Part 5. TRITICALE PRODUCTION

Varieties

A diversity of spring triticale varieties with high grain and forage yield potential are available to producers. The number of adapted winter varieties is fewer than for the spring types. These varieties also allow a greater diversity of crop rotational options for improved protection from disease and insect damage. As well, the potential biomass production capability for these varieties exceeds that of most other cereal crop options under Western Canadian conditions.

Registered triticale varieties have an excellent disease resistance profile. Although they are more resistant than some other cereals, the late maturity of the spring varieties limits suitability for grain production in some areas.

Winter triticale varieties are as winter hardy as the best winter wheat varieties but less than fall rye.

Registered triticale varieties are well suited for grain and silage operations. These operations include:

- Forage mono-cropping.
- Inter-cropping and double cropping.
- Other special forage applications.

All spring and winter varieties are rated as good to very good for resistance to stem rust (except Pronghorn, which is rated as poor in Manitoba), leaf rust, and bunt. They are all rated as resistant to loose smut.

Triticale in general has superior drought resistance compared to barley, wheat and oat.

Spring triticale varieties

Table 24. Aggregate table derived from 2004 Provincial Variety Descriptions

	Yields, adjusted to % of Pronghorn in each Provincial region / area:											
	Alberta Regional Zones						Manitoba	Saskatchewan Areas				
Spring varieties	Irr	1	2	3	4	5+6	Long-term	Irr	1	2	3	4
Pronghorn	100	100	100	100	100	100	100	100	100	100	100	x
AC Alta	106	103	100	84	101	101	105	102	107	102	96	x
AC Certa	95	99	93	91	92	92	104	93	102	98	98	x
AC Copia	105	100	94	96	84	94	95	92	101	97	93	x
AC Ultima	107	103	95	109	105	97	107	na	108	102	100	x
Banjo	na	na	na	na	na	na	103	na	na	na	na	x

na = Insufficient data to describe
x Indicates not recommended in SK Area 4 due to late maturity

	Days to maturity	Height inches	Test weight lb/bu		1000 Kernel weight g	Root rot	Fusarium head blight
Spring varieties	MB	MB	AB	SK	AB	SK	C
Pronghorn	96	40	55	55	43	F	F
AC Alta	99	35	54	54	49	F	P
AC Certa	97	40	59	59	43	G	P
AC Copia	95	39	57	58	46	F	P
AC Ultima	96	38	56	56	45	F	P
Banjo	100	42	na	na	na	na	P

na = Insufficient data to describe
Disease resistance shown as P = Poor, F = Fair, G = Good, C = Consensus from Coop trials and special tests
Data are from different Provinces, indicated as AB, MB, SK

Other agronomic traits:

- All spring and winter varieties are rated as good for shattering and lodging resistance.
- In most regions, spring triticale varieties are typically as late as or later maturing than AC Crystal CPS wheat.
- Compared to other cereal species, triticale varieties have only a fair tolerance to pre-harvest sprouting.
- AC Ultima is a variety bred for improved sprouting resistance. It has a high Hagberg Falling Number, which is associated with a lower proneness to sprout.

Winter triticale varieties

Winter triticale is a high yielding, early maturing alternative to spring triticale for short-season areas of the prairies. Pika and Bobcat are the only two winter varieties currently registered for Western Canada, and typically mature about three weeks earlier than spring varieties. Their winter hardiness is rated as equal to that of the best winter wheat varieties, but not as high as fall rye.

Bobcat is awnletted, with shorter and stronger straw than Pika. It is also easier to thresh than Pika. Bobcat is best suited to areas of higher snowfall, higher summer rainfall, or irrigation.

Winter triticale is best adapted for seed production in the Brown soil zone of Southern Alberta, and in high snowfall areas such as the Black soil zones of the prairies. In areas of good adaptation, winter triticale yields may exceed those of winter wheat by as much as 10 to 20 percent (Table 25).

Table 25. Comparisons of winter triticale, fall rye and winter wheat (1995-2000)

	Winter survival %		Relative grain yield %		Julian Calendar day of maturity		1000 kernel weight, g		Test weight lbs/bu	
Soil Zone :	**Black**	**Brown**	**Black**	**Brown**	**Black**	**Brown**	**Black**	**Brown**	**Black**	**Brown**
Bobcat winter triticale	66	85	118	119	236	223	36	35	53	51
Pika winter triticale	91	88	104	137	233	221	35	42	54	56
Musketeer fall rye	90	91	100	105	229	214	34	34	58	58
CDC Osprey winter wheat	84	80	100	100	223	219	32	32	63	62

Julian Calendar 223 is August 10, 236 is August 23.
(Source AAFRD, Ropin' the Web)

Interpretation: Winter triticale is very competitive agronomically with other winter cereals

Top 10 Reasons to Grow Winter Triticale

The top ten reasons to grow winter triticale in Western Canada are the same as for winter wheat (taken from the website www.usask./agriculture/plantsci/winter_cereals)

1. Good fit with conservation farming systems.
2. Uses water more efficiently than do spring-seeded crops.
3. Avoids wheat midge damage because of early heading. This reduces insecticide use.
4. Good weed competitor, so wild oat herbicide may not be required
5. Not spraying for wild oat control reduces risk for developing herbicide resistance.
6. Reduced risk of fusarium head blight due to early development and maturity.
7. Avoids seeding problems in late, wet springs, and offers earlier, less risky harvest dates.
8. Reduced tillage and pesticide use means lower energy requirements.
9. Less disturbance of wildlife, especially waterfowl and upland game birds.
10. High yields and lower input costs offer a high probability of increased returns per acre.

