (animals / ha)	0.38	0.38
Daily gain (kg / day)	0.94	0.74
Total gain (kg / ha)	23.6	19.3

Interpretation: Not a head-to-head comparison, but gains on triticale/barley pasture were at least equal or higher than those on a perennial grass

Performance of a spring seeded binary combination of winter triticale and spring barley compared to perennial grass as a pasture in central Alberta
(Salmon et al 1996)

Triticale use for green-feed and hay

There is little research on triticale being used for green-feed hay. However, the optimum time for harvesting cereals as dry hay is the same as silage stages of cutting, late milk to soft dough stages.

Triticale green-feed and hay can be managed similarly to other green- feed and hay sources. Dried-out, late harvested samples can cause palatability issues for animals and create mouth ulceration. These problems can be limited by using the semi-awnless winter variety Bobcat. Varieties with rough awns should be avoided for green-feed or hay or cut earlier before awns become hard and thick.

Triticale straw can be used in animal systems but, along with wheat straw, in not considered to have as high a feeding quality as barley or oat straw. This is likely because of the higher fibre content and lower energy content and protein.

Table 23. Hay and green-feed composition of farm samples, Alberta data, 1984 -1994

	Triticale	Wheat	Timothy
Moisture %	11.0 (3.7, 29)	13.6 (4.9, 221)	13.3 (4.1, 440)
Protein %	10.3 (3.5, 29)	9.8 (4.6, 182)	8.2 (3.3, 4330)
Calcium %	0.31 (0.20, 29)	0.29 (0.18, 181)	0.54 (0.30, 429)
Phosphorus %	0.18 (0.10, 29)	0.18 (0.08, 182)	0.15 (0.07, 4340)
Acid detergent fibre %	34.1 (2.8, 29)	31.2 (13.0, 204)	37.3 (6.0, 429)
Selenium mg/kg	-	0.51 (0.37, 23)	0.10 (0.14, 141)
Sulphur %	-	0.27 (0.11, 16)	0.14 (0.07, 77)
Neutral detergent fibre %	-	-	66.3 (5.6, 22)
Lignin %	-	-	4.4 (3.1, 22)
Iron mg/kg	56 (0, 1)	242 (338, 19)	173 (391, 83)
Copper mg/kg	4.6 (0, 1)	4.1 (2.1, 20)	5.6 (7.4, 125)
Manganese mg/kg	17 (0, 1)	56 (24, 19)	68 (82, 119)
Zinc mg/kg	26 (0, 1)	25 (10, 20)	26 (16, 125)
Magnesium %	0.09 (0, 1)	0.17 (0.07, 19)	0.14 (0.05, 117)
Potassium %	0.88 (0, 1)	1.33 (0.59, 19)	1.25 (0.37, 116)
Sodium mg/kg	-	395 (791, 18)	42 (54, 79)
Molybdenum mg/kg	-	1.7 (1.3, 9)	2.0 (2.0, 65)
Cobalt mg/kg	-	2.0 (2.1, 6)	0.7 (0.9, 35)

Average analysis of forages, AAFRD web sources, 1984-1994
The forage had >60% contribution from the crop listed.
Table shows mean, (standard deviation and number of samples)

Interpretation: Triticale forage quality is in the same range as other forage crops, with differences in mineral composition. Considerable variation is found between individual forage samples

Triticale use for swath grazing

Swath grazing is the swathing of late seeded cereals in mid-September at the soft dough to dough stage. The swath is left in the field for cattle grazing through the winter. The swathing is done late in the season in order to maximize quality for cattle grazing through the winter. Cattle can usually eat the swath even if the swath is under snow.

Swath grazing:

- Eliminates the cost and time of baling or silaging.
- Eliminates the cost of cleaning corrals and hauling manure from feedlots.
- Extends the field grazing season.

Successful swath grazers spend a lot of time managing their animals to ensure efficient grazing as well as good animal condition and health. Most users are grazing dry, mature, beef cows in reasonable body condition.

Most information about swath grazing is from producer experience and surveys. Best management practices for swath grazing are summarized below. Productivity data specifically describing swath grazing of triticale were not found in the literature. For general information on swath grazing refer to Ropin' the Web (www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex4245?opendocument).

