PIONEER®

Optimum® GLY

HERBICIDE TOLERANCE

United States Technical Bulletin

CORTEVA™ agriscience

Introduction

Optimum® GLY herbicide tolerance trait is a new herbicide tolerant technology developed by Corteva Agriscience. Glyphosate is the most widely used herbicide active ingredient in agriculture today because it provides effective, reliable, and broad-spectrum weed control. Why develop a new glyphosate-tolerant technology? Farmers value choice and innovation that improves upon existing technology to enable mitigation of current and future weed management challenges. Corteva Agriscience's ownership of this proprietary glyphosate tolerance technology increases options for farmers to choose their supply of traits and germplasm that meets their agronomic needs.

The Optimum® GLY herbicide tolerance trait provides farmers with three primary benefits (highlighted to the right).

This technical bulletin is for educational purposes only and has been designed to provide the details needed to explain why and how Optimum GLY herbicide tolerance products fit as a foundational component to our customers' integrated weed management system.

Optimum® GLY herbicide tolerance trait technology is designed to deliver top yield potential and agronomic trait performance through:

IMPROVED CROP SAFETY
Top yield potential due to unique differences compared to other glyphosate trait-tolerant systems

ENHANCED BROAD-SPECTRUM WEED CONTROL
Improved spectrum and control of hard-to-control annual and perennial weeds

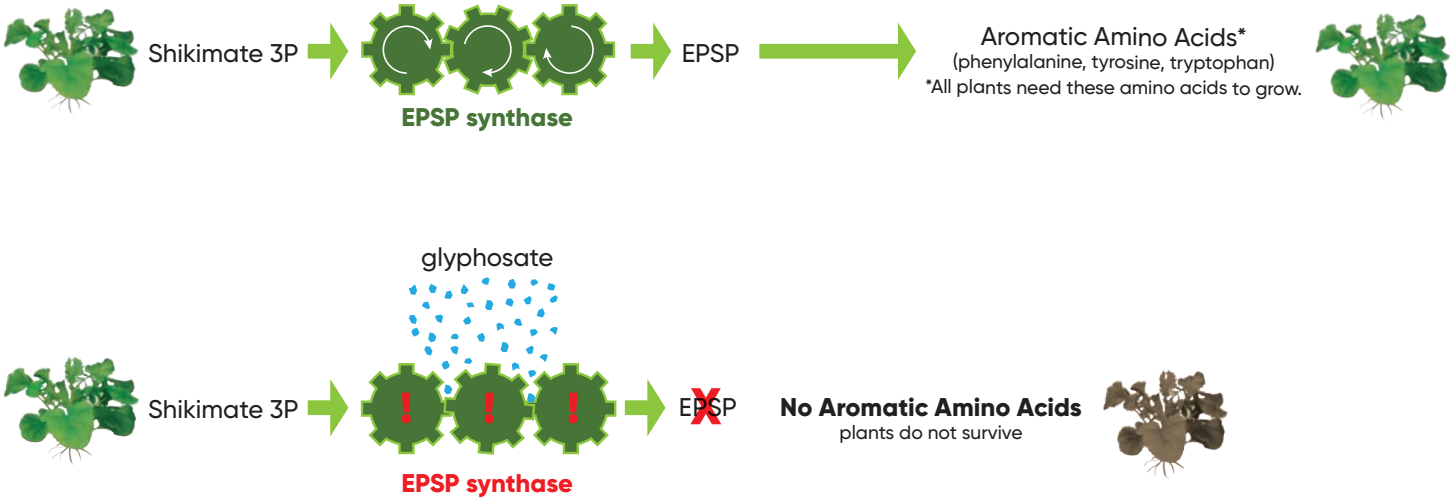
GREATER APPLICATION FLEXIBILITY
Enhanced crop safety and a wider application window from cotyledon to first flower, with a single application of 1.5 lb ae/A or 2 applications of 0.75 lb ae/A/season

What is the Optimum® GLY herbicide tolerance trait?

The Optimum® GLY herbicide tolerance trait enables canola hybrids to deliver on their genetic yield potential and agronomic traits, and allows higher glyphosate application rates and the flexibility to make applications into the reproductive stage of development.

