FIELDCROPNEWS

# Q&As

# 2026

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FIELDCROPNEWS

# Q&As

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# Do you need below-ground rootworm traits in corn fields that follow a good crop rotation?

*Crop rotation remains the most effective management tool for corn rootworm (CRW). However, many growers continue to plant hybrids with below ground traits in rotated fields where they are not needed, which goes against core integrated pest management principles. We took a closer look at data from across the province to help address this question.*

## The simple answer

Five years of trap data and damage reports show that many Ontario counties consistently have low CRW risk in rotated fields. Using Bt RW hybrids (with or without RNAi) in these fields is unnecessary and increases resistance pressure.

But there are exceptions. In Huron, Perth, Oxford and northwest Middlesex, large acreages of continuous corn allow resistant beetles to spill into nearby rotated fields. These higher risk counties require an integrated approach that reduces reliance on below ground traits.

## A little more information

CRW populations remain much lower in rotated fields, except those adjacent to continuous corn acres in high-risk counties (Figure 1). Across more than 300 trap sites in the five years of the CRW Trap Network:

- continuous corn fields had a 90%–97% likelihood of reaching high CRW levels
- only 13% of rotated fields ever reached threshold, and these were exclusively next to continuous corn in the high risk counties

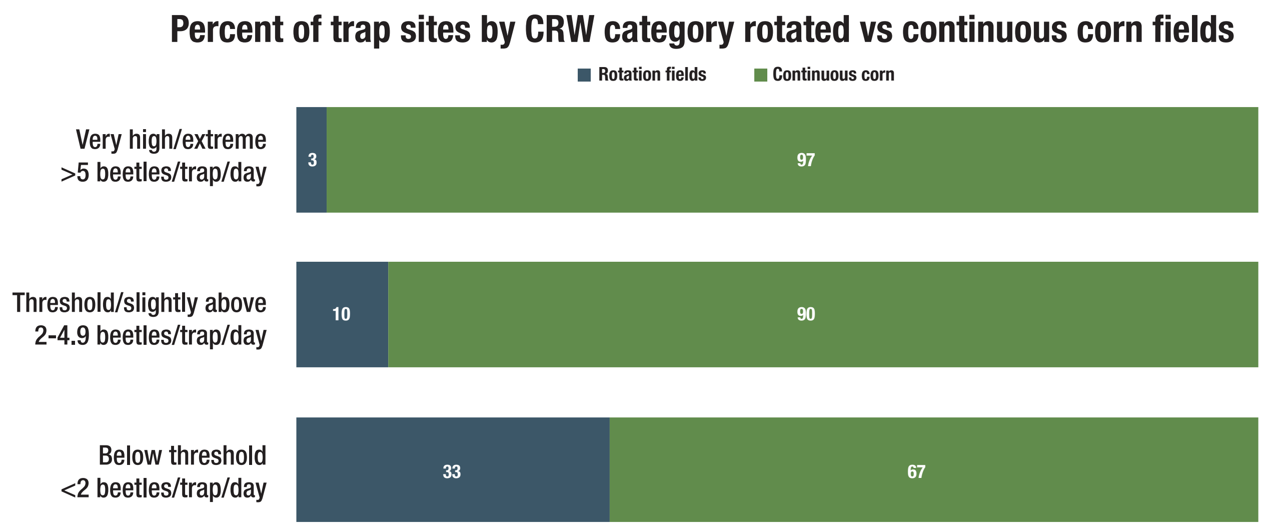


**Figure 1.** Risk of fields reaching CRW threshold based on whether the field is rotated or in continuous corn production. Based on five years of CRW Trap Network data in Ontario.

Adult beetles feed on leaves, tassels and silks, exposing them to Bt and RNAi traits as plants mature. When populations are high, adults move between fields seeking food and increasing their exposure. This repeated exposure as larvae and adults accelerates Bt resistance development. Populations already resistant to Bt traits can more easily survive RNAi, placing the remaining effective mode of action at risk.

**Most rotated fields in Ontario do not require below ground traits and avoiding them reduces unnecessary trait exposure to migrating CRW adults.**

## The full story

Most Ontario counties remain at low risk for CRW. Based on five years of trap network data, 12 counties are consistently very low risk and do not require below ground traits (Figure 2 – counties with full green bars). Growers in these areas can help slow resistance by choosing hybrids without below ground traits, especially in well rotated fields.

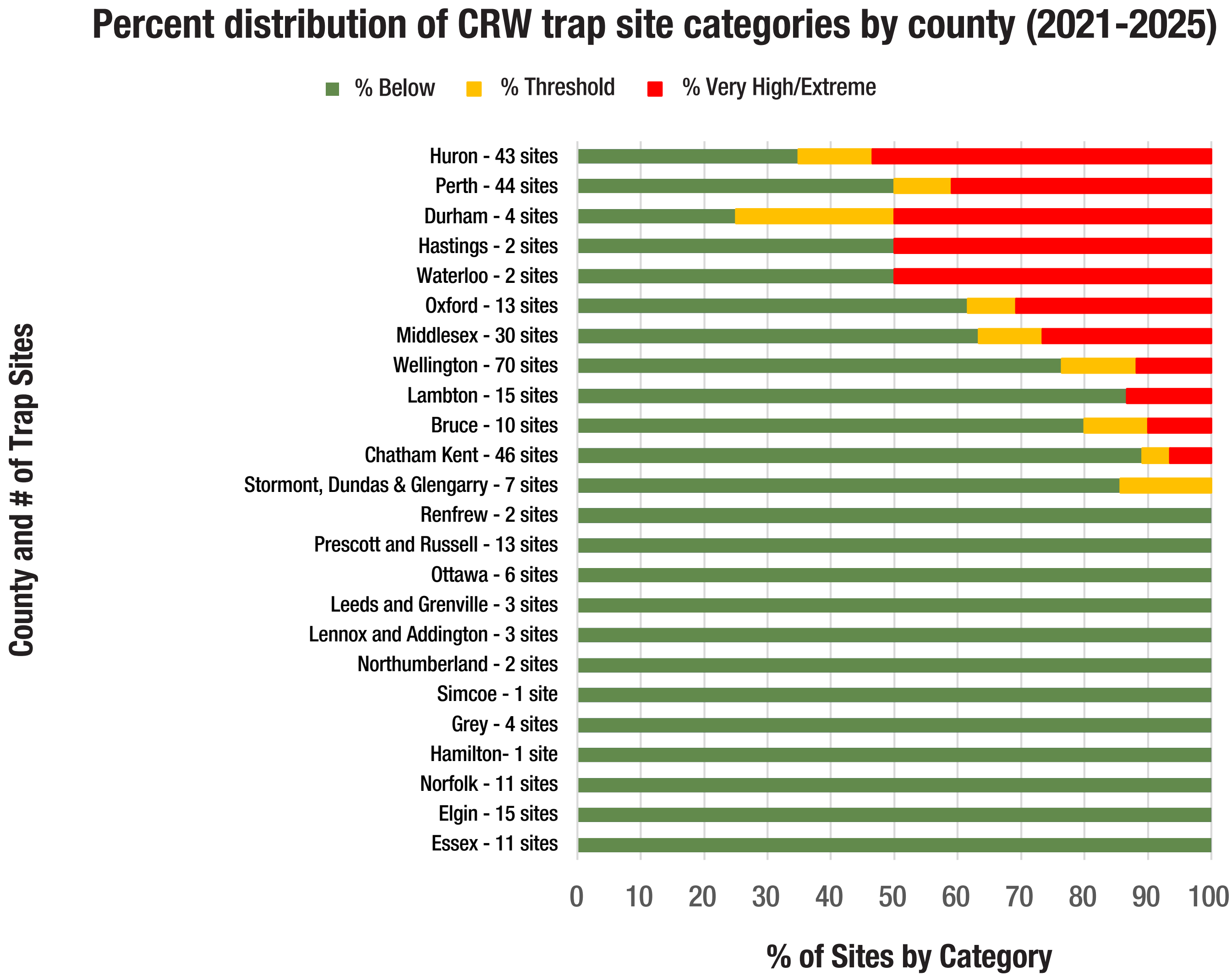


**Figure 2.** Percent of trap sites by county in each CRW risk category. Green bars indicate fields in those counties are at low risk of CRW, based on five years of trap monitoring.

CRW is primarily a continuous corn problem, except in parts of Huron, Perth, Oxford and Middlesex. In these areas, larvae are surviving on Bt corn, resistant adults are increasing and yield loss can occur even with below ground traits. Relying solely on these traits has allowed highly resistant populations to thrive and spread. These populations are already strongly resistant to Bt and put RNAi at risk of failing within a few years. Rotated fields in these counties also face higher first year CRW risk.

Crop rotation can be challenging in livestock systems, so these counties need more sustainable CRW management strategies that reduce continuous exposure to transgenic traits.

### Bottom line

Growers outside the problem counties can help reduce resistance spread by maintaining good rotation and selecting hybrids without below ground CRW traits. Across the province, monitoring with sticky traps helps identify problem fields and gives growers confidence to move away from unnecessary traits when trap counts are low.

# Why did an aerial fungicide application leave stripes in my corn field?

*In the last few years, there have been several reports of tar spot “striping” following aerial sprays in Ontario and corn-producing U.S. states. Crops seem well protected, green and healthy directly beneath the flight path, but efficacy tapers to failure towards the edges of the swath (brown and desiccated).*

**Figure 1.** Tar spot “striping” following a helicopter-applied fungicide in an Ontario corn field.

## The simple answer

Corn rows at the extreme edges of the spray swath are missed or receive a sub-optimal dose of fungicide when the effective swath width (ESW) is overestimated. The aerial sprayer must fly a tighter spacing (i.e., more passes) to ensure complete coverage of the treatment area.

## A little more information

A swath’s effective width presents the lowest variability while minimizing the degree of over- and under-dosing. When it comes to productivity, wider swaths mean wider route spacing, which is attractive because it means fewer passes and faster applications. It is plausible that inappropriate swath widths from aerial applications are common, but not always detected for a number of reasons.

- Fungicides are generally weak systemically and give modest yield increases from disease suppression and “stay green” properties. Until tar spot *(Phyllachora maydis),* a sub lethal dose of fungicide did not lead to rapid and acute crop failure.
- Most growers do not intentionally leave unsprayed checks, or the check locations do not coincide with disease presence.
- Product application rates are sufficiently high to cover regions of under-application.
- Taken together, deficiencies are often too subtle to detect.

But pilots do not intentionally inflate swath widths. Swaths are evaluated during fly-in calibration sessions using established protocols. Drone swath evaluation uses these practices.

Calibrations take place on bare ground or stubble/grass using two-dimensional samplers (i.e., continuous samplers like string or bond paper, or discreet samplers like water sensitive paper). However, this protocol does not account for any physical interference from the crop canopy that likely intercepts the spray before the swath reaches the anticipated width.

## The full story

To test this assumption, we evaluated the ESW from a DJI T50 on bare earth using the Speed Track and Swath Gobbler (Application Insight LLC) sampling system. We then relocated the sampling system at approximately ground height within a soybean canopy, a wheat canopy and at ear-height in a corn canopy and re-evaluated the ESW.

**Figure 2.** DJI T50 flying over sampling system to evaluate ESW on bare ground.

**Figure 3.** Swathing system erected at ear-height inside a corn canopy to re-evaluate ESW.

When ESW is calculated from percent area covered, corn had the biggest reduction in swath width compared to bare ground, then soybean, then wheat. The relationship was reversed when ESW was calculated from deposit density. The relationship between droplet size, crop physiology, planting architecture and canopy penetration is complicated. Regardless of the method used to calculate ESW, there was a significant and consistent reduction in-canopy.

### Table 1. Reduction in average effective swath width in-canopy by crop compared to on ground. Swaths expressed from both percent coverage and deposit density metrics.

| Crop | % reduction in ESW (calculated from percent area) | % reduction in ESW (calculated from deposit density) |
|---|---|---|
| Corn | 44.0 | 20.6 |
| Soybean | 32.2 | 28.3 |
| Wheat | 21.7 | 31.5 |

**Key learnings**
Aerial fungicide applications should account for the influence of the canopy on effective swath width and reduce flight path spacing by approximately 25% to improve coverage uniformity.

