



# CropPest Ontario

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## First Detection of Kudzu in Ontario. What is the Implication for Soybean Rust?

**Albert Tenuta, Field Crop Plant Pathologist, OMAFRA, Ridgeway**

As you may have already heard, the invasive weed Kudzu has been found for the first time in Ontario near Leamington. Kudzu is often referred to “as the vine that ate the south” due to its notorious rapid growth rate (it has the ability to grow a foot a day under favourable conditions). This is a significant confirmation although it shouldn’t come as a surprise considering Kudzu has been found in the bordering Great Lake States of Pennsylvania, New York, Ohio and Michigan. However, the distribution has been very localized in these States as it is here in Ontario.

Will this increase our risk to Soybean Rust? Probably not at this time since the soybean rust fungus requires a living host to survive. It will not produce spores on dead plant material whether that be soybeans or Kudzu. Fortunately for us, Kudzu is sensitive to below freezing temperatures and just about the time we bring out the winter coat, Kudzu will drop its leaves (defoliate). However, based on the size of the vine at the Leamington site, the newly discovered Kudzu appears to have over-wintered in Leamington. But again, without leaves and our very cold winter temperatures, it is very unlikely any soybean rust spores could survive and pose a threat the following year. Samples have already been collected and are now being tested for soybean rust infection.



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# Frost Damaged Corn Silage

**Joel Bagg, Forage Specialist, OMAFRA, Lindsay**

Late planting dates, low Crop Heat Unit (CHU) accumulations, and early frost may result in situations where corn is killed by frost before it reaches the normal stage of maturity for silage. Some fields planted for grain may not mature adequately for optimum yield, moisture and quality. Growers may be looking at salvaging these crops by harvesting or selling some of those fields for silage. A key to making the most of frost damaged corn silage is to harvest it at the correct moisture.

## Nutrient Quality

Slightly immature, frost damaged corn that has dented can make good silage. Energy is partitioned differently

in immature silage than in normal corn silage. Immature corn has lower levels of kernel starch, but there are higher levels of untranslocated sugars in the stalk. Kernel texture will be softer and starch more digestible. Kernel processing of wet, immature corn silage is not likely required. The fibre content will be higher, but it will be less lignified and more digestible than in mature silage. In general, slightly immature corn silage will have slightly higher fibre and crude protein and slightly lower energy levels than normal corn silage

For high quality silage, corn should be past the “late dough” or “early dent” stage of development. Very immature corn at the milk or early dough stages will have lower starch and higher fibre. Research shows that corn silage at the “dough” stage may be 3 percentage points lower in digestibility and 8 percentage points higher in Neutral Detergent Fibre (NDF) than normal. University of Wisconsin research indicates that harvesting silage before the late dough or early dent stage results in less “Milk Per Ton”. Very immature corn silage with less than ideal quality can be fed to animals with lower nutrient requirements. Storage of poorer quality silage in a separate silo, such as a bag silo, is also a consideration. Immature corn can be expected to yield less silage, so more acres will likely be required to fill the silo and meet forage requirements. Dough stage corn has about 65 to 85% of normal silage yield.

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## Laboratory Nutrient Analysis

Accurate laboratory analysis of corn silage is important to successfully predict energy values and balance rations. Wet chemistry, rather than NIR analysis is recommended for frost damaged or immature corn silage because it is so different. Digestible energy of corn silage is primarily determined by the relative amounts of starch and fibre (NDF) and their digestibilities. Immature corn silage has less starch but more fermentable plant sugars. In the past, ADF was used to estimate energy, and NDF was used to estimate intake, but these measures alone do not consider digestibility. Newer methods more accurately estimate corn silage digestible energy using crude protein, NDF, fibre

# Frost Damaged Corn Silage

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digestibility (NDFD), starch, ash and fat. Starch digestibility can also be estimated using moisture, kernel processing scores and other laboratory starch digestibility tests.

### Whole Plant Moisture Critical

Harvesting at the proper whole-plant moisture is critical for producing high quality corn silage. It is difficult to know when to harvest frost-damaged corn because we cannot use the “kernel milk line” guidelines.

Harvesting frost damaged corn silage too wet is the most serious problem. At moisture greater than 70%, clostridial fermentations produce butyric acid. Butyric acid results in high fermentation losses and gives the silage a “fishy”, rancid odour. Silage containing butyric acid results in lower intake, ketosis and poor cow performance. A fermentation analysis can be used as a diagnostic tool when there are suspected fermentation and feeding issues. Seepage results in a loss of highly digestible nutrients and is harmful to the environment. Very wet, frozen silage can be difficult to unload in the winter. Refer to OMAFRA Factsheet 07-047 “Harvesting Corn Silage At the Right Moisture” [www.gov.on.ca/OMAFRA/english/crops/facts/harvesting\\_corn.htm](http://www.gov.on.ca/OMAFRA/english/crops/facts/harvesting_corn.htm).