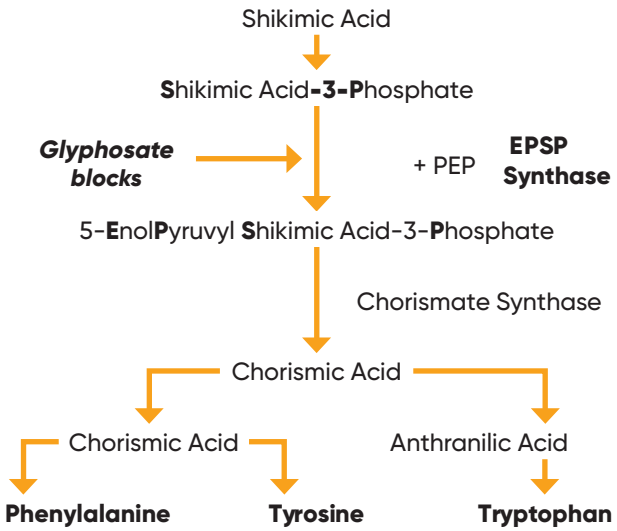
Glyphosate controls plants by inhibiting the shikimic acid pathway, which is critical to plant survival because it produces aromatic amino acids needed to sustain plant growth (Figure 1). Figure 1 provides a simplified version of how glyphosate affects plant growth.

Figure 1. Glyphosate Mode of Action



More specifically, glyphosate shuts down the EPSPS (5-enolpyruvlshikimate-3-phospate synthase) enzyme preventing the construction of three critical aromatic amino acids: phenylalanine, tyrosine, and tryptophan. The EPSPS enzyme is critical to catalyzing the next to last step in the biosynthetic pathway for these aromatic amino acids (Figure 2). Glyphosate inhibits EPSPS from creating EPSP (5-EnolPyruvicshikim Acid-3-Phospate), which is the precursor for creating chorismic acid needed as the base for these three amino acids: phenylalanine, tyrosine, and tryptophan. Amino acids are the building blocks of proteins required for, in this case, plant growth.

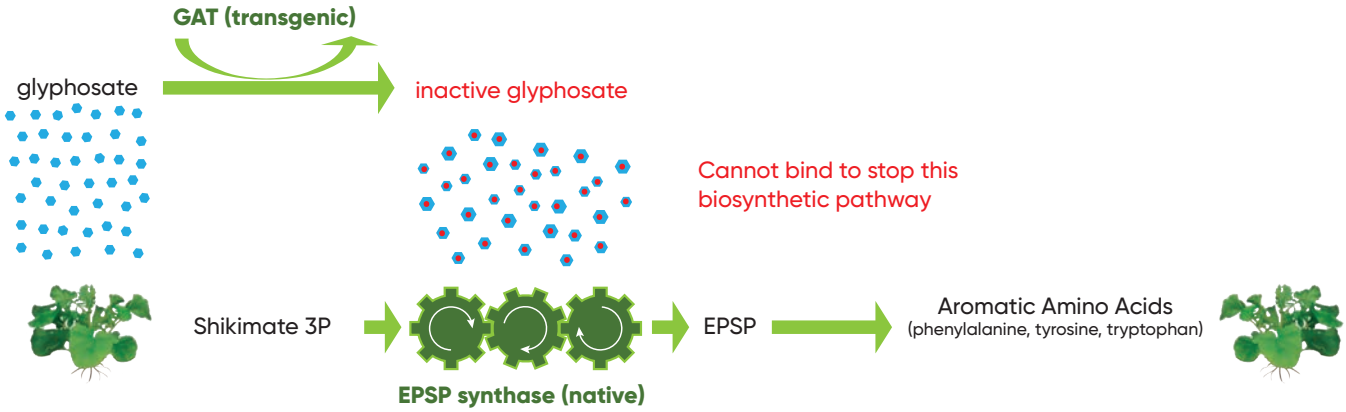
Figure 2. Glyphosate targets the plant EPSPS enzyme involved in aromatic amino acid biosynthesis.



How is Optimum® GLY herbicide tolerance trait different from other herbicide-tolerant glyphosate technologies?