**Read the full study report here.**

# Are ultra-early varieties the key to successful double-crop soybeans in short season areas?

*As more Ontario growers are interested in the options for double-cropping soybeans after winter cereals, we compared the performance of newer ultra-early varieties to help growers make selections for optimum yield and performance.*

## The simple answer

The greatest challenge with double-crop soybeans – in areas with fewer than 2,800 Crop Heat Units (CHU) – is achieving maturity before a killing frost. Ultra-early (very low maturity group) varieties offer the best chance of success under these short season conditions.

## A little more information

Interest in double-cropping soybeans after winter cereals continues to grow across Ontario – even in regions with less than 2,800 CHUs. While dry conditions at mid-summer planting can hinder establishment, the primary risk remains frost before the crop reaches full maturity.

If a killing frost occurs before plants reach at least the R6 growth stage (full seed), the crop is typically not worth harvesting. For this reason, variety selection is critical.

Ultra-early maturity group (MG) varieties – including 000 and 00 types – are now available that were not widely accessible in past decades. To evaluate their suitability for double-crop systems, a field trial was conducted at the Elora Research Station in 2025. Elora is considered a 0.7 MG area, making it a good test location for extremely short-season genetics planted on July 11, 2025.

**Table 1. Double cropping soybean yield. (Elora 2025)**

| | Row width (in.) | Seeding rate (x1000) | Yield (bu/acre) | Row width average (bu/acre) | Gross profit ($/acre) |
|---|---|---|---|---|---|
| Wolf R2X 000.7 MG 2200 CHU | 7.5 | 210 | 42.4 | 44.3 | $492.35 |
| | 7.5 | 350 | 46.1 | | |
| | 15 | 210 | 44.5 | 42.8 | $470.60 |
| | 15 | 350 | 41.0 | | |
| Badger R2X 00.6 MG 2425 CHU | 7.5 | 210 | 38.6 | 40.2 | $432.90 |
| | 7.5 | 350 | 41.7 | | |
| | 15 | 210 | 36.9 | 37.2 | $389.40 |
| | 15 | 350 | 37.4 | | |
| Hydro R2X 0.1 MG 2550 CHU | 7.5 | 210 | 35.5 | 40.3 | $434.35 |
| | 7.5 | 350 | 45.0 | | |
| | 15 | 210 | 39.4 | 41.4 | $450.30 |
| | 15 | 350 | 43.3 | | |

Gross profit assumes a selling price of $14.50/bu and a seed cost of $75.00 per bag. The planting date was July 11, 2025 and the harvest date was November 13.

## The full story

Double crop yields were surprisingly high in Elora in 2025. A dry fall with a late frost (October 9) contributed to this success. Seed quality was acceptable for all three varieties tested but the lowest MG variety (000.7) had the best seed quality and overall yield.

The results provide strong evidence that in short-season environments, varieties up to three full maturity groups earlier than locally adapted varieties may be required for double-cropping success.

Soybeans planted in July remain physically shorter and produce fewer nodes compared to May-seeded crops. With fewer nodes per plant, yield potential per individual plant declines. The only practical way to compensate is to increase plant population. With the growing season compressed in double-crop systems, plants have less time to grow tall and the risk of lodging is low. This allows for higher seeding rates without the typical standability concerns seen in full-season soybeans.

**This trial clearly demonstrated that very high seeding rates are necessary to maximize yield and profitability.**

At $75 per bag seed cost and $14.50 per bushel soybean price, the most profitable seeding rate in this study was 263,000 seeds per acre (Figure 1).

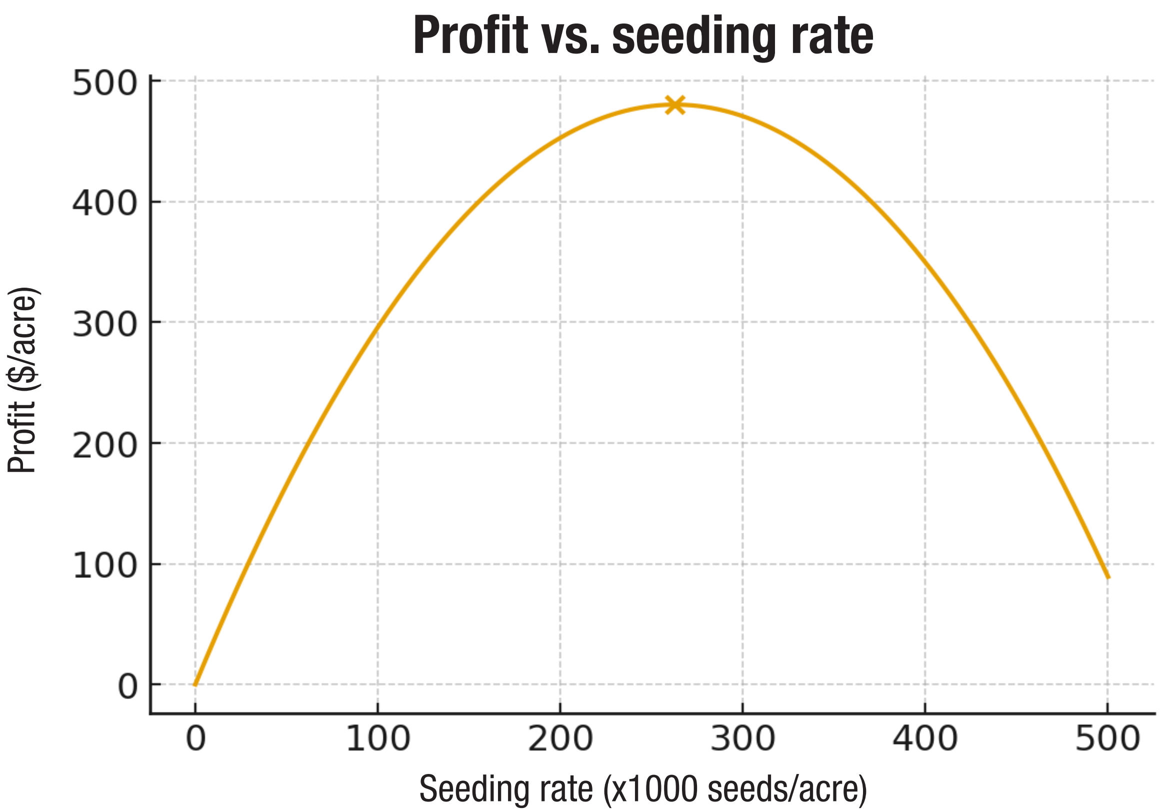


**Figure 1.** Optimal seeding rate when double cropping.

**Note:** The "profit" noted above is calculated based on the cost of seed versus yield and does not include land or other input costs.

**Key takeaways**

- Frost risk is the primary limitation to double cropping success.
- Ultra-early maturity groups (000 or 00) significantly reduce that risk, especially in short season areas.
- The lowest MG variety yielded the highest and had the best seed quality.
- High seeding rates are essential to compensate for reduced plant size and node number.
- In the 2025 Elora trial, the combination of ultra-early genetics and high population produced excellent yields and strong profitability.

**Mike Cowbrough** *Weed Specialist*

# How do I control prostrate knotweed in field corn?

*Prostrate knotweed (Polygonum aviculare) is one of the earliest annual weeds to emerge, but there is very little research on effectively managing it in field corn. Wet soil conditions in 2024 provided the opportunity to evaluate several herbicide options under heavy infestation.*

## The simple answer

In glyphosate-tolerant corn, only glyphosate applied at 3.3 L/ha (1.34 L/acre) or 4.5 L/ha (1.82 L/acre) provided over 90% control of prostrate knotweed.

For non herbicide-tolerant corn, Distinct provided the greatest suppression among the conventional herbicides tested, but control was still unacceptably low at about 45%.

## A little more information

Prostrate knotweed is one of the earliest annual weeds to emerge each spring. Under normal conditions, seedbed preparation – such as tillage or pre-plant burndown programs – removes young seedlings so this weed rarely becomes a problem in field crops.

But wet soils in spring 2024 delayed field work. By the time seedbeds could be prepared, prostrate knotweed seedlings had grown too large for tillage to effectively uproot and kill them. As a result, sizeable plants were competing in a commercial corn field.

There is little published research on managing prostrate knotweed in field corn, and limited information on its herbicide sensitivity.

- Turfgrass research has shown that dicamba can provide over 80% visual control.
- In poppy, the highest labeled rate of mesotrione provided suppression.
- Earlier Ontario weed trials (2004) found that dicamba and glyphosate were the only products to achieve more than 80% visible control.

## The full story

There is very little information on how prostrate knotweed responds to herbicides, so a dense infestation in an Ontario corn field (Figure 1) provided a valuable opportunity to evaluate control options. In 2024, a randomized complete block trial was carried out in a Huron County corn field, testing 16 herbicide treatments. All treatments were applied when prostrate knotweed was 20–30 cm in diameter, and corn was at the 3–4 leaf-over stage.

**Figure 1.** The unsprayed control shows the population density of prostrate knotweed that was competing in field corn.

## Results based on visual control

Here's how the various herbicide treatments performed, 28 days after application, based on visual control of prostrate knotweed. See Table 1 for full data.

- Roundup WeatherMAX at 3.3 L/ha (1,800 g ae/ha) and 4.5 L/ha (2,430 g ae/ha) provided the highest level of control (Figures 2 and 3).
- Roundup WeatherMAX at 1.67 L/ha (900 g ae/ha) was ineffective.
- No other standalone herbicide treatment controlled prostrate knotweed.
- Halosulfuron (e.g., Permit) tank mixed with 1.67 L/ha Roundup WeatherMAX provided over 80% control (Figure 4).
- Acuron tank mixed with Roundup WeatherMAX reduced control compared to Roundup WeatherMAX alone (Figure 5).

**Figure 2.** Prostrate knotweed control at 28 days after the application of Roundup WeatherMAX at 3.33 L/ha (1.34 L/acre).

**Figure 3.** Prostrate knotweed control at 28 days after the application of Roundup WeatherMAX at 4.5 L/ha (1.8 L/acre).

**Figure 4.** Prostrate knotweed control at 28 days after the application of Roundup WeatherMAX at 1.67 L/ha (0.67 L/acre) + Permit at 70 g/ha (28 g/acre) + non-ionic surfactant at 2.5 L/1,000 L.

**Figure 5.** Prostrate knotweed control at 28 days after the application of Roundup WeatherMAX at 1.67 L/ha (0.67 L/acre) + Acuron at 4.91 L/ha (1.9 L/acre).

## Results based on visual crop injury

When we looked at crop injury, 14 days after herbicide applications, there are two key results that stand out. See Table 1 for full data.

- 2,4-D alone and 2,4-D + Roundup WeatherMAX caused unacceptable crop injury (Figure 6).
- 2,4-D + Roundup WeatherMAX tank mix caused more injury than 2,4-D applied alone.

**Figure 6.** Field corn injury, caused by the addition of 2,4-D and expressed as "onion leafing" at 14 days after the application of Roundup WeatherMAX at 1.67 L/ha (0.67 L/acre) + Enlist 1 at 1.8 L/ha (0.72 L/acre).