Seeding triticale

Most cultural practices needed for growing triticale can be taken directly from wheat. These include:

- Managing for seedbed preparation
- Seeding rate
- Seeding depth
- Seeding date
- Seeding methods

Triticale seeding rates

- Plant more weight of triticale seed per unit area than when planting wheat. This is because triticale has larger seeds than does wheat.
- Adjust seeding rates to achieve targeted plant densities for specific triticale uses and conditions.
- Keep in mind that optimum seeding rates vary depending on what the triticale will be used for.

If seeded on its own (mono-crop) for forage, the minimum seeding rate for triticale should be at least the same as the seeding rate used for grain production, or somewhat higher (up to 25 percent), to ensure adequate stand establishment.

When planting mixtures with triticale (inter-cropping), the seeding rate for the mixture is adjusted upwards from the normal rate. However, the seeding rate for each component of the mixture is lowered. Research at the Field Crop Development Centre in Lacombe indicated that 75 percent of the normal recommended rate for each of the components is optimum. For example, if the normal seeding rates for triticale and barley is 2 bu/ac, for a triticale and silage barley mixture the rates should be adjusted to 1.5 bu/ac of triticale and 1.5 bu/ac of silage barley, for a total seeding rate of 3.0 bu/ac. The same recommendation applies to spring/winter cereal mixtures seeded in spring for grazing.

Some quick facts about seeding triticale:

- Choose and manage seeding rates to achieve target plant stand densities in the field.
- Triticale has the largest seed size of all common small-grained cereal crops. Ensure that your seed rate compensates for this.
- Optimum seeding rates depend on the use that is planned for the crop and on local conditions. Check provincial recommendations for general guidelines.
- Rates are usually adjusted upwards when seeding forage mixtures or inter-cropped triticale.
- For mono-crop triticale forage production, recommended seeding rates are usually 25% higher than seeding rates for grain production.
- In two-component forage-crop blends using triticale, one guideline suggests each component consist of 75 percent of the normal seeding rate for the individual components alone.

For best management practices, triticale should be seeded to achieve a desired target plant stand frequency in the field. For this, the 1000 kernel weight (g) of the seed source must be known. Note that triticale has a much larger 1000 kernel weight than do other cereals.

Plant populations recommended in Table 27 and Table 28 are based on research results obtained over several years.

Within limits, higher seeding rates in triticale lead to:

- Higher crop yields.
- Better weed competition.
- Earlier maturity.
- Fewer tillers per plant.
- Shorter plant height.

Seeding rates should generally be adjusted upwards for:

- Large seed size.
- Low seed germination rate.
- Deep seeding (not a recommended practice).
- High moisture and yield potential conditions.
- Heavy textured soils.
- Rough seedbeds.
- Heavy weed pressure conditions (especially in organic production).

Lower seeding rates may be suitable for dry conditions. Triticale does not tiller as freely as wheat, and has greater difficulty in compensating for low stand establishment. Use your own experience to adjust plant density targets to your local conditions.

Lodging

Triticale can lodge because of:

- Height.
- Lush growth under conditions of high moisture and fertility.
- High seeding rates.

Earlier seeding appears to reduce this tendency towards lodging.

Table 26. Seeding rate formula

Use the following formulas to calculate the seeding rate in pounds per acre (or kg/ha). The seedling survival rate value used assumes that 10 percent of seeds planted do not produce plants in the field.

Rate (lbs/acre) = Desired population/ft^2 x 1000 kernel wt (g) ÷ Seedling survival rate (0.90) ÷ 10

Rate (kg/ha) = Desired population/m^2 x 1000 kernel wt (g) ÷ Seedling survival rate (0.90) ÷ 100

Interactive seeding rate calculators for triticale are available on the Alberta Agriculture website at http://www1.agric.gov.ab.ca

Table 27. Recommended seed rates for triticale used for grain

Triticale for grain[1]	Desired plant population Per sq.m.	Per sq. ft. (Range)	Range in 1000 kernel weight (g)	Range in # seeds/lb
Spring triticale	310	30 (25-35)	43-49	9,500 – 10,800
Winter triticale	250	24 (18-30)	43-49	9,500 – 10,800

([1]Adapted from AAFRD AgDex 81)