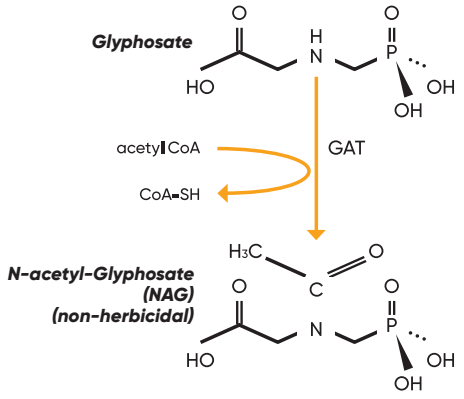
Simply put, Optimum® GLY herbicide tolerance products express glyphosate acetyltransferase (GAT), which is an enzyme that metabolizes glyphosate upon its entry into the canola plant converting glyphosate to a herbicidally-inactive form. This conversion prevents the "herbicidally-active" molecule from binding to EPSPS and stopping the critically important shikimic acid pathway required for canola growth (Figure 3).

Figure 3. Optimum GLY herbicide tolerance trait deactivates glyphosate to survive.



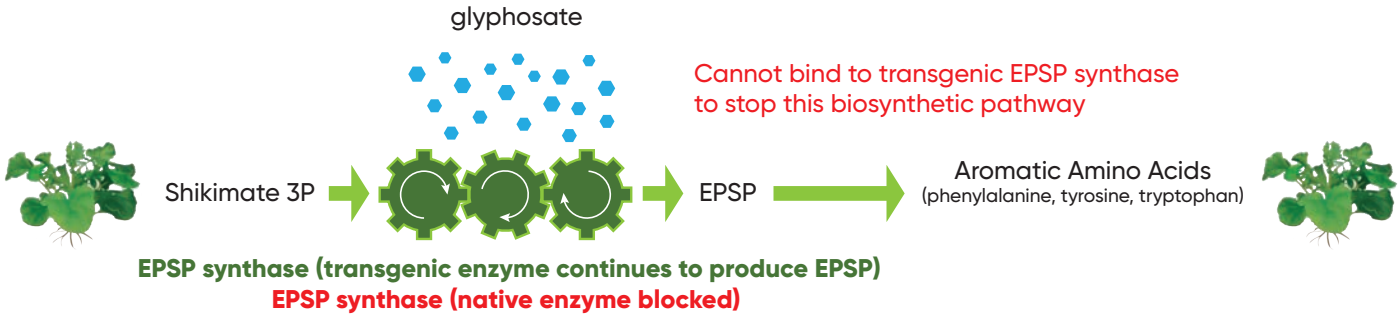
Here is how it works. GAT detoxifies glyphosate through an acetylation process (Figure 4) creating N-acetyl glyphosate, which is herbicidally-inactive. The GAT4621 protein expressed in Optimum GLY herbicide tolerance products originates from a soil bacterium, *Bacillus licheniformis*. DNA shuffling is a process that recombines genetic diversity from parental genes to create libraries of gene variants that are screened to identify those with improved properties. Through DNA shuffling of the original gene, a variant was identified with improved ability to acetylate glyphosate (introduces an acetyl functional group on to the glyphosate molecule). The GAT4621 gene was used to create event DP-73496-4 introduced into canola using biolistic transformation technology. This event (DP-73496-4) produced a single, intact gene insertion with no extraneous DNA. This gene contains a constitutive promoter which means it is expressed in all parts of the plant. The observance of robust tolerance to glyphosate and favorable agronomic performance were the precursors to this gene being introgressed into high yield potential, elite canola hybrids for commercial release.

Figure 4. Glyphosate acetyl transferase reaction



Other glyphosate technologies including Roundup Ready® canola and TruFlex™ technology work by utilizing a gene that creates an altered EPSPS enzyme in the plant, one that is not inhibited by glyphosate (Figure 5). When glyphosate is sprayed, it disables the native EPSPS synthase, but is not able to disable the transgenic gene in Roundup Ready® canola and TruFlex™ technology, allowing the shikimate pathway to proceed. TruFlex™ technology is different from Roundup Ready® canola as it adds an enhancer sequence in the promoter region to heighten transgenic enzyme expression in male (pollen) reproductive tissue.

Figure 5. Roundup Ready® canola and TruFlex™ technology Modes of Action



Why choose the Optimum® GLY herbicide tolerance trait as part of my integrated weed management system?