Managing the crop

- Stagger seeding dates in different fields, so swathed crops are all at the soft to mid-dough stage at the desired swathing date. Late May to June seeded winter triticale works well in this application.
- Use winter triticale plus oat or barley as a mixture to improve the swath forage quality; raise seeding rates up to 25 percent more than for a grain crop.
- Use normal fertilizer rates. If soil N load is very high, and the crop is subjected to major stress during growth (frost, drought, cool weather), be aware of problems that sometimes develop from having high nitrate levels in the forage. If in doubt, send samples to a feed test laboratory.
- Delayed seeding for swath grazing allows for pre-seeding herbicide use. Check herbicides for restrictions on subsequent feed use.
- A crop previously planned for grain can be cut for swath grazing after a heavy frost.
- During the grazing period, animal manure can return high amounts of nutrients to the grazed field. Soil testing is recommended to determine fertilizer requirements for subsequent crops.
- Ensure that any swath residuals are fully grazed off, baled off, or spread in the field. This avoids residual damage to subsequently seeded crops from the swath strips.

Managing the animals

- Test swath quality before feeding to determine necessary levels of supplemental feed, and to estimate the likely duration of the graze period using the swaths in the field. Typical analyses should include fibre content, projected energy levels, protein level, calcium, phosphorus and nitrates.
- If swath grazing calves, young cows, thin cows or cows with calves, supplemental feed and minerals may be necessary, especially during periods of cold and snow.
- Choose fields for swath grazing that are sheltered from the wind, and close to buildings and a water source.
- Choose fields where wildlife grazing will be minimized, as wildlife will trample swaths and reduce the amount of available feed.
- Monitor swath use and ease of access. Blade away snow drifts if the drifts deeply bury the swaths or if snow becomes hard-packed.
- Animals can efficiently graze snow-covered swaths late into the winter with proper management (for example, the use of electric fencing).

Triticale – a crop for all seasons

How Triticale Fits into Sustainable Cropping Rotations

Producers recognize the many different ways in which spring and winter triticale can be incorporated into rotations to extend seasonal access to forage, and to spread field operations throughout the year. As such, forage has become the predominant triticale application in Western Canada.

Winter triticale can be used for dual purposes over more than a calendar year. However, if grazed or harvested for forage and then left for grain production, grain yields are generally reduced. Spring triticale can be grown as a mixture with other cereals or with legumes in a forage or grain mixture harvest. It will improve the standability of weak-strawed species in a mixture. Spring or winter triticale can also be used as a short-term cover crop and/or for green manure, or in combination with chemical fallow.

Salmon et al (1993) warn that, "Over-wintering of spring planted winter wheat or winter triticale is not a suitable means for seed production, compared with conventional fall planting or re-seeding to spring cereals." Some producers have found that with good management practices, they have had some success in producing silage in the second year. However, this practice is not recommended as it increases the probability of winterkill and lowers yield potential.

Spring and winter triticale are both suitable for grain and forage use, with the latter being grazed or conserved. Western Canadian producers have developed numerous ways to use this crop to advantage in different rotations. A number of these options are illustrated in Figures 17 and 18.

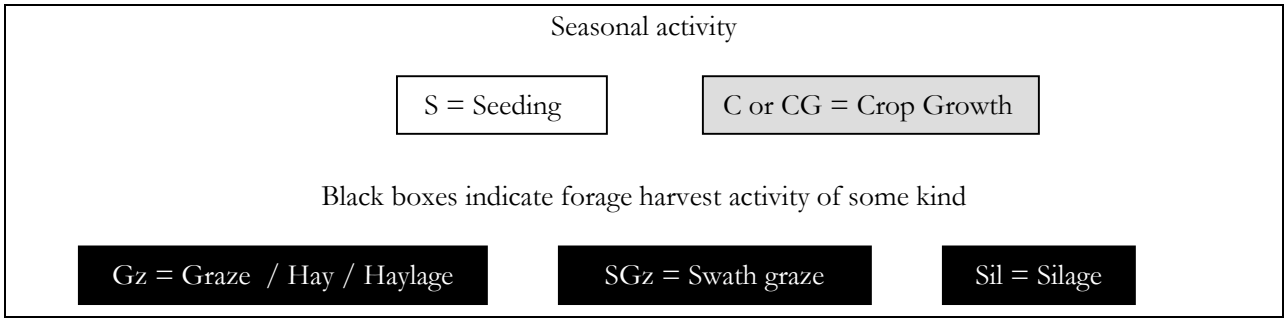
For producers requiring a continuous supply of silage for feedlots, winter and spring triticale can be planted in different fields to provide a continuum of harvesting dates for silage, when scheduled with fields of barley and oat silage. Winter triticale can be harvested for silage from mid to late July, barley from late July to early August, oats from early to mid August, and spring triticale from mid to late August. In addition, use of spring triticale for swath grazing through the winter can reduce the fall workload for storing silage in cow-calf operations.