Table 28. Typical seeding rates[1] for triticale used for forage

	lb/acre	Av. bu/acre
Triticale for greenfeed	80 - 100	1.5 - 2.0
Triticale/pea mixture for greenfeed	¾ normal rate + pea at ¾ normal rate	1.2 (+ 1.5 – 2.3 bu/acre of peas)
Winter triticale, fall and spring seeded, dry regions	80	1.5
Winter triticale, fall and spring seeded, moist regions	110	2.0
Triticale/cereal inter-crop for summer or fall pasture, silage, or fall grazing	100 - 110	1.5 - 2.0
With oat, add oat at	20 - 25	1.2 - 1.75
With barley, add barley at	30	0.5
Spring triticale for swath grazing	100 – 120	1.5 - 2.0
Winter triticale + spring cereal, swath grazing	15 - 20	0.25 - 0.5
With oat, add oat at	70	2.0
With barley, add barley at	100	2.0

[1] Recommended seeding rates, as target plant densities are unavailable, so use lbs/acre
Recommendations may differ from zone to zone

- AAFC recommends 1 bu/acre each of triticale and peas if grown together in a mixture
- AAFC recommends using winter triticale seeded at 1.25 bu/acre plus 1/3 to 1/2 bu/acre of spring cereals, intercropped

(Table adapted from AAFC, AAFRD, BCMAFF, MAFRI, and SAFFR websites, 2004)

Seeding date

For seeding spring triticale, plant as early as possible to reduce risk when harvesting grain and to maximize forage yields. Because spring triticale is a late maturing crop, seeding for grain production should be completed by the second week of May in all parts of the western prairies and British Columbia. If conditions allow, seed as early as May 15 for maximum yield.

Optimum seeding dates for winter triticale for grain are the same as those for winter wheat. At least three or four weeks of growth are needed to develop seedling hardiness in winter triticale. This allows winter triticale to develop at least 3 to 4 leaves and adequate crown establishment.

The range of suitable dates for seeding winter triticale is from the second week of August (the earliest date recommended for more northerly and higher altitude sites) to no later than the second week of September (for southern prairie locations).

Variation in soil temperature for germination is the main environmental factor influencing the optimum planting dates for winter triticale. Late seeding usually results in lower winter hardiness, since winter triticale does not harden as fast as winter wheat and fall rye. Seeding too early allows too much seedling growth and increases the risk of winterkill.

Winterkill can be minimized using the same optimal management procedures as for winter wheat (for more detail refer to *Winter Wheat in the Parkland Area of Alberta*, Agdex 112/11-1). This involves direct seeding into tall standing stubble to trap snow, and to prevent the seedling crown structures from being exposed to critical low killing temperatures. Avoid late, deep seeding as it results in poor establishment of the winter triticale crop.

Consult the section of this manual on triticale forage use for optimum seeding dates for special forage applications. Seeding dates for special purposes, including forage use or swath grazing, should be adjusted according to general guidelines shown in Figures 17 and 18, and adjusted for local conditions and management objectives.

Seeding depth

Shallow seeding is recommended for winter triticale to ensure rapid emergence and optimal winter hardening.

Triticale should be seeded between 0.5 to 1.5 inches deep (optimum 1 inch) and never deeper than 2 inches. Shallow seeding allows for:

- More rapid emergence.
- Early vigor.
- Improved competition with weeds.

Due to its large seed size, triticale is able to emerge from deep seeding. However, this usually results in decreased emergence and less plant vigour. Just as with winter wheat, shallow planting of winter triticale is recommended to ensure a rapid emergence and a hardening of the crown to improve winter survival.

Seed quality and seed standards

Use pedigreed seed as it has many superior properties as compared to bin-run seed:

- Guaranteed genetic purity.
- Certified low levels of other crop types and weeds.
- Potentially lower levels of seed-source disease and pest infection.
- Tested for germination.
- Better seed size uniformity.
- More even germination.
- Generally better yield potential.

If using bin-run seed, ensure that seed is cleaned to pedigreed seed standards, and that germination percentage is never less than 75 percent. Use accredited seed laboratories to check seed quality. Samples with germination percentage as low as 75 percent may also be reduced in vigor.

Fertilizer requirements of triticale

In general:

- Recommended fertilizer rates for forage use are generally similar to those for producing grain.
- Base your fertilizer requirements on results from soil tests, and fertilize according to pre-planned yield targets for the particular field.
- Adjust yield targets and fertilizer applications according to previous crop, soil type, and expected seasonal moisture levels.
- On fields that have received high levels of manure application (to which triticale is well adapted especially for silage production), monitor soil nutrient levels for over-accumulation of P and K in the soil.
- Banding with N is recommended.
- Placing some of the N with the seed can be an effective procedure under optimal conditions. However, maximum recommended rates must be reduced under drought conditions.
- Ammonium nitrate (34-0-0) with the seed is safer than 46-0-0 (Table 32).
- Double shoot, side banding, mid-row banding air drills and/or air seeders with spreader boots all reduce the risk of seed or seedling burn from fertilizer placement with the seed. Air seeders with spreader boots increase the Seed Bed Utilization (SBU). For example 9" sweeps with 3" spreader boot is 33% SBU (Table 32).
- Double shoot systems, new mid-row air drills, or side banding units have seed and fertilizer separation to reduce risk of seed or seedling burn.