All benefits previously observed with glyphosate-tolerant systems will continue, and be improved upon, with the Optimum® GLY herbicide tolerance product's weed management system. Those benefits include improved adoption of conservation tillage and improved flexibility in crop management like 'time of planting' and 'timing of weed control' operations. Beyond the immediate benefits provided to a grower, this trait will increase opportunities for canola germplasm developers to further develop and maximize Optimum GLY herbicide tolerance product's potential, bringing high yield potential germplasm to market for our customers' farms.

Due to Optimum GLY herbicide tolerance products expressing the GAT gene in all growing plant tissues (leaves, stems, flowers, roots), the plant is protected and labeled for spray application from cotyledon to first flower. **This allows for spray rate and timing decision flexibility while improving control on a wider spectrum of weeds.** Hard-to-control weeds such as dandelion, foxtail barley, perennial sow thistle, Canada thistle, and wild buckwheat that can now be managed effectively.

Improved crop safety of Optimum GLY herbicide tolerance products compared to existing Roundup Ready® canola is evidenced in comparing approved label application rates, the number of allowable sprays during the growing season, and the flexibility of spraying on later stages of canola crop development. In 10 research locations over 2 years, crop injury evaluations on Optimum GLY herbicide tolerance products demonstrated <1% injury at all application timings with 1.5 lb ae/A. Greater than 80% of locations had 0% injury. At these same locations, Roundup Ready® canola resulted in an average >50% injury with higher rates and later application timings (Figure 6). Past research has shown a 4.3 bu/ac yield loss when applications are made too late (past the six-leaf stage on Roundup Ready® canola). Above label rates on Roundup Ready® canola also contribute to yield loss through reduced flowering. Late application or higher than recommended rates can cause yield loss on Roundup Ready® canola.[1] Optimum GLY herbicide tolerance products allow growers more flexibility to spray effective rates and timings to help manage environmental conditions and/or late flushing weeds.

Optimum® GLY Herbicide Tolerance Products Key Features

- **IMPROVED CROP SAFETY**
- **ENHANCED BROAD-SPECTRUM WEED CONTROL**
- **GREATER APPLICATION FLEXIBILITY**

[1] Always read and follow label directions. Testing conducted on Roundup Ready® canola was for research purposes only and were not labeled application rates or timings.

Figure 6. Comparing Roundup Ready® canola to Optimum® GLY herbicide tolerance trait with 1.5 lb ae/A applied at 4 leaf and 1st flower stage of development.

Roundup Ready® canola after 1.5 lb ae/A applied at 4 leaf and first flower.

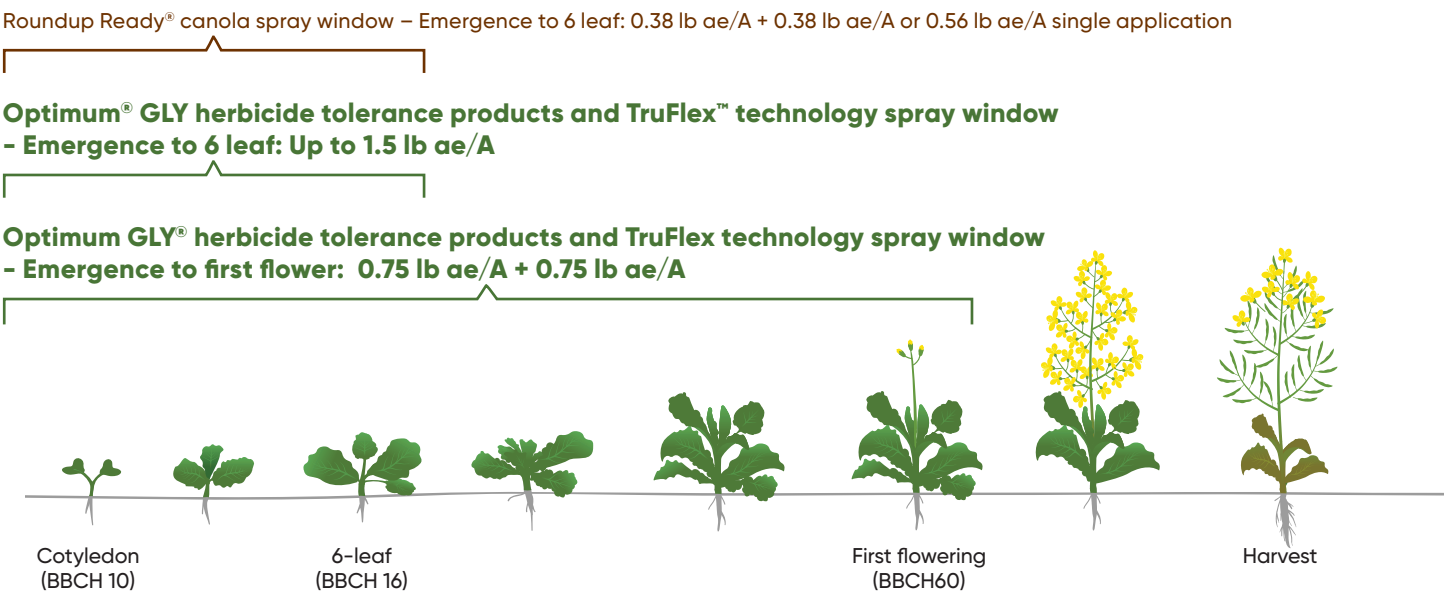
Optimum® Gly herbicide tolerance products after 1.5 lb ae/A applied at 4 leaf and first flower.