## Table 1. Visual control (%) of prostrate knotweed at 28 days, and visible crop injury (%) at 14 days after application of various herbicide treatments.

| Treatment | Active ingredient | Trade name | Product rate (mL/ha) | Average control (%) | Average crop injury (%) |
|---|---|---|---|---|---|
| 1 | glyphosate | Roundup WeatherMAX | 1,670 | 64 | 0 |
| 2 | glyphosate | Roundup WeatherMAX | 3,330 | 91 | 0 |
| 3 | glyphosate | Roundup WeatherMAX | 4,500 | 96 | 0 |
| 4 | glufosinate | Liberty 200 SN | 2,500 | 54 | 0 |
| 5 | 2,4-D | Enlist 1 | 1,800 | 15 | 25 |
| 6 | halosulfuron | Permit + non-ionic surfactant | 70 | 28 | 0 |
| 7 | dicamba | Engenia | 500 | 10 | 5 |
| 8 | dicamba/diflufenzopyr | Distinct + non-ionic surfactant + UAN | 285 | 45 | 5 |
| 9 | bromoxynil | Pardner | 1,000 | 10 | 0 |
| 10 | bicyclopyrone, mesotrione, s-metolachlor, atrazine | Acuron | 4,910 | 38 | 0 |
| 11 | glyphosate + 2,4-D choline | Roundup WeatherMAX + Enlist 1 | 1,670 + 1,800 | 70 | 33 |
| 12 | glyphosate + halosulfuron | Roundup WeatherMAX+ Permit + non-ionic surfactant | 1,670 + 70 | 83 | 0 |
| 13 | glyphosate + dicamba | Roundup WeatherMAX + Engenia | 1,670 + 500 | 69 | 6 |
| 14 | glyphosate + dicamba/diflufenzopyr | Roundup WeatherMAX + experimental | 1,670 + 357 | 71 | 9 |
| 15 | glyphosate + bromoxynil | Roundup WeatherMAX + Pardner | 1670 + 1,000 | 66 | 0 |
| 16 | glyphosate + bicyclopyrone, mesotrione, s-metolachlor, atrazine | Roundup WeatherMAX + Acuron | 1,670 + 4,910 | 59 | 0 |
| 17 | untreated control | | | 0 | 0 |

**Acknowledgements:** Thanks to Mike Russell (Hensall Coop) and Mark Baker (farm cooperator).

# How do I manage alfalfa weevil?

*Alfalfa weevil is a major alfalfa pest in Ontario. Larvae feeding on alfalfa leaves can reduce both yield and forage quality.*

## The simple answer

As alfalfa gets taller, it can tolerate more weevils before action is necessary to protect forage yield and quality. Action thresholds for managing alfalfa weevil are based on stem height.

| Stem height | Action threshold (# of larvae per stem) |
|---|---|
| Up to 30 cm (12 in.) | 1 or more |
| Up to 40 cm (16 in.) | 2 or more |
| At any height | 3 or more |

Here are key alfalfa weevil management strategies.

- Cut alfalfa early to reduce populations.
- Consider spraying an insecticide if 40% of plant tips show signs of weevil feeding and it is more than 7–10 days until the preferred harvest date.
- Check the label first – some insecticides offer suppression rather than control.
- Monitor weevil activity on stubble regrowth for 5–7 days with severe infestations. The characteristic symptom is the alfalfa plant does not "green up" due to larvae and newly hatched adults feeding on the developing crown buds.

**After cutting, the presence of 2 or more active larvae per crown, or 4 to 8 larvae per square foot, indicates a need to spray the stubble with insecticide.**

## A little more information

Alfalfa weevil larvae begin feeding in mid- to late-May, beginning with the leaf buds. The larvae then move to leaves near the stem tips, where damage starts off as pinholes and progresses until no leaf tissue remains between the veins. This is called "skeletonization". Heavy infestations may look frosted from a distance, as the shredded leaves appear greyish white.

When alfalfa is harvested, alfalfa weevil larvae are removed from the field, and remaining larvae either dry out or starve. This reduces the population and usually gives alfalfa regrowth a chance to get ahead of feeding pressure.

**The Ontario Crop Protection Hub is OMAFA's official crop protection resource and includes insecticides labelled for use on alfalfa against alfalfa weevil.**

## The full story

There is only one generation of alfalfa weevils per year. Adults overwinter in plant debris, so mild winters may increase survival. Eggs are laid in alfalfa stems in early May. When larvae hatch, they climb up the stems to feed on leaf and flower buds. Hot, dry springs slow the development of pathogens that keep alfalfa weevil populations in check. Fields located in areas with frequent insecticide use are more likely to have alfalfa weevil problems, since parasitoid wasp populations are suppressed.

### Scouting

Scout fields twice a week from mid-May until 10 days after first cut. To scout, check several areas throughout the field, especially areas with shallow soils or southerly slopes. Walk an M-shaped pattern while collecting 30 stems. Hold the stems inside a clean white bucket and beat them against the sides to knock off the weevil larvae. Count how many 3rd and 4th stage instar larvae are in the bucket. Do not include any larvae less than 3 mm long, or diseased larvae of any size, which are slow-moving and yellow or tan. Divide the total of healthy 3rd and 4th stage larvae by 30 to get an average per stem.

### Biological control

Biological control is the main way alfalfa weevil populations are kept in check in Ontario. Parasitoid wasps (*Microctonus aethiopoides* and *M. colesi*) attack adult and larval weevils and lay their eggs inside them. When the eggs hatch, the wasp larvae feed on their host, which eventually kills it. A fungus (*Zoophthora phythonomi*) also infects alfalfa weevil larvae. The larvae will curl around the leaves at the top of the plant and turn brown. These biological control organisms are widespread throughout the province. It is only when weather conditions allow alfalfa weevil development to outpace the biological control that other interventions become necessary.

### Harvest timing

Cutting alfalfa early can reduce alfalfa weevil populations. However, damage from larval feeding is generally not apparent until the crop reaches bud stage, which coincides with peak forage quality and the earliest first cut harvest dates. In years where the larvae reach threshold before the alfalfa reaches bud stage, cutting early can reduce second cut yield and vigour. These high larval populations may also be above threshold on the stubble after cutting, and feed faster than the alfalfa can regrow.

### Product restrictions

As a result of the Pest Management Regulatory Agency re-evaluation, all feed uses are cancelled for lambda-cyhalothrin products as of April 29, 2023. Any crops treated with lambda-cyhalothrin products cannot be used directly or as by-products in feed to livestock. Alfalfa is grown exclusively in Ontario for livestock feed, so lambda-cyhalothrin products (e.g., Matador, Silencer and Labamba) cannot be used on this crop.

Parasitoid wasps are affected by insecticides. Spraying for alfalfa weevils increases the risk of future outbreaks because wasp populations are reduced.

**Colin Elgie** *Soil Fertility Specialist*

# What is the right source of phosphorus fertilizer for my crop fertility plan?

*Phosphorus is an essential macronutrient necessary for crop production in Ontario. Monoammonium phosphate has been the industry standard dry phosphorus fertilizer for many years for Ontario producers, but recent market trends have led to both old and new phosphorus fertilizer formulations being supplied from Ontario agricultural retail locations. Phosphorus is a major component of organic amendments and liquid fertilizers – but this article focuses on dry commercial fertilizer sources.*

## The simple answer

The right source of phosphorus (P) fertilizer for an individual field depends on the intended crop to fertilize, how and when the fertilizer is applied, and soil test P levels. Cost is part of the decision but shouldn't be the sole decision-making factor.

**Monoammonium phosphate** (MAP) – and products containing MAP such as Microessentials SZ (MESZ) – are best used when the crop can take advantage of the nitrogen (N) portion of the fertilizer, and risk of P loss is generally low.

**Triple superphosphate** (TSP) doesn't contain N and can supply P to legumes that don't require additional N, or in the fall ahead of corn or soybeans where N would otherwise be lost to the environment.

**Struvite** (trade names CG P2X or Crystal Green) is a slow-release P fertilizer that is best to band or incorporate near the seedling, and can be used safely on fields at higher risk of P loss. Struvite contains N in a similar ratio of N:P as MAP.

## A little more information

4R nutrient management principles help producers maximize the efficient use of fertilizers by applying the **right source**, at the **right rate**, the **right time** and the **right place**.

### Nutrient uptake

Phosphorus is mainly taken up by plants through fine root hairs on the rooting system. All three major types of P fertilizers used in Ontario supply orthophosphate ($HP_2O_4^-$ or $HPO_4^{2-}$) – the plant available form of the nutrient. However, these products differ in how they get into solution to be taken up into the plant.

MAP and TSP are highly water soluble. The P is immediately available to plant roots – which is beneficial in cool, wet soils with limited root growth. But high water solubility means the plant available P is also at greater risk of loss through leaching and runoff, or reacting with other compounds in the soil, reducing availability to the plant.

Struvite is very insoluble in water and nutrients become available only when struvite reacts with acidic root exudates. Struvite requires actively growing roots in immediate proximity to provide plant available P – but is at less risk of nutrient tie-up or loss to the environment of residual soluble P. Table 1 shows the differences in solubility between some P sources.

### Table 1. Relative solubilities of select fertilizers in water or citric acid extractants under laboratory conditions.

| Fertilizer source | % of total P soluble in | |
|---|---|---|
| | Water | Citric acid |
| Monoammonium phosphate (MAP) | 100 | 97 |
| Triple superphosphate (TSP) | 88 | 95 |
| Struvite | 2 | 93 |

### Placement and timing

Fertilizer application methods can help drive selection of the best P fertilizer source for the operation.

MAP is best used in a starter band in corn and cereals, due to an acidifying effect surrounding the granule as it breaks down. This effect can increase P uptake in cool, wet soils. MAP and MESZ both contain N, and MESZ also supplies a source of sulphur (S) and zinc (Zn). The best value from these products occurs when these additional nutrients trigger a response from the crop.

TSP does not contain N and provides the best value where only P is required. Fall broadcast/incorporation, spring broadcast with or without incorporation, or with legume crops are also good fits for this source of P.

Struvite (CG P2X or Crystal Green) is best in a starter band, similar to MAP, and must be close to the growing roots for availability. Struvite can also be used in the fall or spring under a broadcast/incorporation system as an environmentally safer option in fields with higher risk of P loss.

## The full story

Determine crop P requirements based on soil test results from an OMAFA-accredited soil test laboratory using the Olsen (bicarb) extraction. If soil test P levels are sufficient, there will likely be little response to any P fertilizer applied. In low testing soils, placement of P in a band close to the seedling can provide the best value, depending on the crop grown, and application rate and method.

Regardless of the P fertilizer source used, give proper credit to other sources of P applied to the field – liquid starter fertilizers and organic amendments such as manure, biosolids or compost.

**The Phosphorus Loss Assessment Tool for Ontario (PLATO) on OMAFA's Agrisuite can calculate the risk of P loss from an application of P-containing material like fertilizer or organic amendments.**

### Yield response

P fertilizers show comparable yield response to similar P rates in research trials under low to moderate soil test P.

Research by Dr. Kim Schneider started in 2021 in Elora has shown that treatments of MAP, struvite and a blend of 25% struvite and 75% MAP produced similar corn yields over a two-year period. A significant increase in yield was noted in the struvite treatments compared to the P-free control treatment (Table 2). This research trial has continued, and shown similar response to P fertilizers in corn, with no significant response in soybeans.

### Table 2. Grain yield and aboveground biomass in a two-year corn trial with four phosphorus treatments.

| Treatment | Yield (tonne/ha) | Dry matter (tonne/ha) |
|---|---|---|
| Control (no P fertilizer applied) | 10.15 b | 19.80 b |
| Struvite | 11.39 a | 23.35 a |
| Blend – 25% struvite + 75% MAP | 11.53 a | 21.88 ab |
| MAP | 10.65 ab | 20.04 b |

**Note:** treatments with different letters within a column were found to be significantly different at $p < 0.05$ level according to the Tukey-Kramer test.

### Phosphorus loss

Phosphorus losses from the field are generally small from an agronomic standpoint, but can have an oversized impact on water quality, as seen by algae blooms, especially in Lake Erie.

Water soluble fertilizers like MAP and TSP are quick to dissolve and potentially be lost to the environment, especially during the non-growing season and with high soil test P levels.

Research has shown that treatments with MAP contained higher soil pore water and surface runoff P concentrations compared to the untreated control – the struvite treatment generally resembled the control.

Risk of loss depends on field characteristics like soil type and slope, and application characteristics like source, rate, timing and placement. Figure 1 gives an example of a scenario of a MAP fertilizer broadcast using three different application methods and the risk index of each.