Production goals can be set by reviewing the specific suggestions that are included with the soil test results. General guidelines for fertilizer application on the prairie provinces can be used when soil test results are unavailable (Tables 29 to 32).

When growing winter triticale, N-P-K-S should normally be banded at recommended rates.

If you are broadcasting additional nitrogen in spring, 34-0-0 is preferred as losses can occur with 46-0-0 when there is low moisture and temperatures higher than 10 degrees Celsius.

Table 29. General fertilizer recommendations (lb/acre) for wheat, for Alberta
(These recommendations can safely be used for spring and winter triticale)

		Nitrogen		Phosphate (P_2O_5)	
	Soil zone	**Fallow**	**Stubble**	**Fallow**	**Stubble**
Spring wheat	Brown	5-20	20-50	10-20	0-15
	Dark brown	5-20	25-60	15-35	0-25
	Thin black	5-25	35-65	15-35	10-35
	Black + Grey wooded	5-35	30-80	15-40	15-40
Winter wheat	Brown	20-30	25-55	10-25	10-25
	Dark brown	25-35	30-65	20-40	15-30
	Thin black	25-45	40-80	25-45	20-40
	Black + Grey wooded	nr	nr	nr	nr

nr = No recommendation reported *(AAFRD website, 2004)*

Table 30. General fertilizer recommendations (lb/acre) for all crops, for Saskatchewan

	Nitrogen				
Soil zone	**Stubble**	**Summerfallow**	**Phosphorus**	**Potash**	**Sulphur**
Dark brown	25-60	0-15	20-35	-	-
Black	45-65	15-55	20-35	-	-
Dark grey	50-90	20-60	20-35	0-35	0-20
Grey	50-95	20-60	20-35	0-35	10-20

(SAFFR website, 2004)

Table 31. General fertilizer recommendations for triticale for Manitoba

Nitrogen (N)	0-20 lb/acre following fallow or legume breaking
	20-40 lb/acre following grass and grass-legume breaking
	40-60 lb/acre following stubble
Phosphate (P_2O_5)	30-40 lb/acre (shortage shows as purpling/browning on leaf tips)
Potassium (K_2O)	On sandy textured or organic soils, 15-30 lb/acre
Sulphur (S)	When required, 15 lb/acre

(MAFRI website, 2004)

Table 32. Maximum rates of nitrogen (as urea 46-0-0) that can be safely placed in the seed row with cereal grains

	Width of spread in the row											
	1 inch			2 inch			3 inch			4 inch		
	Disc or knife			Spoon or hoe			Sweep			Sweep		
Row spacing (in)	6	9	12	6	9	12	6	9	12	6	9	12
Seed Bed Utilization (%)	17	11	8	33	22	17	50	33	25	67	44	33
	Maximum recommended N with seed (lb/acre):											
Light soil (sandy loam)	20	15	10	30	25	20	40	30	20	50	40	30
Medium soil (loam to clay loam)	30	25	20	40	35	30	50	40	35	60	50	40
Heavy soil (clay to heavy clay)	40	35	40	50	40	35	60	50	40	70	60	50

- If ammonium nitrate (34-0-0) is used, and seedbed moisture is good to excellent, 50% higher rates can be used.
- 'Safe' rates listed are for good to excellent seedbed moisture conditions, with packing and residue cover to reduce seedbed moisture loss.
- The research for these rates was done with wheat, barley and oats, but results would also apply to triticale.

(Source AAFRD website 2004)

Grain harvest and storage

Harvesting and storage management for triticale is generally similar to that for wheat. However, spring triticale for grain is a late-maturing crop, and is also more susceptible to sprouting conditions at harvest than HRS wheat.

In dryland conditions, straight cutting of triticale is recommended where conditions allow. This is because straight cutting for grain can help reduce losses from pre-harvest sprouting, which triticale is much more susceptible to than is wheat.

Combining at 14 percent grain moisture is considered dry for triticale. This moisture content will not cause storage problems.

Moisture content lower than 13.5 percent is very desirable, as most moulds and insects tend to be inactive below this moisture level. Risk is also reduced when storage temperatures are lowered below:

- 8°C for insects.
- 3°C for moulds.
- –8°C for mites.

Kernels with moisture content up to 20 percent can be harvested and, if properly dried, will not lose quality. If drying triticale grain, maximum desirable temperatures are:

- 40°C for seed.
- 65°C for commercial grain.

If swathing the crop, ensure that the grain moisture is 35 percent or lower. It is recommended that winter triticale be straight combined, as it matures three weeks earlier than spring triticale and several classes of wheat. Combine settings should be set similar to those for wheat, with care taken to slow the cylinder speed to minimize grain cracking and splitting.

Triticale grain grade standards

Kernel size and test (bushel) weight

- Triticale test weight is comparable to other cereals, except some wheat classes and hulless barley.
- Registered varieties have test weights that readily allow them to meet the minimum requirement of the top grade of No. 1 Canada Triticale (65 kg/hl = 52 lb/bu; Source CGC Official Grain Grading Guide, August 1, 2003) (Table 34).
- Triticale has a very large kernel size which should always be taken into account when determining seeding rates, and for which processing adjustments may also be needed for grain use in value-added technologies.