Table 1. Comparison of glyphosate labeled timing and rates on the three glyphosate-tolerant technologies.

Stage	Roundup Ready® canola	TruFlex™ technology	Optimum® GLY herbicide tolerance trait
Emergence – 6 leaf	Glyphosate[1] at 0.38 lb ae/A as two applications OR Glyphosate at 0.56 lb ae/A as a single application	Glyphosate[1] at 1.5 lb ae/A for a single application	Glyphosate[1] at 1.5 lb ae/A for a single application
Emergence – First flower	N/A	Glyphosate[1] at 0.75 lb ae/A for two applications	Glyphosate[1] at 0.75 lb ae/A for two applications

[1] For information regarding glyphosate products see page 83 in the North Dakota Weed Control Guide (https://www.ndsu.edu/agriculture/extension/publications/2023-north-dakota-weed-control-guide).

Figure 7. Approved label application rate and timing comparison.



Stewardship Requirements

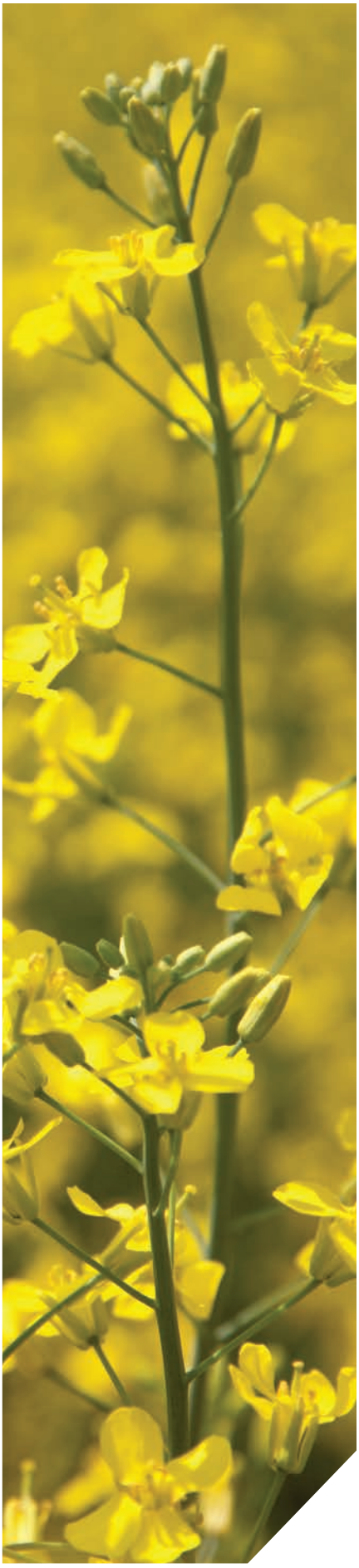
There are many glyphosate products on the market today. Corteva Agriscience supports the use of any glyphosate product labeled for use with Optimum® GLY herbicide tolerance trait. Growers should also follow recommended crop and herbicide rotations to avoid or delay the development of herbicide resistant weed populations.