Thus triticale for forage can well be described as '**The Crop for All Seasons**'.

Because of the high demand for barley silage and feed grain, many western Canadian rotations tend to have too high a frequency of barley cropping. This causes increased problems from barley leaf diseases. Triticale for silage or grain provides an excellent disease break from barley and oats, since triticale is not susceptible to many of the same diseases as oat or barley.

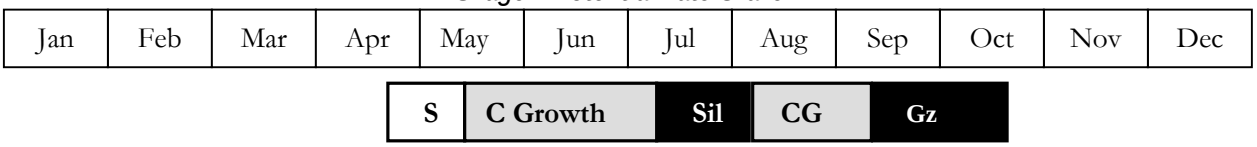
Figure 17. Seasonal windows for spring triticale for different forage applications: Some examples

These charts show comparative time lines for different forage applications with spring triticale.



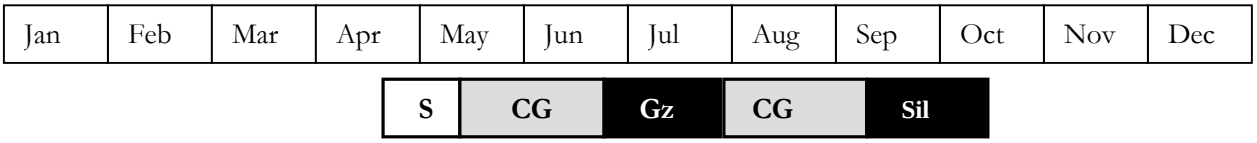
1. SPRING TRITICALE

Silage + Potential Late Graze



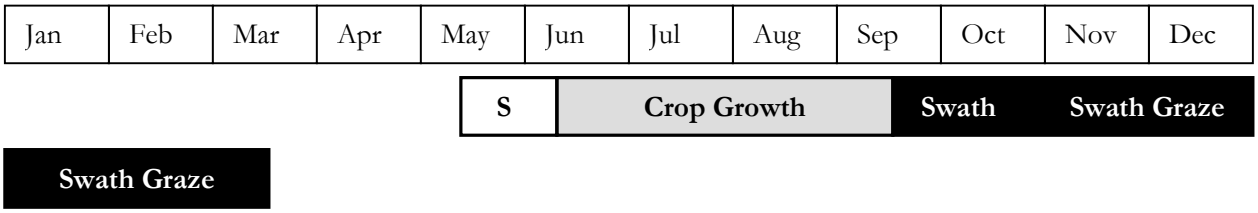
2. SPRING TRITICALE

Grazing and Hay



3. SPRING TRITICALE

Swath grazing



4. SPRING TRITICALE