Modern triticale varieties have very high kernel weights, and test (bushel) weights that are comparable or superior to many other cereal grains. The range of differences between varieties for test weight is of similar order for all the cereal crops listed in Table 33 except for milling wheat and malting barley, where uniformity of test weight in different varieties is a more stringent registration requirement.

A wide range of seed size is found between varieties in all cereals, including triticale (Table 33). It is particularly important to properly adjust seeding rates for triticale to meet adequate target plant densities in the field due to:

- Wide range of differences in varieties
- Variability between seed lots
- Large average kernel seed size

Adjustments are often needed to milling and processing equipment for optimal performance when working with larger seeded grains.

Plant Breeder's Rights

Avoid becoming involved in unauthorized sales of varieties that have Plant Breeders Rights (PBR). Fines are substantial for illegal use. Many varieties of grain are managed under Plant Breeder's Rights legislation. This legislation allows the owner of the variety to prevent the unauthorized sale or use of a protected variety's seed. Fines for unauthorized use are substantial, and active programs are underway to identify all PBR-related unauthorized seed use in Western Canada. Contact your seed distributor for clarification of your rights and obligations when growing a PBR variety.

Table 33. Test weight and 1000 kernel weight of triticale and other cereal grains

		Test Weight (lbs/bushel)[1]		1000 Kernel Weight (g)		
Cereal crop		Min – Max	CGC Min.[2]	Min – Max	Average	Variety
TRITICALE	Spring triticale	54 – 59	52.0	43 – 49	43	Pronghorn
	Winter triticale	54 – 59	52.0	43 – 49	43	Pika
OAT	Milling or feed oat	38 – 42	44.8	35 – 43	41	Derby
	Hulless oat	41 – 50	-	30 – 38	-	-
WINTER	Fall rye	56 – 58	52.6	30 – 33	30	Dakota
	Winter wheat	62 – 65	62.4	30 – 38	34	CDC Claire
WHEAT	CWRS wheat	58 – 64	60.0	33 – 42	37	AC Barrie
	CWHWS wheat	58 – 59	60.0	34 – 35	35	Snowbird
	CPS wheat (all)	61 – 62	61.6	39 – 43	42	AC Crystal
	CWES wheat	60 – 62	60.0	39 – 46	43	Glenlea
BARLEY	General purpose barley	48 – 53	50.4	39 – 49	48	CDC Dolly
	Semi-dwarf barley	47 – 53	50.4	35 – 48	48	CDC Bold
	Hulless barley	57 – 62	60.0	32 – 41	38	CDC McGwire
	2-row malting barley	51 – 53	50.4	43 – 47	45	AC Metcalfe
	6-row malting barley	47 – 51	50.4	36 – 42	40	Robust

[1] lb/bu x 1.25 = kg/hl; Data source: Alberta, Manitoba and Saskatchewan Provincial annual variety description pamphlets
[2] CGC Min. - Canadian Grain Commission minimum test weight (lb/bu) required for the top deliverable grade

Table 34. Triticale Canada Grade Standards

	Triticale, Canada		
	No. 1 Canada	**No. 2 Canada**	**No. 3 Canada**
Minimum test weight, kg/hl (lb/bu)	65.0 (52.0)	62.0 (49.6)	-
Foreign material:			
Cereal grains other than wheat %	1.0	2.0	3.0
Ergot %	4K	8K	0.1
Excreta %	0.01	0.01	0.03
Matter other than cereal grains %	0.5	1.0	2.0
Sclerotinia %	4K	8K	0.1
Stones %	0.033	0.033	0.066
Total foreign material %	2.5	4.0	7.0
Grain damage:			
Broken %	4.0	7.0	50.0
Fireburnt %	Nil	Nil	Nil
Fusarium %	0.25	0.5	1.0
Heated %	0.1	0.75	5.0
Smudge and blackpoint %	10.0	15.0	-
Sprouted %	0.5	2.0	10.0

K = Number of kernel-sized pieces in 500g
(Official Grain Grading Guide, August 1, 2003, Canadian Grain Commission)

Table 35. Triticale seed grade standards for Canada

	Maximum number of weeds in 1 kg of seed				Maximum	
	Noxious weeds			Total	ergot	Minimum
		Primary +	Total	other	bodies	percent
Seed grade name	**Primary**	**secondary**	**weeds**	**crops**	**per kg**	**germination**
Canada Foundation No. 1	0	0.0	2	1	2	75
Canada foundation No. 2	0	0.2	4	2	10	65
Canada Registered No. 1	0	0.0	3	2	2	75
Canada Registered No. 2	0	0.2	6	4	10	65
Canada Certified No. 1	0	0.2	3	4	4	75
Canada Certified No. 2	0	1.0	6	10	15	65
Common No. 1	0	2.0	10	25	4	75
Common No. 2	2	4.0	20	50	15	65

- True loose smut tests are also required on all samples of pedigreed seed, to determine need for seed treatment
- Tolerance frequency for genetic off-types in certified seed production is 5 / 10,000 plants *(CSGA Circular 6-94)*

(Source: Canada Seeds Act, Schedule I, Table II, March 2004)

Interpretation: Using pedigreed seed avoids planting high frequencies of weed seeds, and provides crop purity

Part 6. CROP PROTECTION

Diseases of triticale

Triticale usually has a very low incidence of disease problems compared to other cereals. It is not susceptible to barley scald, making it an excellent alternative for grain or forage/silage use in continuous barley rotations.