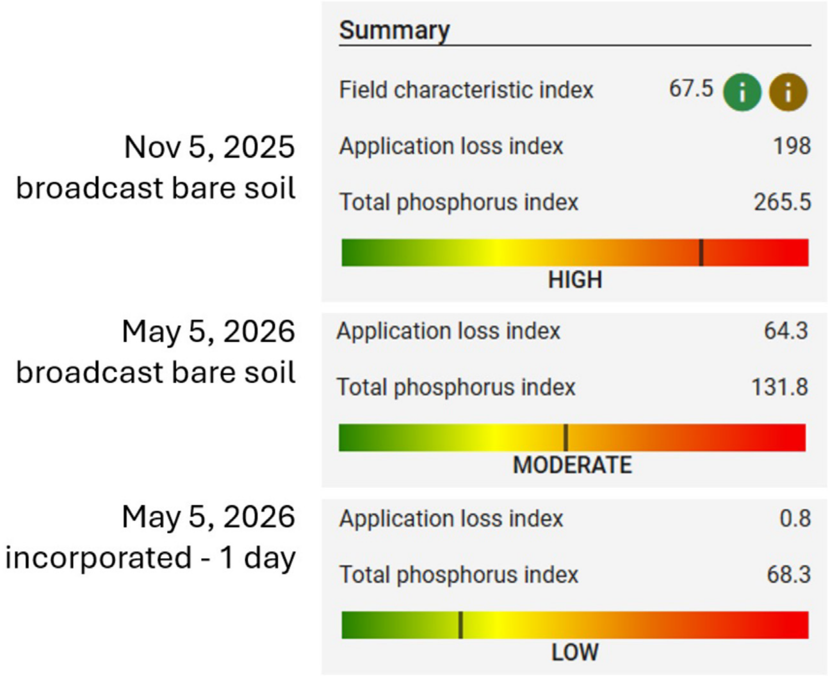


**Figure 1.** The phosphorus index of loss for a scenario comparing application of 150 lb/acre of MAP fertilizer with three different timing/application methods using Agrisuite's Phosphorus Loss Assessment Tool for Ontario (PLATO).

### Economics

Producers often focus on the price per tonne of fertilizer, or the price per lb or kg of $P_2O_5$ when determining the P source to use on farm. But the best value and return to added P fertilizers comes from 4R nutrient management principles to reduce loss and improve nutrient use efficiency, and may involve using different sources across the farm, depending on intended crop, soil type and topography, and application method.

Another important factor when deciding fertilizer source is the potential to use the full amount of available nutrients in the product. For example, if N, S and Zn are required for a crop of corn on a field, 100 lb/acre of MESZ may offer better total value than using the equivalent rate of actual $P_2O_5$ from TSP.

Table 3 gives a comparison of the price per lb of $P_2O_5$ , price per lb of total nutrient for dry P fertilizers and the blend of 25% struvite + 75% MAP.

## Table 3. Cost comparison of dry fertilizer P sources, including cost per lb of $P_2O_5$ and total nutrient.*

| Fertilizer source | Analysis | $/t fertilizer | $/lb $P_2O_5$ | $/lb total nutrient[a] |
|---|---|---|---|---|
| MAP | 11-52-0 | 1,294 | 1.13 | 0.95 |
| MESZ | 11.7-40-0-10S-1Zn | 1,359 | 1.54 | 0.98 |
| TSP | 0-46-0-21Ca | 1,098 | 1.08 | 0.74 |
| CG P2X (struvite) | 7-33-0-9Mg | 1,703 | 2.34 | 1.64 |
| Blend – 25% struvite/75% MAP | 10-47-0-2Mg | 1,396 | 1.35 | 1.07 |

*Prices shown are for use as an example only and are current suggested retail price from a retailer in southwestern Ontario as of January 2026. Your price may vary substantially from this chart and should be calculated to determine value using your own prices.
[a]$/lb of total nutrient assume that the nutrients included in the fertilizer are responsive to the crop in their entirety. For example, if Mg or Ca are already sufficient in the soil, this value should not be used for comparison.

### Bottom line

The right source of phosphorus fertilizer for a given field depends on many different factors. All dry fertilizer sources included in this article provide adequate P nutrition to the crop. Factors such as utilization of other fertilizer nutrients, timing and method of application, risk of nutrient loss and fertilizer cost per unit of nutrient are critical parts in the crop fertility planning process.

**Joanna Follings** *Cereals Specialist*

# How can I increase the yield potential of my oat crop?

*Oats provide an excellent opportunity to diversify crop rotations. When managed well, they can be both productive and profitable for Ontario growers.*

**Figure 1.** A crown-rust-susceptible oat variety (right) can be protected with a timely fungicide applied at the flag-leaf stage (left).

## The simple answer

Like many cereal crops, oats respond well to management. The success of an oat crop is a function of variety selection, management – particularly the amount of nitrogen applied, planting date, the suppression of crown rust – and seasonal growing conditions such as temperature and rainfall.

## A little more information

Optimizing the yield potential of your oat crop depends on several factors.

- Selecting a variety based on the needs of a particular operation.
- Planting oats by the optimum target dates for a particular region.
- Applying ideal nitrogen (N) rates – 90 kg/ha in a split application or all up front.
- Managing crown rust through a combination of variety selection and timely fungicide applications.

**Find out more about a variety's performance in a particular area, disease ratings and quality at www.GoCrops.ca.**

## The full story

Let's look closer at all these factors that can affect your oat crop yield.

### Variety selection

Consider yield, test weight, crown rust resistance and lodging risk when selecting varieties. Ontario oat performance trials (www.GoCrops.ca) and trials by Dr. Josh Nasielski at New Liskeard Research Station demonstrate that varieties are more likely to lodge under heavy crown rust pressure. That makes variety selection – in combination with a timely fungicide application at flag leaf – important for managing disease and lodging risk.

### Planting date

Like other spring cereals, it is hard to seed oats too early unless soil conditions are excessively wet. Frost seeding has proven successful for optimizing the yield potential of oats. Cool, moist spring conditions in early plantings promote tillering, and avoids hot and dry conditions during the early growth stages that oats are sensitive to. Early planting dates also advance flowering dates and avoids hot, dry conditions during grain fill. Target seeding dates for oats are:

- April 10 in southern Ontario
- April 15 for central and eastern Ontario
- May 10 for northern Ontario

### Nitrogen rates

Using a starter fertilizer and fine tuning your N rates have also proven to increase yields. However, there can be a fine line between too little and too much N where lodging becomes a concern. Selecting a variety with better standability can help reduce the risk of lodging and may lead to better success with higher N rates.

In trials conducted at the Winchester and New Liskeard Research Stations by Dr. Josh Nasielski, University of Guelph, the optimum rate of N was 90 kg/ha applied pre-plant (Table 1). Applying the N all up front resulted in the highest yield potential, but split applications helped reduce lodging risk (data not shown). Fungicides were also extremely effective at reducing lodging at high N rates, compared to plant growth regulators.

## Table 1: Comparing N rate and timing in oats.

| N application timing and rate | 0 N control | 90 kg pre-plant | 90 kg at GS 60 | 60 kg N pre-plant and 30 kg at GS 60 | 30 kg N pre-plant and 60 kg at GS 60 |
|---|---|---|---|---|---|
| Yield (bu/acre) | 84 | 97 | 89 | 95 | 85 |

**The optimum rate of nitrogen applied to oats in Winchester and New Liskeard was 90 kg/ha applied pre-plant in trials conducted by Dr. Josh Nasielski, University of Guelph.**

### Crown rust

Crown rust is the most important disease of oats. Yield losses as high as 75% and a 50% reduction in test weight have been reported when a susceptible variety is grown and left untreated. Selecting varieties with good crown rust resistance, managing buckthorn (an alternate host for crown rust) and timely fungicide applications prior to head emergence are effective strategies for managing crown rust.

Crown rust also increases lodging risk, but fungicide applications, especially in the presence of disease, are effective in reducing lodging. In the 2024 Ontario Cereal Crop Committee (OCCC) performance trials, lodging was reduced in Area 2 on average by 6.6 points where a fungicide was applied compared to where one was not applied (Table 2). This reduction in lodging was also seen in Area 3 where it was reduced by an average of 1.5 points. In Area 5 there were no differences in lodging scores between treatments. Timely fungicide applications are effective in managing crown rust and can help avoid the weakening of stalks that can occur with this disease.

## Table 2: Ontario Cereal Crop Committee Performance Trials 2025: Oat cumulative lodging score[1] Area 2 fungicide applied.

| Hull Colour | Variety | 5–Year lodging score fungicides | | 4–Year lodging score fungicides | | 3–Year lodging score fungicides | | 2–Year lodging score fungicides | | 2024 lodging score[3] fungicides | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| white | RC Amaze | 3.5[2] | 0.7 | 2.6 | 0.2 | 3.8 | 0.3 | 4.7 | 0.3 | 9.0 | 0.7 |
| | AAC Bullet | 4.4 | 1.1 | 4.0 | 0.8 | 4.8 | 1.1 | 4.5 | 0.3 | 9.0 | 0.7 |
| | AAC Reid | 2.2 | 1.3 | 1.7 | 1.0 | 2.3 | 1.5 | 0.5 | 0.3 | 1.0 | 0.0 |
| | AAC Captain | | | 1.1 | 0.3 | 1.1 | 0.4 | 0.7 | 0.0 | 1.3 | 0.0 |
| | AAC Basil | | | | | 2.9 | 0.7 | 4.3 | 0.0 | 8.7 | 0.0 |
| | Annie | | | | | | | 4.2 | 0.2 | 7.3 | 0.0 |
| | Trinity | | | | | | | 4.5 | 0.7 | 9.0 | 0.0 |
| Means | | 3.9 | 1.9 | 3.1 | 1.2 | 3.9 | 1.5 | 3.3 | 0.2 | 6.8 | 0.2 |
| Location-Years | | 7 | | 6 | | 4 | | 2 | | 1 | |

[1] Lodging scores range from 0 to 9. A high score is undesirable.
[2] Cultivar lodging rankings may vary from year to year. Decisions are best made using data with the greatest number of years.
[3] 2025 had minimal to no lodging due to drought impact on plant growth.
PBR Status; indicates varieties protected under PBR 91 or PBR78s. Visit pbrfacts.ca to learn more.

# Which maturity group soybean variety is best suited to my farm?

*There is a balancing act when selecting a variety based on yield potential and harvest date. Here are some practical tips based on extensive trials comparing varieties across the province.*

## The simple answer

The Ontario Soybean and Canola Committee has updated the soybean maturity group recommendation map for Ontario. The map is based on the last 10 years of performance trial results conducted across Ontario and includes hundreds of varieties and thousands of yield comparisons.

## A little more information

Soybean varieties cannot be categorized simply by the number of days they take to mature. Days to maturity can change depending where they are grown, the growing season and the planting date. Crop Heat Units (CHUs) are also inaccurate since soybeans are photoperiod sensitive so day length and temperature impact maturity. Instead, soybean varieties are classified using a relative maturity system that compares new cultivars to established cultivars.

In North America, there are 13 maturity groups (MG) ranging from the earliest (MG 000) to the latest (MG X). In Canada, maturity groups range from MG 000 to MG III. With the use of decimals, each decimal unit equals approximately one day of maturity. For example, a variety rated MG 1.5 will mature 5 days later when compared to a variety rated MG 1.0 planted on the same day at the same location.

## The full story

The **Ontario Soybean Maturity Group (MG) Recommendation Map** (Figure 1) provides a general MG guideline to optimize soybean yield potential. The map is based on current varieties grown in the Ontario Soybean Variety Trials. But note that not all varieties available for sale in Ontario are tested in these trials. Varieties that yield the highest and mature normally are considered “adapted” for a given growing region. These varieties are adapted to mature in early fall, given a normal planting date (late April through May).