### Dry Down After Frost

Although dead, frosted leaves give the appearance of rapid dry down, most of the moisture is in the stalk and grain. Frosted corn often appears to be drier than it really is, and harvesting at a moisture level that is too high is a common mistake.

Immature, frozen corn often does not dry down significantly faster than unfrozen corn (typically about 0.5% per day), and may require many days of drying to reach the correct moisture content. When this is happening, dead plants will drop leaves and sugars leach from frosted leaves. Yield losses and moulds will increase with time. However, producers need to balance these losses against fermentation and butyric acid problems associated with silage that is too wet. What typically occurs is that a few days following a killing frost, everyone wants to harvest at the same time.

If you are in doubt about the whole-plant moisture, chop a sample to determine percent dry matter. Watch for moisture variability within fields. Keep in mind that Koster Testers and microwaves tend to under-estimate moistures by about 3% because it is so difficult to remove the residual. A 68% moisture sample reading is actually about 71%. In a typical year, that 3% is equivalent to almost a week in harvest time. If using a Koster Tester or microwave, taking the time to carefully dry the sample is important. The finer the sample is chopped, the easier it will be to dry, and the more accurate the result. A more accurate alternative is to courier a sample overnight to a forage laboratory for a moisture determined by oven drying.

### Nitrates & Cutting Height

After a frost, if the leaf material is dead but stalks and roots are alive, nitrates can accumulate in the lower stalk. This increases the risks of nitrate toxicity and silo gas. Increasing cutting height by 30 cm (12 in.) can reduce yield by about 15%, but it will increase quality because the lower stalk has the lowest digestibility and the highest nitrate levels. Do not add non-protein nitrogen (NPN) to very immature corn silage, as seepage will concentrate NPN in the lower portion of the silo. Refer to OMAFRA Publication 811, *Agronomy Guide* for more information on silo gas and managing high nitrate levels.



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# Corn and Cold September Nights

## Greg Stewart, Corn Specialist, OMAFRA

A combination of late planting dates in many areas of the province along with crop heat units accumulating at a pace somewhat behind normal has caused an increased level of anxiety over cool September nights where the risk of frost looms large. The actual level of anxiety for most growers will be determined by the stage of maturity their grain corn crop has reached.

As temperatures drop to zero, frost damage first occurs to the leaves of the corn plants. This damage will eliminate any further photosynthesis, reduce grain filling and often have a negative effect on stalk strength. However, as long as air temperatures do not fall below -2 Celsius stalk tissues will remain viable and stalk constituents will be mobilized to fill the ear as much as possible. If on the other hand temperatures fall below -2 Celsius both leaves and stalks may be damaged and no further photosynthesis, or remobilization can occur. This will terminate grain filling and kernel black layer will develop. Table 1 outlines the potential risks to yield and quality for grain corn experiencing different levels of frost damage.

Generally growers will recognize the early dent stage as being the cut-off point where corn can withstand frost damage to the leaves and still produce a reasonable grain yield. This stage is characterized by having kernels, at least in the lower half of the cob, showing small indentations in the crown of the kernel. It should also be noted that grain quality concerns are based mostly on low test weights. However, most of the experience and research from Ontario and other jurisdictions indicate that the feed value of low test weight corn (46-52 lbs/

bushel) is quite similar to normal test weight corn.

The other question regarding cold nights revolves around the corn crop's ability to continue grain filling after experiencing several cold nights but where no frost damage occurs. Dr. Thys Tollenaar, University of Guelph has conducted research where he measured 50% reductions in photosynthesis and rate of grain filling due to cold nights of 2 degrees Celsius. However when these plants were restored to higher temperature conditions they resumed plant activities at rates similar to those plants that had never experienced the low temperatures. Producers can take heart in the fact that if cornfields can escape any serious frost damage during cold nights, grain filling will carry on once normal temperatures return.

In some situations frost damage will preclude harvesting the crop as grain and will force the grower to consider harvesting it as silage. There are important issues surrounding the management of the silage crop as well. Following a frost, silage corn frozen before reaching the half milk line on the kernel may be too high in moisture to be properly ensiled. In cases of frost, ideally corn harvest should be delayed until the whole plant reaches the desired moisture content for ensiling.

Recommended corn silage moisture content for optimal fermentation are: 60 to 70 percent moisture for an upright top unloading silo, being closer to 60 for the taller silos', 50 to 60 percent moisture for an upright bottom unloading silo and 67 to 72 percent for a horizontal or bunker silo. Excessive silage moisture at harvest can also lead to storage seepage and unloading

difficulties in winter. Often after a frost event, and with rapid change in leaf colour, standing corn appears drier than it actually is. Check whole plant moisture content and be sure to get silage moisture correct for proper storage.