Triticale has an excellent resistance level to rusts and to powdery mildew, but shares many other minor diseases in common with other cereal crops. Crop rotations that include triticale should be lengthened so that cereal crops that are at risk from the same diseases are never grown back-to-back (Table 36). Using proper crop rotation, disease-free seed, and seed treatments will solve most disease problems before they occur.

The only registered seed treatment approved for use on triticale is:

- Vita flo 280 for damping off, seed decay and seedling blight.

Management practices that result in rapid crop establishment, proper crop nutrition and early vigorous growth also produce crops with a better ability to tolerate disease infestation. In the case of ergot infection in cereals, there is considerable evidence linking high levels of ergot infection with sub-optimal levels of copper availability in the soil. Soil tests for micronutrients are required to check soil copper levels when this deficiency is suspected.

Due to triticale's excellent leaf and head disease tolerance, the use of fungicides for control of infection has not proven necessary in Western Canadian triticale production.

Fusarium head blight or FHB (*Fusarium graminearum*) is the most serious disease threat to triticale, especially in the eastern prairies. Growers need to practice a high level of seed and crop rotational management to minimize infection risk. Special post-crop measures are required in any field where this disease occurs to minimize further disease spread to other crops. In Alberta, all triticale seed must be tested for *Fusarium graminearum* before cleaning at municipal plants and seeding.

When best management practices are applied, similar to those recommended for rye, the risk of ergot infection in triticale should be no more than for wheat:

- Use ergot-free seed, planted in ergot free fields in an extended rotation that gives yearly separation between ergot-susceptible crops.
- Mow grassy headlands to avoid infection from grasses spreading into the edges of triticale production fields.
- Ensure soil copper levels are adequate. High ergot levels are a good indication of low copper.

There are other diseases that occur rarely or at an insignificant level in Western Canadian triticale. These include:

- Bacterial blight
- Barley yellow dwarf virus
- Cochliobolus and browning root rots
- Cephalosporium stripe
- Sharp eyespot
- Spot blotch (and blackpoint)
- Take-all
- Tanspot
- Wheat streak mosaic virus

For details about specific diseases of triticale, see ***Diseases of Field Crops in Canada***, Editors K.L. Bailey, B.D. Gossen, R.K. Gugel, and R.A.A. Morrall, Univ. of Saskatchewan Extension Press 2004.

Fusarium head blight

Fusarium head blight (FHB) is the most destructive disease of wheat and barley in the eastern prairies. It affects a number of crops including triticale (Table 36).

The causal fungus is *Fusarium graminearum*. It has the capacity to survive for many years in the soil of previously infected fields. It is very serious problem in Manitoba and Saskatchewan, but as of 2004, had not moved significantly into Alberta.

With the exception of Pronghorn and some of the new varieties, which are rated as intermediate or fair for resistance, current spring triticale varieties have poor tolerance to *Fusarium graminearum*.

Winter triticales, like winter wheat, also have poor tolerance. However, like winter wheat, winter triticales may escape serious FHB infection because they flower and mature earlier in the season than do spring cereals. Under intense disease pressure, such as in Manitoba, winter triticales may escape heavy late-season infection from the disease. When doing so they offer a lower-risk management alternative for feed or forage production.

A provincial plan has been enacted in Alberta to reduce the risk of the disease spreading into the province. Under this plan, the following statutory preventative measures apply to all cereal seed crops, including triticale.

These measures also represent best management practice for areas that already have the disease:

- In Alberta all cereal seed must be tested and certified free of *Fusarium graminearum* before cleaning and planting.
- All non-Alberta seed must be treated with a fungicide seed treatment registered for *Fusarium graminearum*.
- If *Fusarium graminearum* is found in an Alberta production field, that crop will be immediately ensiled, harvested or destroyed, and the crop residue deeply buried. Cereal production, including corn and grasses, is then disallowed in that field for a minimum of three years.
- Infected feed brought into Alberta, or found in Alberta, shall be managed using best management practices in order to prevent the escape of inoculum during transportation and feeding.

While *Fusarium graminearum* can significantly reduce a crop's yield potential, there is an even more serious effect. The fungus produces a mycotoxin, deoxynivalenol (DON), that can reduce crop value and create feed and food safety risks. This toxin reduces feed intake and can cause serious illness in animals and humans. Growing plants and kernels may not show visual symptoms of FHB but can still have high DON levels in the grain.