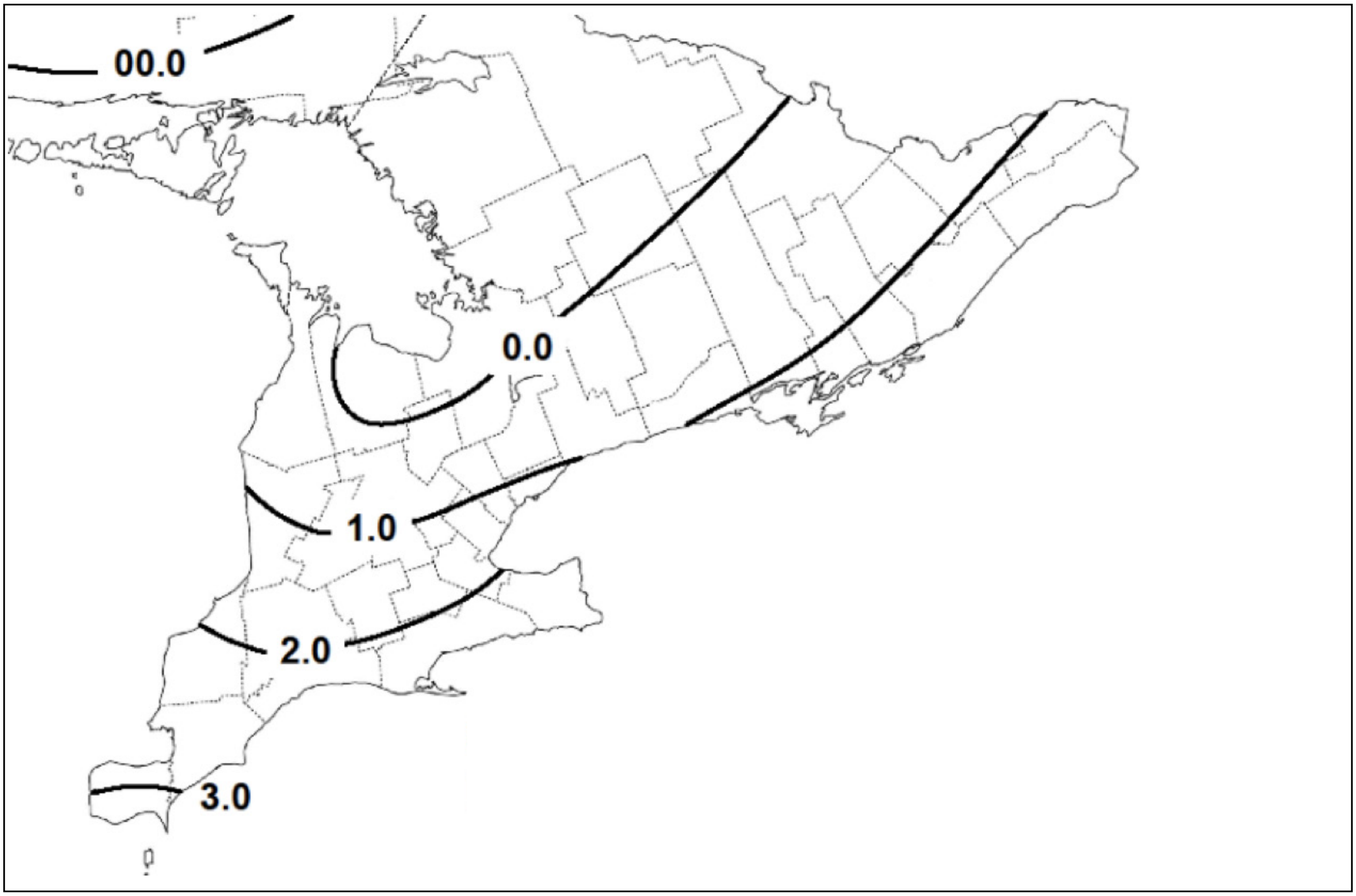


**Figure 1.** Soybean maturity group (MG) recommendation map for Ontario.

Selecting the proper variety provides the opportunity to make use of the full growing season and maximize yield. Remember that planting a shorter season variety (lower MG) than adapted has less yield potential because it will mature too quickly. Conversely, a variety that is too long (high MG) for a given area may not finish before a killing frost. A variety can "adjust" to the season only a limited amount due to its photoperiod sensitivity. Planting date, individual variety characteristics, field elevation, soil type, desired harvest date and other local parameters must also be considered. For example, when planting very early, a slightly higher MG than is recommended in Figure 1 can yield more. Conversely, when planting extremely late (past the production insurance deadline) or in a double crop situation, a lower MG is necessary. Winter wheat often follows soybean harvest in Ontario. The dilemma in choosing a soybean variety is about balancing a high-yielding soybean variety with one that has an early harvest date. Selecting a variety that is approximately 0.5-1.0 MG less than the adapted for a given area is usually a good approach before winter wheat.

**Bottom line**

Use Figure 1 as a general guideline when choosing soybean varieties for your farm planted before the crop insurance deadline.

**View the full Ontario Soybean Variety Trials here.**

# When should I plant my winter cereals?

*Planting date is one the most important components of winter cereal establishment. Planting winter cereals within their optimum planting date window provides the largest window of opportunity for fall tillering and root growth to deliver improved winter survival and optimum yield potential.*

## The simple answer

The seeding date for winter wheat is often determined by when soybeans are harvested. However, this strategy often delays the planting date for winter cereals and reduces yield potential.

Figure 1 shows the ideal seeding dates for winter wheat in Ontario. The planting zones on the map are based on combined Environment Canada 30-year normals between 1981–2010 and calculated average daily temperature from 2011–2017 from Weather Innovation Network and Environment Canada. Actual results will vary from year to year.

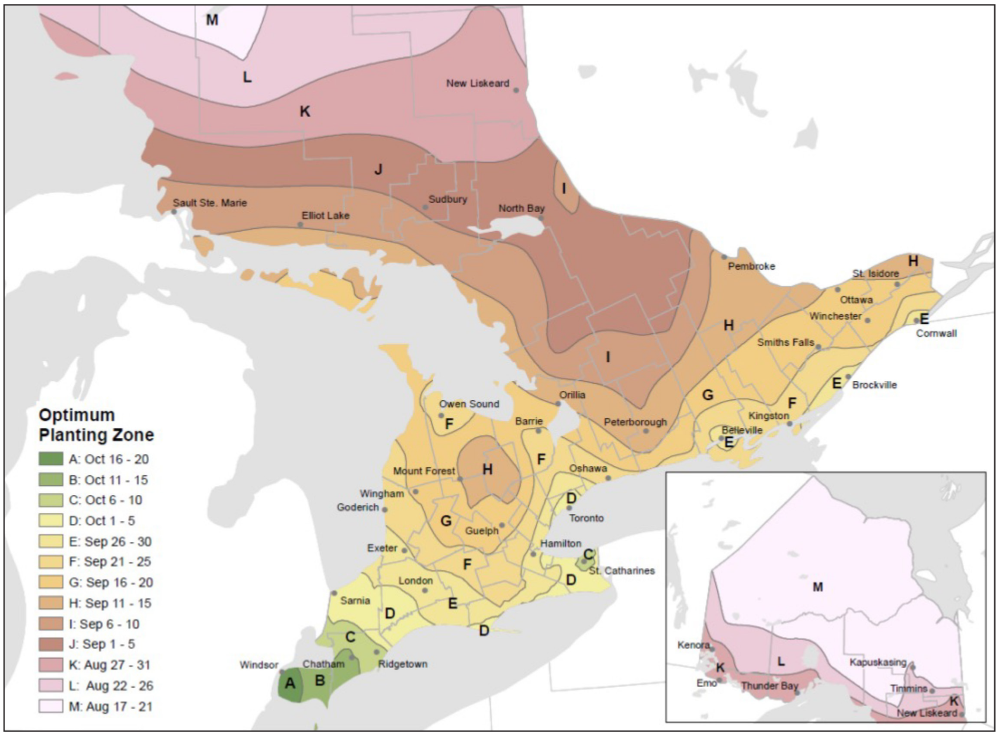


**Figure 1.** Optimum planting date map for winter wheat in Ontario.

## A little more information

Cereal crops are very responsive to planting date. Ontario research shows a 1.1 bu/acre/day decrease in yield for each day that cereal planting is delayed beyond the optimum date.

While Figure 1 is specific to winter wheat – with optimum winter wheat planting dates across all planting zones – the map can also be used to determine optimum planting dates for other winter cereals.

- Winter barley should be seeded 7–10 days prior to the optimum dates for winter wheat to improve winter survival.
- Winter triticale should be seeded 10–14 days prior to the optimum winter wheat seeding date to optimize tillering and spring forage yields.

## The full story

Later planting dates can work. However, research by Emma Dieleman at the University of Guelph, Ridgetown Campus showed that the maximum yield potential achieved at earlier planting dates could not be realized with later planting dates, even when an intensive management strategy was used (Figure 2).

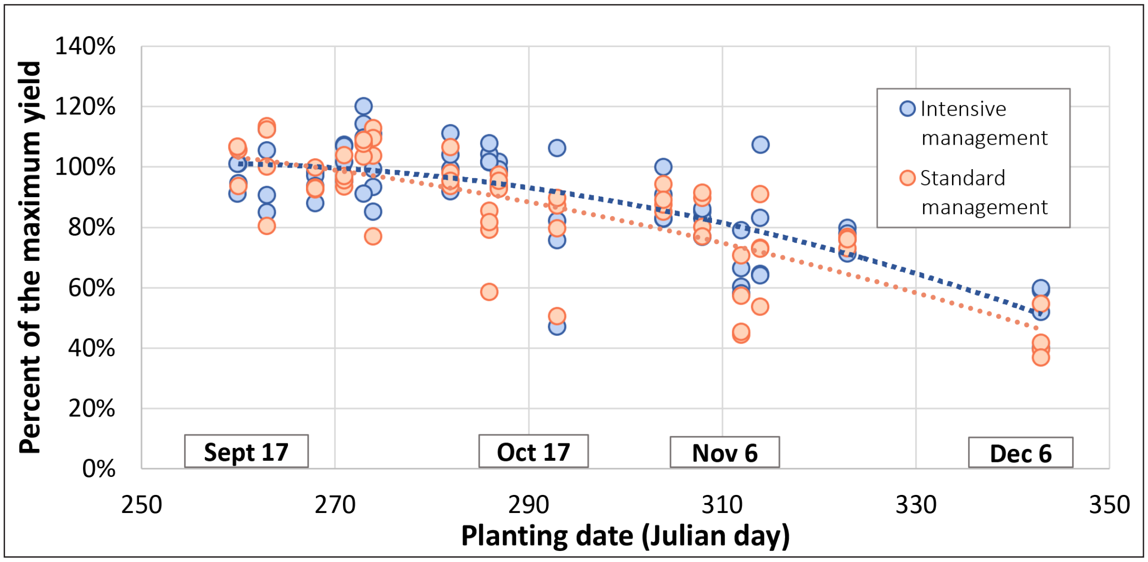


**Figure 2.** When seeding beyond the optimum planting date of a particular region, the maximum yield potential achieved at earlier planting dates cannot be achieved even with an intensive management strategy.

While winter cereals can be seeded too early and increase the risk of barley yellow dwarf virus (BYDV) (Figure 3), snow mould (Figure 4) and lodging, the risk of not planting in a timely fashion carries far greater yield risk. When seeding winter wheat more than 10 days prior to the optimum date, decrease the seeding rate by 25%. Using lower seeding rates in this situation reduces the risk of snow mould and lodging. When seeding winter barley and winter triticale, select varieties with tolerance to BYDV, or use a seed-applied insecticide that controls aphids. For information on a variety's tolerance to BYDV, please contact your seed dealer. Varieties with good resistance to snow mould are also recommended, particularly where stands are thick prior to snowfall.

**Figure 3.** Barley yellow dwarf virus symptoms in winter wheat.

**Figure 4.** Snow mould in early planted winter triticale.

# Do cover crops increase or decrease yield of subsequent cash crops?

*Cover crops provide many benefits, but uncertainty about their impact on cash crop yield can be a barrier to on-farm adoption. We've summarized some of the latest research on cover crop yield effects and paired it with management strategies to help improve outcomes.*

## The simple answer

In most cases, growing a cover crop delivers an equal or greater yield in the cash crop that follows, compared to not growing a cover crop.

## A little more information

Based on research trials from 2015–2021, crop yields following a cover crop were increased in 51% of cases, showed no difference 7% of the time and reduced yield in 42% of instances when compared to a no cover crop control.

At first glance this may look like a wash, but clear differences emerged when management factors like cover crop type, cover crop biomass and main crop were considered. Legumes tended to promote yield more than grasses, and vegetable crops benefitted from cover crops more than field crops.

The findings come from an analysis of 63 different studies conducted in temperate climates in Canada and the U.S. by Drs. Inderjot Chahal and Laura Van Eerd of the University of Guelph. The collection of trials included more than 670 observations – 48% on corn (Figure 1), 29% on vegetables and 11% on soybeans as the cash crop.