Integrated Weed Management and Best Practices

A farmer's weed management system choice is only one of many considerations when determining what seed and crop protection products to purchase. For each and every field, farmers need to prioritize many canola seed decision factors that typically include yield potential, disease management, harvest ease, targeted return on investment, and weed management. Optimum GLY herbicide tolerance hybrids provide a tool that will fulfill many of these factors, while also allowing farmers to diversify and customize their weed management solutions to satisfy their short- and long-term goals. As described below, we support an integrated approach to maintaining clean, weed-free fields.

An Integrated Weed Management system is defined as the use of a range of control techniques, embracing cultural, mechanical, chemical, and biological methods in an integrated fashion without excessive reliance on any one method. (Figure 8). Consider building a multi-year integrated weed management system that incorporates the following key "best practice" principles:

1) Focus on implementing a diverse herbicide program including **multiple effective modes of action** (as opposed to depending on the efficacy of a single product). This includes **use of both pre- and post-emergence herbicides every season.**
    a. Give your canola the best start possible with a labeled soil-applied herbicide.
        i) Controls grass and some broadleaf weeds. Sonalan® may also control kochia.
        ii) More consistent and complete control than glyphosate alone
2) **Crop rotations** that promote a diverse herbicide program across years are recommended.
3) Utilize **herbicide mixtures** (tank mixes) with multiple MOAs against key hard-to-control weed species.
4) Within your crop rotation, utilize **multiple herbicide tolerant traits** within and among products to enable diverse herbicide use.



What about hard-to-control weeds?

Optimum® GLY herbicide tolerance trait allows for effective management of several "hard-to-control weeds." Robust glyphosate tolerance without crop injury enables Optimum GLY herbicide tolerance trait to provide superior weed control through flexible application rates and timing. Hard-to-control weeds include perennial sow thistle, Canada thistle, wild buckwheat, foxtail barley, and dandelion. The following herbicide options may be used in combination with glyphosate as herbicide partners to control hard-to-control weeds (Table 2).

Table 2. Four possible herbicides that could be used with labeled rates of glyphosate to control hard-to-control weeds.

Application Timing	Rate	Difficult Weeds Controlled
2 leaf – 6 leaf	Stinger™ @ 1.5 to 3 oz ae/A combined with glyphosate @ up to 1.5 lb ae/A - Single application	Large weeds or high weed populations. Perennial sow thistle, Canada thistle, wild buckwheat, foxtail barley, and dandelion
2 leaf – early flower	Stinger™ @ 1.5 to 3 oz ae/A + glyphosate @ up to 0.75 lb ae/A prior to 6 leaf followed by second application of glyphosate @ 0.75 lb ae/A prior to early flower	
Emergence - Early Flower	quizalofop (Assure®II or Targa®) @ 0.77 to 1.32 oz/A + glyphosate @ labeled application rates	Season-long control of perennials and winter annuals
	sethoxydim (Poast®) @ 0.2 to 0.3 lb/A + glyphosate at labeled application rates	
	clethodim (Select® Max 1EC, Select® 2EC, Shadow® 3EC) @ 1 to 2 oz/A + glyphosate at labeled application rates	

Should I use multiple herbicide tolerant weed management systems?

The short answer is – YES. Using multiple systems will fulfill many of the best practices listed above. Those herbicide tolerant systems include:

a. Imidazolinone (IMI) tolerance canola–Clearfield® trait canola: Through mutagenesis, tolerance to the imidazolinone group of herbicides allows the application of Group 2 herbicides for post emergent control.

b. Glufosinate tolerance canola–LibertyLink® trait canola: Through genetic modification, canola containing glufosinate tolerance can be effective in managing some hard-to-control weeds, especially weeds such as kochia that carry resistance to glyphosate.