Grazing, Hay, or Haylage

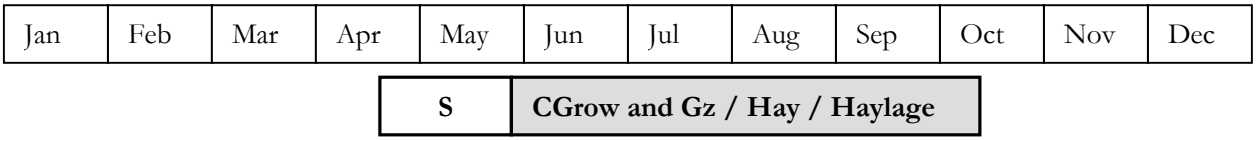
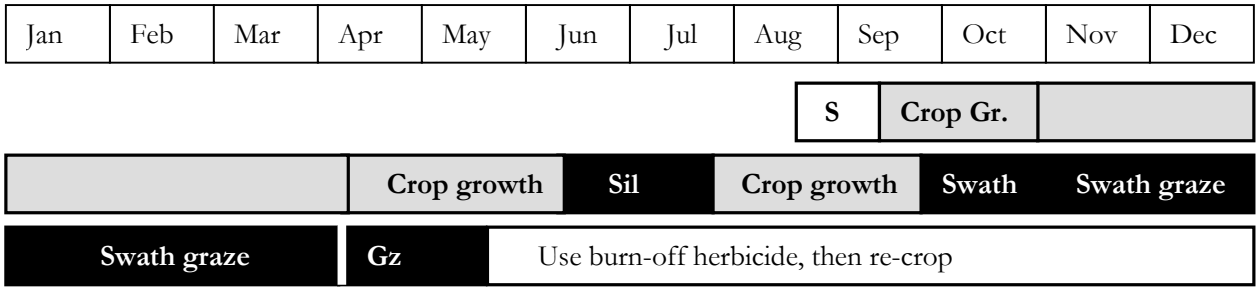


Figure 18. Seasonal windows for winter triticale for different applications: Some examples

Best management practice dates for different activities will vary considerably from north to south in Alberta. These charts show comparative time lines for different forage applications with winter triticale.

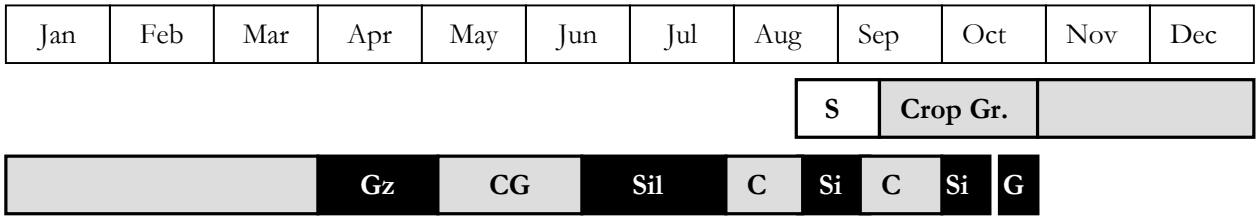
1. WINTER TRITICALE – Fall seeded

One Silage Cut + Swath Graze + Potential Spring Graze



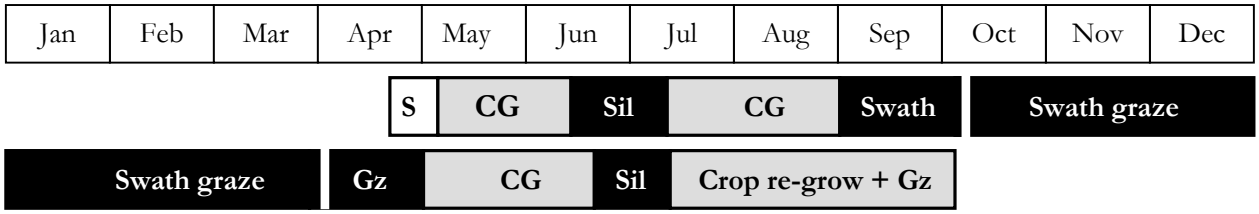
2. WINTER TRITICALE – Fall seeded

Potential Spring Graze + 3 Silage Cuts + Potential Fall Graze



3. WINTER TRITICALE – Spring seeded (Pure stand or with cereal or legume)

One Silage Cut + Swath Grazing + Potential Spring Graze + Silage Cut



4. WINTER TRITICALE – Spring seeded with oats or barley

Spring Graze + Fall Graze + Spring Graze