**Figure 1.** Corn growing following a fall-terminated red clover cover crop in Brant County, Ontario.

## The full story

### Cover crop type

Four types of cover crops were compared:

- grasses – mostly winter cereal rye and oats
- legumes – primarily clovers, vetch and peas
- non-legume broadleaves – predominantly brassicas
- mixtures – half were legume-grass combinations

Overall, legumes improved cash crop yield by 11% compared to a no cover crop control. The other three cover crop types did not lead to stronger yields, with grasses actually showing a slight trend toward lower yield (4%).

### Cover crop biomass

The picture becomes clearer when yield results are categorized by cover crop type and the amount of aboveground growth at termination. Grass cover crops were likely to hurt cash crop yields when biomass was more than 3 tonnes/ha (~1.3 tons/acre) (Figure 2). For legumes, medium and high amounts of biomass 1.1–4.9 tonnes/ha (0.5–2.2 tons/acre) tended to increase crop yields.

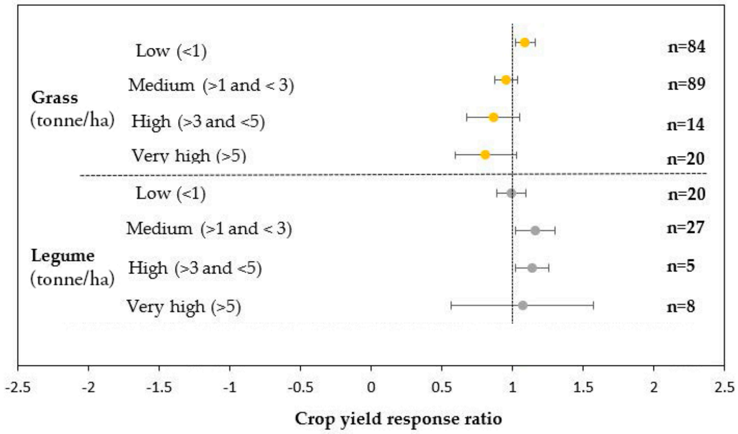


**Figure 2.** The response ratio (crop yield with vs. without cover crop) trended lower for grasses and higher for legumes with increasing biomass.

Let's look at why this happened. Nitrogen tie-up by grasses like cereal rye – which represented nearly half the grass cover crops in this research – increases with greater biomass. Conversely, more nitrogen is produced by legumes as biomass increases. Allelopathic effects from grasses such as rye can also be amplified by larger amounts of plant material.

### Cash crop type

Yield impact also varied by crop type. Grass and legume cover crops both contributed to greater yields in conventionally grown vegetables by 14% and 19%, respectively (Figure 3). For conventionally produced field crops, yield effects were neutral for all types of cover crops, with a trend of slightly lower yields following grasses. This is consistent with other research that has shown grasses like winter cereal rye before corn can hamper yields under some circumstances. Data for certified organic crops not shown.

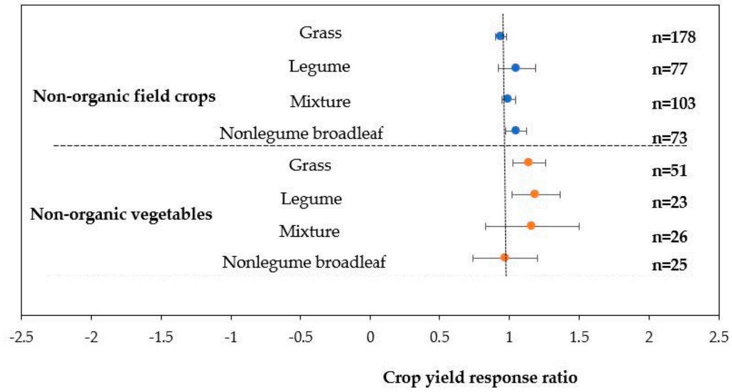


**Figure 3.** The yield effect of cover crops, or response ratio, was neutral (close to 1) for non-organic field crops and positive for grasses and legumes grown ahead of non-organic vegetable crops.

### Bottom line

- **It's all about management.** Match cover crop species with complementary crops and manage cover crop growth based on goals and equipment capabilities.
- **Look for short-term wins beyond yield.** In field crop systems where single-year yield benefits aren't common, capture value from cover crops through nitrogen credits, forage and grazing, and by keeping topsoil in place with living roots.
- **Manage costs.** Less can be more – dial in species and seeding rates to match goals and combine seeding with other operations when possible to reduce establishment expenses.
- **Cover cropping is a long game.** About 70% of the studies included in this analysis were short term. North American research and on-farm experience shows that yield and economic benefits tend to accrue when cover crops are grown for multiple years.

**For more information on cover crop management and species selection, visit midwestcovercrops.org/ontario/**

**Ian McDonald** *Crop Innovations Specialist*

# What are the benefits and risks of different approaches to residue management?

*Tillage can be a hot topic, and for good reason. Every farm is different and you can't judge another grower's tillage decisions without understanding their soils, equipment and workload. But most farmers agree on one thing: soil health matters. Let's look at how different residue management approaches can influence crop performance and long term soil conditions.*

## The simple answer

Residue management is about deciding whether to bury residue or leave it on the soil surface – each choice has clear benefits and risks. Surface residue protects soils and improves organic matter, while incorporated residue breaks down faster but can increase erosion and reduce long-term soil health.

## A little more information

Residue breakdown is driven by soil biology – microorganisms, earthworms and other soil fauna. This process is also affected by moisture, temperature, oxygen, nutrient availability, residue size and soil structure. Burying residue speeds decomposition but often loses carbon as $CO_2$. Leaving residue on the surface slows decomposition but helps build soil organic matter.

## The full story

How you manage residue has an impact on the management of many other aspects of your operation:

- erosion control
- soil structure
- infiltration
- pests and diseases
- planting conditions
- nutrient cycling
- overall soil health.

The following tables provide comparison information to consider with residue management plans.

### Table 1. Benefits and risks of keeping crop residues on the soil surface.

| Benefits | Risks |
|---|---|
| • controls erosion<br>• conserves moisture<br>• regulates soil temperature<br>• improves soil biology and soil structure<br>• reduces labour, fuel and equipment costs | • delays spring soil warming/drying<br>• pest and disease potential<br>• weed management issues<br>• nutrient stratification<br>• planting issues – hairpinning, penetration |

### Table 2. Benefits and risks of burying/incorporating crop residues.

| Benefits | Risks |
|---|---|
| • easier spring operations<br>• nutrient cycling<br>• pest and weed control<br>• temporary nutrient release<br>• faster soil warming/drying | • erosion (wind, water, tillage)<br>• loss of soil nutrients<br>• soil degradation<br>• loss of organic matter<br>• labour/equipment costs<br>• soil crusting<br>• restricted infiltration |

## Table 3. Implications of management on value and effectiveness of crop residues.

| Well managed | Poorly managed |
|---|---|
| • increases soil organic matter<br>• feeds soil microbes<br>• improves infiltration<br>• reduces erosion<br>• enhances nutrient cycling<br>• moderates soil temperature<br>• resists compaction<br>• supports reduced/no-till | • nutrient immobilization or loss<br>• higher disease/pest loads<br>• cooler/wetter soils<br>• compaction/poor structure<br>• planting interference<br>• altered water dynamics<br>• loss of organic matter<br>• stalled organic matter formation |

## Table 4. Residue management options.

| Option 1 | Option 2 |
|---|---|
| • bury or incorporate with plows, discs, etc.<br>• cut and pin with VT tools (Figure 1)<br>• leave on surface behind combine<br>• cut or shred with flail mowers or rollers<br>• strip till | • bio-strip till<br>• cover crops<br>• residue row cleaning (Figure 2)<br>• residue removal with end use |

**Figure 1.** A vertical tillage (VT) tool managing corn residue in the fall.

**Figure 2.** A row cleaner clearing corn residue in the area to be planted.

## Table 5. Residue conditioning methods.

| | |
|---|---|
| **Combine** | As a starting point, consider:<br>• headers<br>• choppers<br>• spreaders (Figure 3) |
| **Tillage tools** | Factors related to residue sizing, positioning and amount of soil volume disturbance:<br>• speed<br>• width and depth<br>• disc shape/type<br>• timing |
| **Planter** | Factors that affect the ability of planting equipment to place seed in the optimum environment for success:<br>• row cleaners<br>• coulters<br>• openers<br>• down pressure |

**Figure 3.** Proper combine set-up ensures more even spread of crop residue.

**Ben Rosser** *Corn Specialist and Jonathan Sawicki/University of Guelph*

# How much urea is too much for strip till corn?

*Safe fertilizer rates in strip till are one of the most common questions strip tillers ask, but solid guidelines are still limited. Applying higher fertilizer rates in the strip can improve efficiency, reduce extra field passes and boost crop response to nutrients. However, placing too much fertilizer too close to the seed increases the risk of seedling injury from fertilizer burn.*

## The simple answer

Here are preliminary findings based on average yield responses across urea rates from 0 to 250 lb N/acre.

- **Shallow shank banding** (SS) – 6" shank depth, 4" release depth – and **coulter mix** (CM) offered good nutrient availability but were the riskiest placements, with yield losses starting above 100 lb N/acre.
- **Double banding** (DB) on the strip edges was safer but yield loss showed up above 150 lb N/acre, and at lower rates where the planter drifted too close to the band.
- **Deep shank banding** (DS) – 8" shank depth, 6" release depth – was the safest placement with no yield loss at any rate tested.

**Growers looking to push fertilizer rates in strip till should pay close attention to where fertilizer is placed within the strip and test rates on small areas before applying them across whole fields.**

## A little more information

Ontario has clear guidelines for safe fertilizer rates when placing nutrients in furrow or in a 2"x 2" band at planting. But strip till fertilizer placement varies much more, making it harder to know what rates are safe.

Coulter-style strip tillers generally mix fertilizer throughout the strip. Shank-style machines can mix fertilizer around the shank or band it behind the shank – sometimes as deep as 6" or as shallow as 4". Placing fertilizer closer to the seed can improve early nutrient availability, but it also reduces the amount that can be safely applied without risking seedling injury.

A project with University of Guelph's John Lauzon evaluated yield response to different strip till fertilizer placements to provide recommendations for growers. A custom 4 row strip tiller was built to test four placements (Figure 1).

1. **Shallow shank band** (SS): Fertilizer released at 4" deep behind a 6" shank to provide some starter effect by keeping nutrients closer to the seed zone.
2. **Double band** (DB): Fertilizer banded on the strip edges (~3–4" off centre). Some Ontario growers use this setup to keep fertilizer out of the seed zone for safety, while still hopefully making it accessible early in the season.
3. **Deep shank band** (DS): Fertilizer released at 6" deep behind an 8" shank to reduce fertilizer burn risk by keeping nutrients well below the seed zone.
4. **Coulter mi**x (CM): Fertilizer mixed evenly into the strip – as done by many shank or coulter strip till units – to avoid concentrated bands.

## The full story

Trials were conducted from 2022 to 2025 to evaluate a wide range of fertilizer rates on three soil types – clay loam near Atwood, silt loam near Elora and sandy loam near Paris. To avoid confounding yield loss from nitrogen (N) shortage, all plots received additional sidedress or broadcast N to ensure total N supply was not yield limiting.