Research on DON levels in triticale is underway, but very little is yet known about the relationship between symptoms of FHB and DON levels in triticale. Little is also known about whether or not DON levels differ among diseased triticale varieties.

Table 36. Cereal crop host range for major diseases that can attack triticale

	Triticale	Wheat	Barley	Oat	Rye	Corn	Cultivated grasses	Wild grasses
Fusarium head blight	x	xx	xx	xx	xx	xx	x	x
Ergot	x	x	x	-	xx	-	x	x
Leaf spot complex	x	xx	x	x	x	-	-	-
Common root rot	x	xx	xx	x	x	-	x	x
Leaf rust	x	xx	x	-	x	-	-	-
Stem rust	x	x	xx	-	x	-	-	-

Diseases listed in order of relative risk for triticale.
x = Some risk xx = Severe risk
(Source http://www.infogrow.ca/content/disease/general/hostRangeWCan.shtml)

Interpretation: Other crops in the rotation can affect the disease risk for triticale, because some diseases have a wide host range

Ergot

While ergot rarely reduces the yield potential of any cereal crop, it can reduce the value of triticale for food and feed grain. This is due to the highly toxic nature of alkaloids found in the ergot bodies in the harvested crop. These alkaloids are extremely poisonous to humans and to livestock. This potential danger has resulted in an extremely low grade tolerance of 0.1 % for ergot in triticale and other cereal grades. Marginally deficient micronutrient levels of copper will increase ergot levels.

Ergot can infect (in order of risk from most to least):

- Rye
- Triticale
- Wheat
- Barley

Ergot infects grasses, which provide a source of infection from headlands into infected fields.

- If ergot is only found in the triticale crop perimeter, infection from grassy headlands is the most likely inoculum source.
- If ergot bodies are found in heads of the crop scattered evenly throughout the field, the likely source of the infection is seed contaminated with black, grain-sized, over-wintering bodies called sclerotia.

When an ergot-infected field is harvested, some sclerotia will be found in the harvested seed sample. Other sclerotia will return to the soil with the chaff and straw where they can over-winter for usually not more than one year.

In spring, the sclerotia germinate and produce tiny mushroom-like structures. These structures in turn produce spores that can infect open florets of susceptible cereals. Infected florets have their seed replaced by a sclerotium. Honeydew liquid may also be formed which splashes between heads and further spreads the disease.

High levels of ergot are found when cereal flowers open under stress (e.g. drought stress) and when conditions are cool and moist, as this extends the time under which infection can occur.

Ergot control measures

Florets in new triticale varieties are less frequently sterile than florets in earlier varieties. Also, the florets tend to remain closed, unlike the open floret structures of rye. As such, the risk of spores getting into the florets is much lower than in rye, and more like the risk found in wheat. However, as florets can open under stress, good management is still the best approaching to controlling the disease.

Best management practices to prevent ergot occurring in triticale are the same as those for rye:

- Use cleaned triticale seed (preferably pedigreed) that is completely free from ergot to avoid introducing this disease to the field. There are no cereal varieties with a true resistance to ergot, nor are there any pesticide controls available.
- Do not grow triticale in fields following crops that you know to have had an ergot infestation. Mix up the crop types in your crop rotation to avoid cereal following cereal. Also avoid planting triticale after brome or in fields with quack grass, as both of these grasses are extremely susceptible to ergot.
- Keep grass headlands mowed up to heading time, so that ergot cannot complete its annual life cycle on the wild grasses that grow there. This will reduce the potential for field-edge infections in the next year. If ergot bodies survive in the headlands, they can be a source of infection for adjacent triticale plants in the field.
- If ergot bodies are seen in the crop on the field edges, but not elsewhere in the field, cut the edges of the field separately and store that harvested grain apart from the rest of the grain from that field. Delaying crop harvest will allow many ergot bodies to fall to the ground, reducing their frequency in the harvested crop.
- Ensure soil copper levels are adequate. High ergot levels are a good indication of low copper.

Several other techniques also help to control ergot. These include crop rotation, and deep cultivation or deep seeding (1-2 inches deep) to deeply bury the sclerotia. Commercial seed cleaning can also reduce ergot levels. However, if infection levels are high around field margins, separate binning may still be required.

Insects and pests of triticale

Risks from insect damage in triticale are similar to those for wheat. Triticale is vulnerable to grasshoppers, aphids, armyworms, orange blossom wheat midge and cutworms.

Management practices for these insects are the same as for other cereals. These practices should be applied only when continual field scouting indicates that the problem has reached an economic threshold for control.

Consult provincial recommendation guides (*'Crop Protection'* AgDex 606-1) for the best management practices for controlling insect infestations, and for information about approved insecticides.

Weed management in triticale

The ability of various cereals to compete with weeds is usually in the following order for winter cereals, ranked from best to worst:

- Fall rye
- Winter triticale
- Winter wheat

For spring cereals the order from most competitive to least is:

- Oat
- Barley and triticale (equal)
- CWRS Wheat
- CPS Wheat

The actual competitiveness of different cereals depends on growing conditions, management practices, weed load and relative growth stage of the weed and crop. As such, the actual order of resistance may differ.