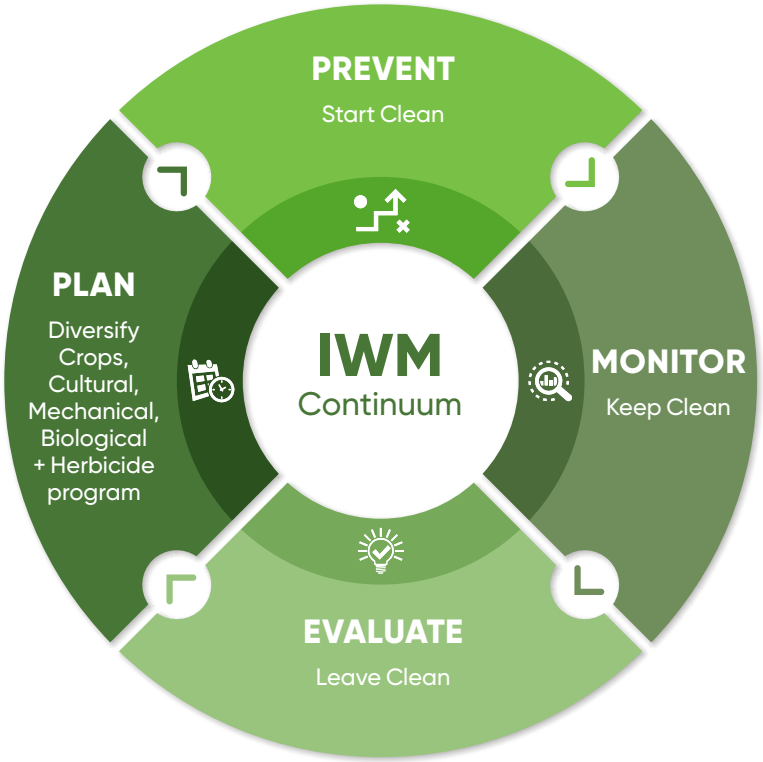
c. Glyphosate tolerant canola–Optimum® GLY herbicide tolerance traits: Through genetic modification, three different technologies including Optimum® GLY herbicide tolerance, Roundup Ready® canola, and TruFlex™ technology. Their system benefits are compared in Figure 7.

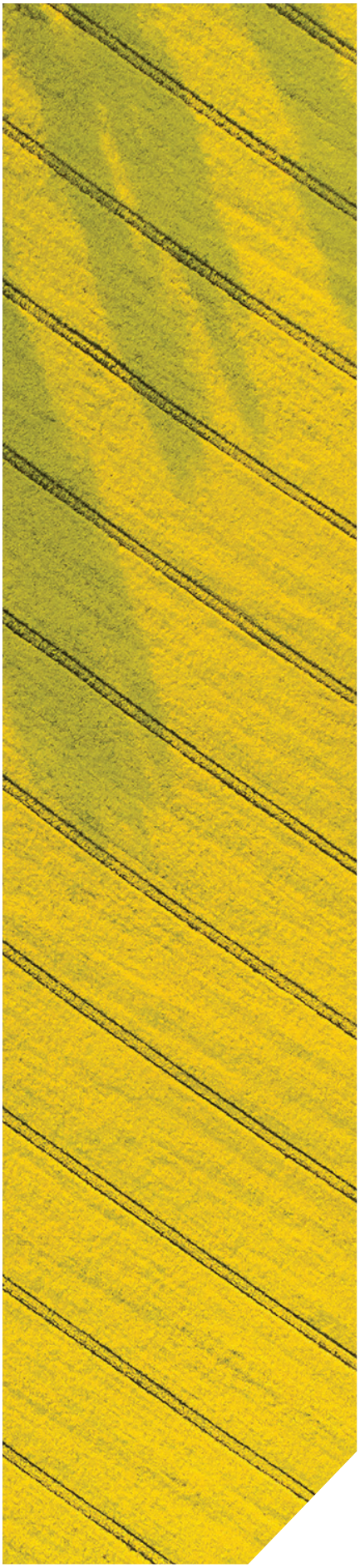
Weed management decision considerations for each field typically include: historical management tactics (including herbicides and rates) and crops grown, current weed composition and infestation levels, and areas of the field containing hard-to-control weeds (including those weeds tolerant and resistant to certain herbicide groups). There is no "one size fits all" to any weed management program, but our purpose with this technical guide is to demonstrate the value Optimum® GLY herbicide tolerance trait technology can bring to a farmer's integrated weed management system. The Optimum GLY herbicide tolerance product's weed control system provides superior control of hard-to-control weeds over other herbicide tolerant weed control systems such as LibertyLink® traits.