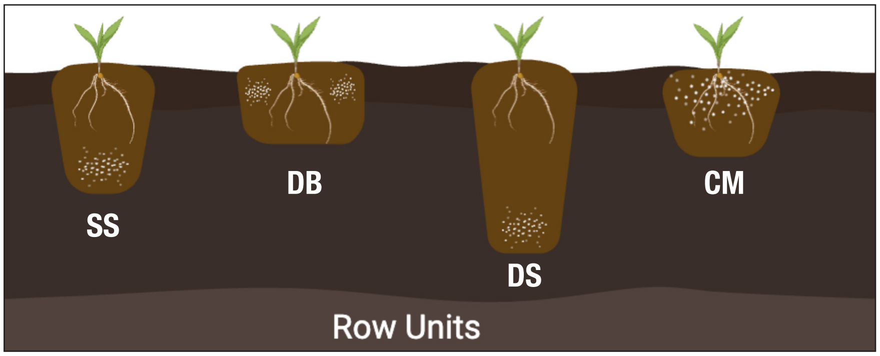


**Figure 1.** Four strip-till fertilizer placements investigated with custom strip till bar.

### Urea rates when yield starts to drop for each placement

Preliminary yield responses for each fertilizer placement across urea rates from 0 to 250 lb N/acre are shown in Figure 2. On average:

- shallow shank banding (SS) – 6" shank depth, 4" release depth – and coulter mixed (CM) placements showed yield decline above 100 lb N/acre
- double banding (DB) on the strip edges showed yield loss above 150 lb N/acre
- deep shank banding (DS) – 8" shank depth, 6" release depth – showed no yield decline at any rate tested

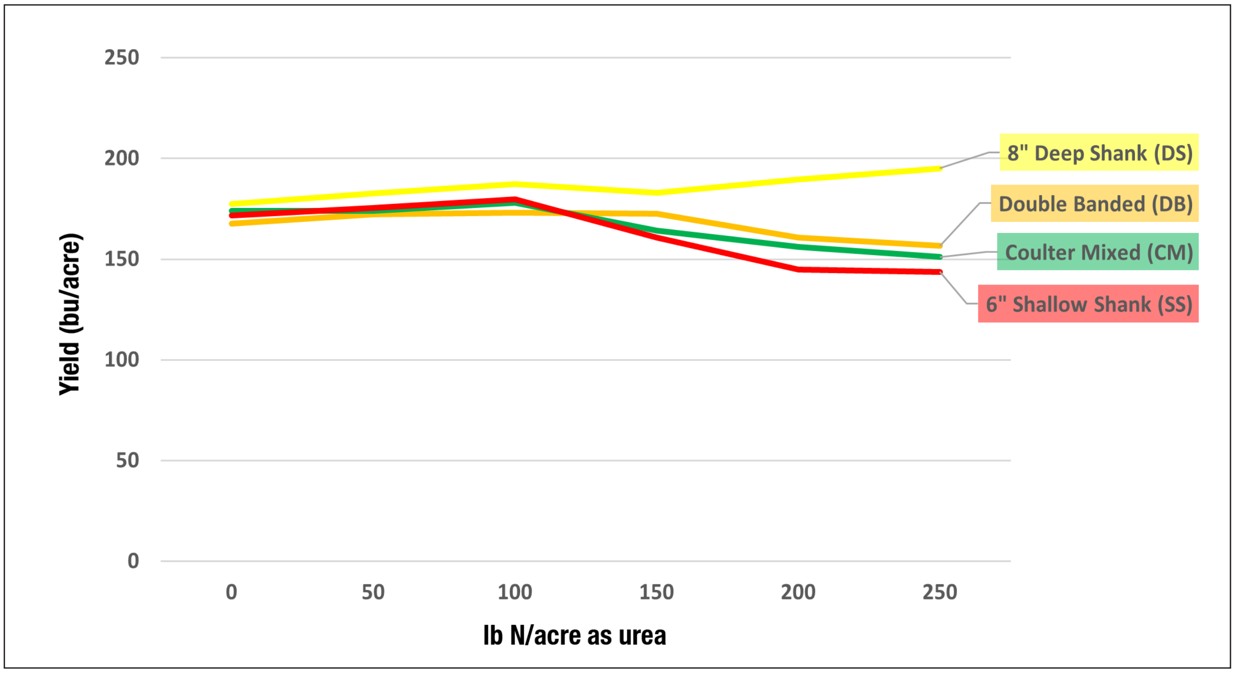


**Figure 2.** Corn yield response across six rates of urea for four strip till fertilizer placements.

### Guidelines for safe fertilizer rates

Keep the following points in mind when interpreting safe strip till fertilizer rates and this research.

1. **Guidelines will be conservative.** The data from 11 site years is helpful, but some locations still showed yield loss at fertilizer rates lower than the averages suggest. Safe rate recommendations will reflect those more sensitive sites.
2. **Shallow placements increase risk.** Some growers have seen fertilizer burn at rates lower than those tested here – especially when fertilizer is placed shallower (e.g., 4" in spring). Shallow bands become risky quickly if rates are pushed high or if seed is placed too close.
3. **Edge band safety depends on planter accuracy.** Edge banding looked relatively safe in this study, but only when the planter stayed centred on the strips. If the planter drifts toward the strip edge – particularly with high, shallow bands – the risk of fertilizer injury increases.
4. **Actual fertilizer placement may differ from the "paper plan."** Fertilizer doesn't always end up where you expect in the strip. Mixing may be uneven, or concentrated pockets may form. Knowing where your strip tiller places fertilizer in your soil is key. A simple way to test placement is to run oats through the strip tiller and watch where they germinate – this reveals where fertilizer (or seed) is being delivered.
5. **If pushing rates, start small.** Test higher fertilizer rates on a few strips across different fields or years before applying them farm wide.

**Christine Brown** *Sustainability Specialist*

# How can including pH and C:N ratio in a manure analysis help predict nutrient availability?

*Manure analysis provides a lot of valuable information to help you manage crop nutrient needs. We took at deeper look at two components to provide insights that might impact your overall crop management plans.*

## The simple answer

When crop prices are low and input costs are high, it's important to maximize the nutrient value of organic amendments to maintain profitability and support environmental stewardship. A manure analysis that includes pH and carbon-to-nitrogen (C:N) ratio helps fine tune nutrient availability and identify when additional fertilizer may be required.

## A little more information

Manure pH is an indicator of how quickly ammonium N ($NH_4$-N) may be lost through volatilization. Knowing the pH supports better decisions around manure rate, timing and the impact of incorporation for maximizing available nitrogen (N). Manure pH can also influence phosphorus (P) and micronutrient availability, especially in soils with very high or low pH levels.

The C:N ratio provides insight into the balance between these elements in the manure, helping predict whether organic N will be mineralized (released) or immobilized (tied up) during the growing season. This information helps determine how much plant available N can be anticipated, and when, for the current crop.

Manure provides nutrients, organic matter (OM) and biological activity.  A manure analysis measures composition to provide valuable information for nutrient management planning. Typically, dry matter (DM), total and ammonium N, total P and potassium (K) are tested. When these results are combined with soil test information it can help set application rates and determine additional fertilizer needs.

Including pH and C:N ratio in an analysis improves understanding of nutrient fate and nutrient interaction with the soil. Manure pH influences what happens to the nutrients once they are applied to soil. Nutrient availability from manure is influenced by both manure and soil pH.

## The full story

### pH affects N availability and microbial activity

Manure pH drives the balance between ammonium ($NH_4^+$) and ammonia ($NH_3$). As manure pH moves above 7.5 there is a shift to a higher proportion as $NH_3$ gas, which accelerates volatilization losses. These losses are boosted in warm, windy conditions with surface applied manure. Liquid manure with high $NH_4$-N and high pH applied on a warm windy day can lose a significant portion of N within a few hours of application. Losses for manure with more neutral pH (<7) applied in the same conditions occur more slowly.

Ontario field trials studying spring/late summer applied manure found the $NH_4$-N loss in the first few hours was higher with manure pH 7.9 than accumulated $NH_4$-N loss in a week with manure at pH 7 or lower. Solid manure tends to have higher pH levels (often >8), however the $NH_4$-N levels are also low.

Microbial processes essential for mineralizing nutrients from manure are also pH sensitive. Microbes tend to mineralize N and P more quickly in manure with slightly higher pH, while lower pH manure can slow microbial activity and delay nutrient release. This can affect the timing of nutrient supply relative to crop demand.

### Managing manure with high pH

It is difficult to change manure pH, but knowing the pH means you can make decisions to reduce rapid volatilization losses and prevent crop N deficiency. Some of these considerations include:

- timing liquid manure applications when conditions are cooler or application can occur into standing crops
- placing manure by injecting, rapid incorporation or application into standing crops
- adjusting supplemental N for crops relying on manure N when conditions during application were favourable for high N loss
- potential use of nitrogen (nitrification) inhibitors – more research required

### pH effect on P and micronutrient availability

Manure P, mainly in organic form, must be mineralized by microorganisms to be available. Soil pH has the bigger influence but manure pH can impact areas with manure/soil contact by slowing P availability.

In calcium-rich, high pH soils, calcium binds with P and reduces its availability to crops. For example, the use of alkaline-stabilized biosolids (N-Viro or ashed biosolids) when precision applied improves low pH soils, but can reduce P availability when applied to field areas with high pH (eroded knolls). Availability of micronutrients such as zinc, manganese, copper and iron can also be reduced in high pH conditions.

### Why C:N ratio matters

Soil microbes drive manure decomposition. Bacteria and fungi use carbon as an energy source, and N builds proteins, enzymes and new microbial cells. As microbes break down sugars, starches and proteins, they temporarily tie up N in their biomass (immobilization) that is eventually released back to the soil as plant-available N (mineralization).

The C:N ratio of the microbial biomass is about 8:1. The C:N ratio in manure, combined with environmental conditions, determines how quickly N is available to a crop. Warm temperatures, adequate moisture and oxygen accelerate decomposition and nutrient release. Cold, dry and anaerobic conditions slow microbial process and nutrient release.

Including the C:N ratio in a manure analysis helps predict:

- when N will be available
- whether supplemental N is required
- how manure will interact with soil microbial activity

Here's how to determine crop N management using the C:N ratio.

| C:N ratio | Manure source | N management |
|---|---|---|
| <10:1 | anaerobic digestate, liquid hog or poultry (Figure 1) | • rapid mineralization with surplus N released to the soil as $NH_4^+$ with rapid conversion to $NO_3^-$<br>• manure N is readily available for plant uptake almost immediately after application and if timed wrong will be subject to environmental losses<br>• cover crops can be effective for capturing N to prevent losses when applied during the growing season post harvest |
| 10:1 to 20:1 | solid cattle-minimal bedding, liquid cattle-some bedding, poultry-sawdust bedding | • there is enough N for microbes to break down the carbon, but environmental conditions impact how rapidly N is converted to $NH_4^+$ or nitrate ($NO_3^-$) |
| 20:1 to 30:1 | solid cattle-high bedding (Figure 2) | • microbes use the available N for decomposition, however the mineralization process is slower<br>• slower and gradual release of N through the season<br>• increases risk of immobilization immediately after application<br>• improves soil health and still provides N credit |
| >30:1 | low N cattle manure with high bedding, horse manure | • microbes need more N than manure can provide and "steal" soil N to decompose carbon<br>• increased risk of immobilization and N deficiency when applied to early season crops<br>• crops with high N requirement require supplemental N<br>• slow mineralization contributes to increasing soil OM and N credit |

**Figure 1.** Anaerobic digestate (pH 8) injected and surface applied. Cover crop oat growth shows N deficiency in surface applied areas compared to injected areas.

**Figure 2.** An organic amendment, spring applied with a C:N ratio of 22:1, reveals N deficiency in this side-by-side comparison with commercial N.

### Bottom line

Knowing the manure pH and C:N ratio of manure and/or other organic amendments being applied can help management decisions around timing of application and incorporation to better match crop N needs, prevent losses and help determine supplemental N needs for crops with high N requirements.

**Laura Scott** *Cropping System Specialist*

# Are we over complicating our cropping system?

*Farmers have spent years studying the array of factors that affect a cropping system. Changing one small thing can have an immediate impact on another part of the system. With so many variables – from fertility to rotation to weather patterns – we took a closer look at whether we are overthinking how we approach cropping systems.*

## The simple answer

Yes. Cropping systems are complex and can have both minute and massive effects on a farm operation from minimal changes. That means that small, simple changes could create a larger ripple effect on the system. With some careful planning and informed decision making, we can create a system that's manageable and suits each individual farming operation.

## A little more information

Washington State University defines a cropping system as *"…the crops and crop sequences and the management techniques used on a particular field over a period of years."* This definition focuses on managing each individual field as its own system. For Ontario producers, we could expand that even further. You could have multiple fields on one farm, multiple farms with similar properties and history, or individually managed fields. At the highest level, a cropping system includes the entire farm, and all the acres managed in that farm operation.

Cropping systems vary from farm to farm and are often centred around the different goals and needs of the operation. Farms that are exclusively crop producers likely have different management goals than mixed operations that need livestock feed and have manure to manage.