Triticale's competition to weeds is provided by its leafiness and tallness, which impact light and moisture competition. Even so, there is still a wide range of weeds that can be a problem for triticale. These weed types vary between spring and winter triticale, and also vary by soil zone.

Best management practices for weed control

Best management practices for weed control in spring triticale are similar to those for spring wheat, and for winter triticale are similar to those for winter wheat.

These include:

- Seed at higher rates and ensure proper fertility, which can help control weeds in spring and winter triticale.
- Plan ahead. Chemical weed control options in triticale are limited. Select relatively clean fields to seed triticale.
- In the case of perennial weed problems such as Canada thistle and quack grass, apply pre-harvest glyphosate the previous fall or use as a pre-seed burn-off in direct seeded situations. Use in-crop herbicides to control or suppress broadleaf weeds.
- Use certified seed as this ensures that only triticale, and not weeds, is seeded. Certified seed is also more vigorous than bin-run seed.
- Seed early, as earlier sown spring triticale usually results in more competitive stand establishment, and provides a jump-start on the weeds.
- Seed shallow at between 0.5 to 1.5 inches (optimum 1.0 inch). Shallow seeding generally results in uniform seedling emergence that quickly covers the ground and competes with emerging weeds.
- Use good sanitary practices. Clean machinery and seeding equipment before seeding.

Only a few registered herbicides are available for triticale. It would be useful if a wider range of minor-use registrations could be approved, for use in single and double cropping situations for both grain and forage. This would include burn-off applications for perennial weed control in reduced tillage situations.

Weed competitiveness of triticale

No differences have yet been reported for the weed competitiveness between triticale varieties. However, a general rule of thumb in cereals is that taller, leafier varieties are more competitive due to the ability to close the canopy quickly.

Being somewhat weed competitive, triticale is sometimes used in a 'green' approach in crop rotations to reduce weed seed banks. When seeded early and under good conditions, triticale will compete with many weed species. Although it is not as effective as rye, winter triticale is very competitive with wild oats.

Triticale's potential as a herbicide substitute is of particular interest to organic growers, who could use this crop for partial control of weeds in their rotations. Use of triticale in this way has not been promoted in any of the extension literature available in Western Canada. This is because while triticale's 'competitiveness' is known, there is not a large database about its effectiveness for weed control when used in this manner.

Australia's Lemerle and Cooper (1996) found that triticale was a better weed competitor than wheat against the grass weed annual ryegrass. Triticale's potential to suppress weed growth in organic crop production is currently being tested (Spaner, 2004) at the University of Alberta.

Weed management strategy in spring triticale should follow the same principles as used for spring wheat. Strategies for winter triticale should follow winter wheat principles.

When grain is delivered and graded, weed seeds that cannot be cleaned out are considered foreign matter. Grain containing more then two percent foreign matter are downgraded.

'Foreign matter' could include:

- Cow cockle
- Ragweed
- Tartary buckwheat
- Vetch
- Wild oats
- Non-cereal domestic grains

Problem weeds and limited availability of registered herbicides for triticale

Although there are many herbicides that could control the most common weeds that occur in spring and winter triticale (Table 37), very few herbicides are registered in Canada for use in this crop. There is clearly a need for more herbicides to be registered for minor use in triticale.

Registered products for control of wild oats and some broadleaf weeds in triticale include:

- Achieve
- Hoe Grass II
- Pardner

Check the Alberta AgDex 606-1 '*Crop Protection*' each year for registration changes.

The use of pre-seeding and post-seeding glyphosate (Roundup), which must be applied before the crop emerges, are options to reduce weed competition when direct seeding. Pre-harvest glyphosate can also be used in the crop year prior to seeding spring triticale.

Currently, Alberta Agriculture researchers (Hall and Topinka) have submitted two years of research supporting the following herbicides for minor-use application:

- Horizon, Everest and Sundance for wild oats.
- Refine extra, 2 4-D and MCPA for broadleaf weeds.

Note these herbicides are not recommended and listing these products does not imply endorsement for use.

Table 37. Commonly occurring weeds in triticale on the Canadian Prairies

Summer Annuals		**Winter Annuals**	**Perennials**
Annual smartweed	Persian darnel	Downy brome	Canada thistle
Annual sow-thistle	Prostrate pigweed	Stinkweed	Field horsetail
Cleavers	Redroot pigweed	Flixweed	Foxtail barley
Barnyard grass	Russian pigweed	Narrow leaved Hawk's-beard	Quackgrass
Bluebur	Russian thistle	Shepherd's purse	Perennial sow thistle
Shepherd's Purse	Cleavers		Toadflax
Common chickweed	Spiny sow-thistle		Dandelion
Common groundsel	Stork's-bill		Field bindweed
Corn spurry	Tartary buckwheat		
Cow cockle	Volunteer canola		
Green foxtail	Volunteer mustard		
Hemp Nettle	Wild mustard		
Kochia	Wild oats		
Lamb's quarters	Wild buckwheat		
Night flowering catchfly			