**Table 1. Estimated risks to grain corn yield and quality associated with late season frost damage.**

Crop Growth Stage	Frost Damage	Estimated Grain Yield Loss (%)	Grain Quality Concerns
Mid-dough	Complete plant	40	Severe
Mid-dough	Leaves only	25	Severe
Early Dent	Complete plant	25	Moderate
Early Dent	Leaves only	15	Moderate
Half Milk Line	Complete plant	10	Minor
Half Milk Line	Leaves only	0-5	None

Note: This table is meant as a guide; differences among hybrids, overall plant vigour at time of frost, and subsequent temperatures will all affect final grain yield and quality.

# Beware of Nitrates in Corn Silage

## Beth Wheeler, Dairy Cattle Nutritionist, OMAFRA

Dry conditions may cause high nitrate levels in corn silage. High nitrate levels can lead to nitrate poisoning and the formation of toxic silo gas.

- Any condition which kills the leaves while the roots and stems remain active (drought, overcast, weather, hail, grazing or trampling, frost)
- Prolonged drought followed by rain
- High nitrogen fertilization caused by heavy fertilizer or manure applications or following legume plow down

Under these conditions, plants accumulate high levels of nitrates. When eaten by animals, the nitrates are converted rapidly to nitrites which are absorbed into the blood stream. Nitrite in the blood alters the way the blood carries oxygen. This causes rapid breathing, fast and weak heartbeat, muscle tremors, staggering and death if corrective steps are not taken quickly.

In normal growing conditions, much of the nitrate is taken up by the cobs and converted to protein. When there are few (or no) cobs, nitrate content of the stalks will be higher. Use caution when green chopping corn this year as nitrates may be considerably higher than normal. Higher cutting height will help, as nitrates are more concentrated in the bottom 4 to 6 inches of the

stalk. Ensiled corn has 25% to 65% lower nitrate levels than fresh cut material.

**When high nitrate forage is ensiled, deadly nitrogen dioxide gas (silo gas) can be produced within hours!** Silo gas is heavier than air, so it settles in low points in the silage pack and in feed rooms at the base of the silo. The gas may be visible as a reddish to yellowish-brown haze around the silo base, and has a bleach-like odour.

**Protect yourself, your staff and your family from this dangerous poison. If someone must enter the silo to level or cover the silage, do it immediately after filling and leave the blower running while anyone is in the silo. Do not enter the silo for at least three weeks after ensiling. Post a sign at the silo chute as a reminder of the danger. Silo gases can be deadly!**

If you suspect high nitrates in the corn, have it tested by a forage-testing laboratory. Sample after ensiling and when fermentation is completed (at least 3 weeks).

For information about safely entering a silo, refer to the Ontario Farm Safety Association factsheet called "Silo Gas Dangers".

**Table 2. Grading Information**

Green Beans in Soybeans		Corn		
% green	Grade	Test Weight		Grade
		(kg/hl)	(lbs/bu)	
up to 2%	#1	68	54.5	#1
3%	#2	66	53	#2
5%	#3	64	51.4	#3
8%	#4	62	49.7	#4
15%	#5	58	46.5	#5
above 15%	sample	below	below	sample

Adapted from  
Canadian Grain Commission

# First Detection of Kudzu in Ontario. What is the Implication for Soybean Rust? ...continued from Page 1

As mentioned earlier, this is important but we need to keep it in perspective. The risk for Ontario producers continues to be the over-wintering locations in the southern US. We will continue to monitor the overwintering situation and track the disease using sentinel plots, rainfall spore traps, computer prediction models and other information from around North American to manage and reduce producer risk to the disease.

Funding for the Ontario sentinel monitoring was provided in part by OMAFRA, AAFC through the Agricultural Adaptation Council CanAdvance Program and the Ontario Research Development (ORD) program, the Ontario Soybean Growers and the Ontario Soybean Rust Coalition.



**Figure 2.** Kudzu patch in Leamington, Ontario.

Photos Courtesy of Terry Anderson



**Figure 1.** Kudzu grows at an alarming rate and will cover ground, trees, etc.

Photos Courtesy of Terry Anderson



**Figure 3.** Kudzu infected with soybean rust in Georgia (Tenuta, OMAFRA)

# Frosted Soybeans?!

**Horst Bohner, Soybean Specialist, OMAFRA, Stratford**  
**Albert Tenuta, Field Plant Pathologist, OMAFRA, Ridgeway**

Over the weekend various areas in the province received frost. There are concerns around the impact subsequent frost may have on the soybean crop. The extent of injury will depend on the stage of development as well as the length of exposure to frost.