Within each cropping system, there are various levels to consider. At a whole operation level, you would include every specific sector of the farm – crop acres, livestock, acres required for feed production, manure management, marketing decisions, weather and climate patterns and whole farm tillage patterns. As you look field by field, you still include most of these factors, but some may not apply every year. Manure applications may not be happening on every field, every year, or a field may go into a perennial forage crop for multiple years, changing the year-to-year demands of that field.

# The full story

We chronically over complicate cropping systems, so how do we break this down into pieces we can manage?  If we think of any farming operation with crop production as a cropping system, it can help how we approach long-term management.

If a farm is a system, then we can look at all the different parts of that farm to create the system. Maybe the farm doesn't include cover crops, but there's no tillage after harvest, allowing the root systems of the harvested crop to help with soil retention. Perhaps the operation has cattle and grows corn on corn, but also consciously rotate both annual and perennial forage crops into the rotation. This approach breaks up the pest cycle, changes nutrient demands and allows a chance for amendments like manure or lime to be worked into the rotation at the right time. All these decisions, when teamed up, create a cropping system.

### Changing your perspective

So, should we change how we manage farm and crop planning if we understand what our particular cropping system looks like? The short answer is no. But we can change the perspective on planning to build more long-term outlook and forethought into decisions.

Instead of planning a crop year at a time in the winter before the growing season, try laying out a crop plan for 3–4 years. Creating a multi-year crop plan can help you determine where there are critical timing points, and when you need to be expecting certain key management windows.

Beyond the typical crop rotation and fertility planning, a 3–4 year plan can include these elements.

- **Soil testing:** Most soils should be tested every 3–4 years. When is each field or farm due to be soil tested?
- **Lime applications:** Is your soil pH where it should be to grow each crop in your rotation? Do you know what soil pH you need to aim for based on the crops in your rotation?
- **Cover crops:** Where do you want to fit in cover crops or are there windows with extended periods of bare soil?
- **Manure management:** Do you have manure that needs to be applied each year? What windows do you want or need to apply it in?
- **Perennial crops:** Do you have perennial crops in your rotations? Having a plan of when to terminate them can make it easier to stick to the system, instead of trying to evaluate stands on shorter notice.
- **Fall tillage:** Does your soil require more extreme fall tillage passes, such as plowing or deep ripping?
- **Winter crops:** Do you plant winter crops that may see a yield advantage if seeded earlier? For example, planting a shorter-day bean can allow winter cereals to be planted in the correct window and offer a yield advantage.

These questions will help you scratch the surface at the decisions that can have long-term effects on your operation. Growing seasons don't always give us time to do everything in our plan. But putting your intentions on paper – and looking more than 12–18 months ahead – gives you room to adjust, introduce new crops to the rotation or make more effective use of available nutrients.

### Bottom line

Farms are already systems and each one is unique. When we shift our perspective to think of our operation this way, it can open up opportunities for more long-term planning and take some of the guesswork out of year-to-year decision making. Creating long-term plans also gives you time to consult advisors including agronomists, nutritionists, financial planners and brokers. Approach crop planning with a multi-year perspective and see how your operation might change.

**Cesar Cappa** *Weed Management Specialist* and **Mike Cowbrough** *Weed Specialist*

# Where can I get herbicide resistance information for my region?

*To build an effective Integrated Weed Management plan, you need to know the herbicides that no longer work on your weeds. A new online tool helps you quickly search by weed species and herbicide group for a snapshot of herbicide resistance in your area.*

## The simple answer

Ontario has a comprehensive, easy to use database with more than 30 years of herbicide resistance testing. You can search the Ontario's herbicide resistant weed database through the Ontario Crop Protection Hub under **"Resistant Weeds – How to test, distribution maps and database."** This tool is available in two formats: a full-featured desktop version and a simplified version optimized for mobile devices. The following descriptions and images are based on the desktop version.

## A little more information

There are four main ways to search the database for herbicide-resistant weeds in your area. All the visualizations maps use the same dataset, but each one is designed to answer different questions for farmers, agronomists and researchers.

- **Weed Species:** Shows resistance cases for a single weed species, broken down by herbicide group.
- **WSSA Herbicide Group:** Lists weed species with confirmed resistance to a selected herbicide group.
- **Species Within a County/Region:** Summarizes resistance cases in a selected area, organized by weed species and herbicide group.
- **Regions Where Species Exist:** Shows where herbicide resistance has been found by herbicide group and municipality. By default, this view displays results for all weed species, but you can also filter to view a single species.

## The full story

To demonstrate how the new tool works, we've put together two practical examples of how to use the database.

### Example 1: Waterhemp in Middlesex County and Acuron effectiveness

A field with waterhemp in Middlesex County raises concerns about herbicide resistance, and product performance is being considered for Acuron. Acuron contains active ingredients from Group 5 (atrazine), Group 15 (s-metolachlor) and Group 27 (mesotrione and bicyclopyrone). Using the **Weed Species** search button and searching for waterhemp typically shows:

- no resistance detected to Group 15 in the database results for the region (where testing exists)
- resistance commonly detected to Group 5
- some cases detected for Group 27, including instances of multiple resistance to Groups 5 and 27

In practical terms, this means atrazine (Group 5) has a high risk of poor performance. Group 27 active ingredients are more likely to provide control, but results can vary with the population and s-metolachlor (Group 15) will offer suppression but is not expected to give reliable control on its own, even without confirmed resistance.

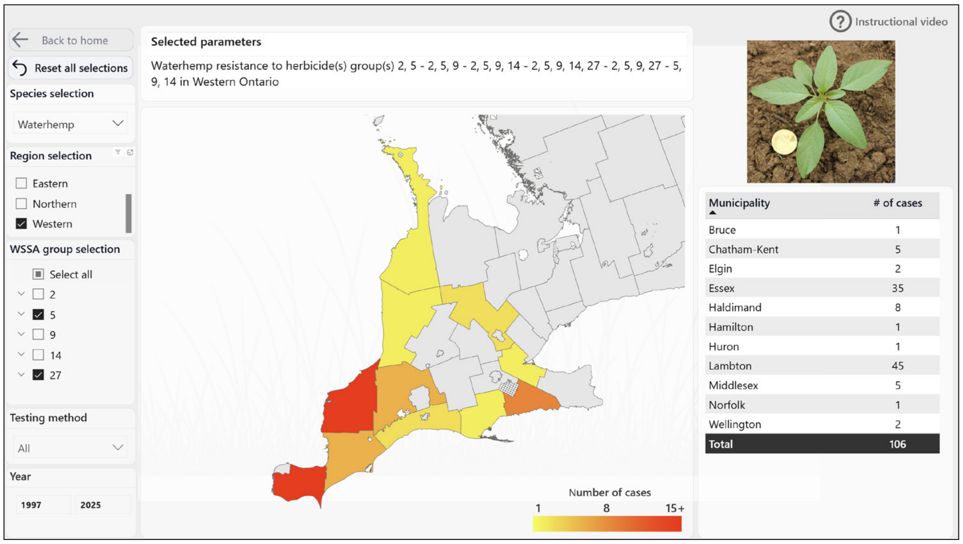


**Figure 1.** The distribution of waterhemp populations in western Ontario with confirmed resistance to Group 5 and Group 27 herbicides.

### Example 2: Group 1 graminicides "not working like they used to"

A vegetable grower has heard that Group 1 graminicides (e.g., Assure II, Select) aren't giving the same level of control as in past years and wants to know if resistance has been confirmed in Ontario.

The quickest way to check is through the **WSSA Herbicide Group** search button. A search for Group 1 shows that resistance has been documented in Ontario. This result means resistance is a reasonable explanation once other factors – like application timing, weather conditions and weed size – are ruled out.

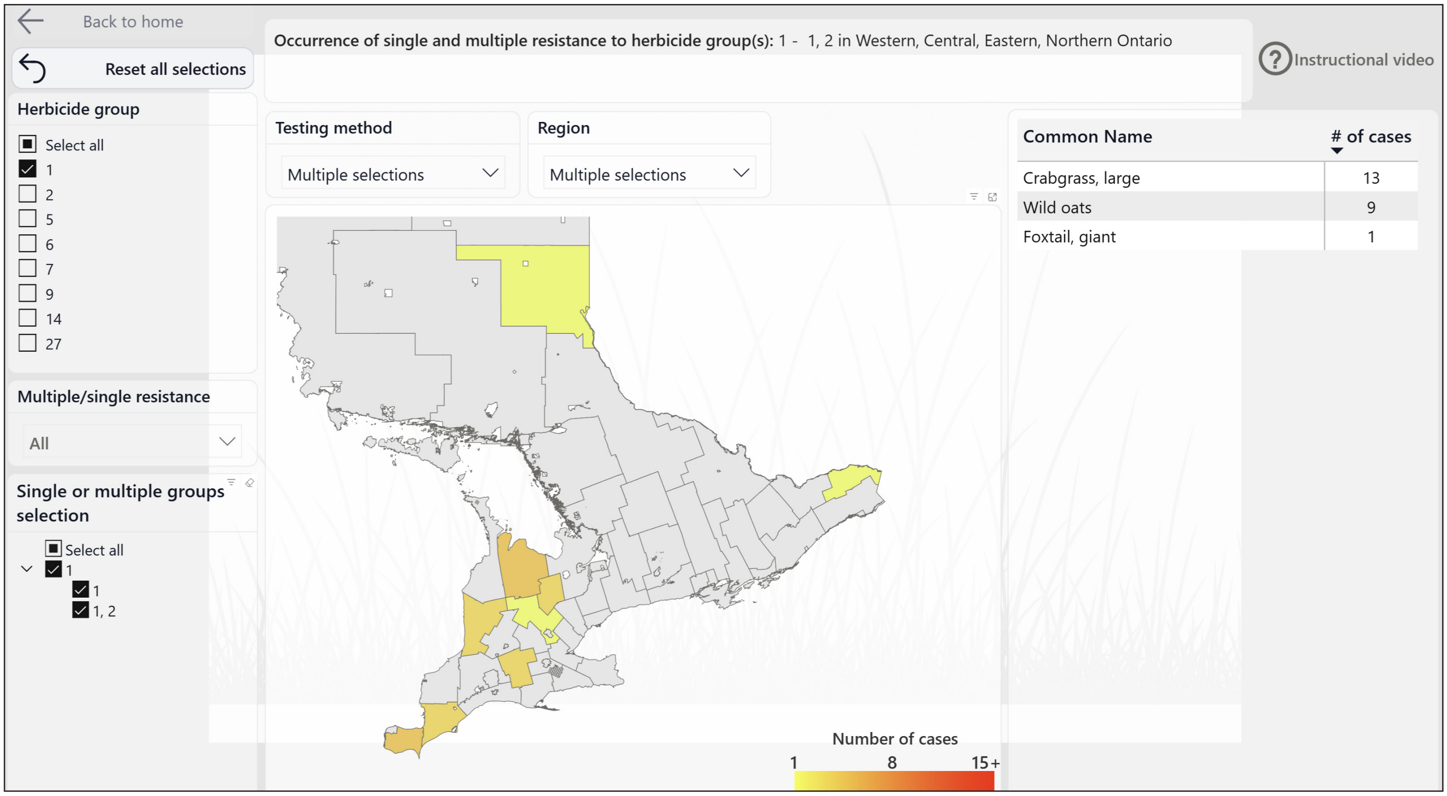


**Figure 2.** The distribution and frequency of Group 1 resistant weed species in Ontario.

### Bottom line

The database is a great starting point when you are looking for information about resistant weeds in your area. But it is one piece of the puzzle, not the full answer. When it comes to resistance, here are some other factors to keep in mind.

- **Resistance isn't always group wide.** Some weed populations may resist certain active ingredients within a herbicide group but not others. For example, pigweed species are often resistant to atrazine, but susceptible to metribuzin.
- **Resistance continues to evolve.** A region with no confirmed cases doesn't guarantee resistance isn't present. If you suspect resistance, consider submitting samples for testing using the process outlined in the Ontario Crop Protection Hub.
- **Testing coverage varies.** Some weeds and regions have been tested far more than others. Few, or no results for a region doesn't mean resistance is unlikely. It may simply mean the weed and region combination hasn't been tested much.

**Look for resistant weeds in your area.**

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by OMAFA Field Crop Team
January 7, 2026

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