## MECHANISM

Low temperatures injure plants primarily by inducing ice formation between or within cells. The water that surrounds the plant cells freezes first (at about 0 C), while the water within the cell contains dissolved substances that depress the freezing point of water by several degrees. When the water around the cells becomes ice, water vapour moves out of the cells and into the spaces around the cell, where it becomes ice. The reduced water content of the cells depresses further the freezing point of the intracellular water. This can continue to a point without damaging the cell, but below a certain point, ice crystals form within the cell, disrupt the cell membrane, and cause injury to the cell.

## LATE-SEASON FROST INJURY

Studies indicate that soybeans are easily injured by frost until they reach physiological maturity or R7 stage. Prior to this stage, soybeans will be injured both for grain and seed purposes. Soybean reproductive development can be divided into eight stages (Table 1).

**Table 1 - Stage of development descriptions for soybeans.**

**R1 (Beginning flower)** - One open flower on any node on main stem.

**R2 (Full flower)** - Open flower at one of the two uppermost nodes.

**R3 (Beginning pod)** - Green 0.5cm (1/4") long pod at one of the four upper nodes.

**R4 (Full pod)** - Green pod 2cm (3/4") long at one of the four upper nodes.

**R5 (Beginning seed)** - Beans beginning to develop 0.25cm (1/8") seed in at one of the four upper nodes.

**R6 (Full seed)** - Green seed fills pod cavity at one of the four uppermost nodes.

**R7 (Beginning maturity)** - One normal pod on main stem has reached its mature colour (brown or tan); 50% of leaves yellow.

**R8 (Full maturity)** - 95% of pods are mature brown colour. Harvest moisture is reached within 1-2 weeks.

Freezing during earlier development (the green pod stage, **R6**) will result in a severely damaged bean with a greenish "candied" appearance. Even moderately frosted beans with a greenish colour and slightly wrinkled seedcoat are considered damaged soybeans and may be discounted. The seed will eventually dry down with a wrinkled seedcoat: germination will be severely affected. The Canadian Grain Commission classifies frost damaged soybeans as those "soybeans whose cotyledons, when cut, are green or greenish-brown in colour with a glassy wax-like appearance". **Table 2 on page 5** shows the pertinent grading standards for frosted soybeans and corn.

An early frost can significantly reduce seed yield. See Table 3.

**Table 3  
Soybean Yield Response to Freeze Damage**

Growth Stage		Yield Reduction
R4	Full Pod	70-80%
R5	Beginning Seed	50-70%
R6	Full Seed	15-30%
R7	Beginning Maturity	0-5%
R8	Full Maturity	0%

# Frosted Soybeans?! ...continued from Page 7

Seed quality can be impacted by frost, both with reductions in seed germination and seed vigour. (Table 4).

Seed producers and growers should be especially cautious about using soybean seedlots that have been frosted before maturity. Although some of the severely wrinkled and shrunken seed can be eliminated during cleaning, slightly injured seed may remain which would be expected to have less seedling vigour, storability and field

performance capacity.

Frosted plants will reach harvest maturity earlier but seed moisture will be equal to non-frosted plants. Seed protein should not be affected by frost. Oil concentration will be lower if the frost occurred before the R6 stage.

### Points to consider when assessing a field:

**Table 4 - Effect of freezing temperature on the standard germination of seed**

Temp. Celsius	Exposure Time	Percent Germination		
		Green	Yellow	Brown
Control		12.2	84.2	83.2
-2	1 Hr	7.2	----	----
	2	12.2	78.5	----
	4	9.2	72.8	----
	8	10.0	79.0	----
	16	9.0	74.0	----
-7	32	----	75.8	----
	1	7.0	----	----
	2	0.8	63.0	77.2
	4	0.2	61.0	82.5
	8	0.0	50.8	82.5
-12	16	0.0	34.2	80.8
	32	---	10.2	58.0
	1	0.0	42.8	73.8
	2	0.0	34.2	77.8
	4	0.0	23.5	58.0

1. If all the seed has turned yellow (physiologically mature) there are no yield or quality impacts due to frost. R7 fields that have not completely turned yellow may have green beans that will remain green at harvest. Yield impact is minimal. (0-5% reduction)
2. Yellow or brown pods should be opened to determine if the seed is detached from the pod. If the beans have not detached from the white membrane inside the pod the beans will stay green. If the seed has detached from the pod the seed should turn yellow over time.
3. If all the pods were green before the frost a large percentage of the seed will remain green even after dry-down. (frosted pods may turn black due to frost)
4. Even if the stem is still green, once the temperature gets below -2 C essentially no translocation occurs from the stem to the pods. The majority of the seed will stay green.