We recommend the advice of your local agronomist or technical advisor to develop an integrated weed management solution that utilizes widely accepted best management practice (BMPs) concepts.

Timing of weed control in canola is extremely important. It is important to maintain clean fields before, during, and following the growing season (Figure 8). **The key is to control weeds early (critical weed-free period is cotyledon to 4 leaf) before they get too large and start reducing yield.** Yield loss from late herbicide applications vary on a field by field basis depending on herbicide rate, overall health of the field, and growing conditions during and after the application. Losses cannot be predicted, but they could be up to 30 percent, and even more in overlap area from late herbicide applications. (Canola Council 2021)

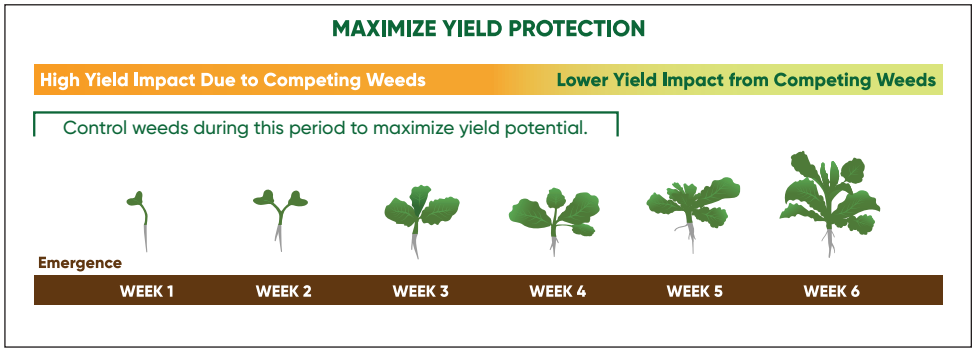
Figure 8. IWM Contiuum





1) START CLEAN
   a. Scout fields before and after use of any management tactic
   b. Keep accurate records of your management tactics used and their results, including any indications of changes in response with hard-to-control weeds
   c. Control weeds early, generally before exceeding 6" in height
2) KEEP CLEAN
   a. Use correct herbicide(s) for the weed spectrum, with proper rates and timing
   b. Rotate modes of action ensuring herbicides used provide effective control of the target weed species present in your field
   c. Incorporate sound agronomic practices that improve your crop's ability to compete effectively with weeds (e.g., crop canopy to compete with weeds)
3) LEAVE CLEAN
   a. Control weed escapes that can occur before or after harvest
   b. Thoroughly clean equipment to avoid field to field weed spread

Figure 9. Critical weed-free period in canola is between the cotyledon and 4-leaf stage.



Timing of herbicide applications is crucial for controlling weeds effectively and preventing excessive interference with the crop. The critical weed-free period for canola is from seedling stage up to 4-leaf stage, or 17-38 days after crop emergence (Martin et al., 2001).

Weed resistance is a serious problem that needs consideration when planning our integrated weed management program. Herbicide resistance is the ability of a weed biotype to survive a herbicide application, where under normal circumstances that herbicide applied at the recommended rate would control the weed (HRAC). Understanding risk for herbicide resistance is important. Table 3 on the next page will help assess the risk of resistance developing in each field.

Table 3. Assessment of the Risk of Resistance Development per Target Species (The major risk factors within a cropping system) (HRAC 2021)

Management Option	Risk of Resistance		
	Low	Moderate	High
Herbicide mix or Mode of Action (MOA) rotation in cropping system	≥3 MOAs	2 MOAs	1 MOA
Integrated Weed Control	Cultural, Mechanical, & Chemical	Cultural & Chemical	Chemical only
Use of same MOA per season	Once	More than once	Many times
Cropping system	Full rotation	Limited rotation	No rotation
Resistance status to MOA	Unknown	Limited	Common
Weed infestation	Low	Moderate	High
Control in last 3 years	Good	Declining	Poor

Best management practices (BMPs) specific to delaying resistance corroborate with our integrated weed management discussion earlier in this document. Key tactics to delay the onset of resistance include three main areas: 1) rotating crops, 2) using multiple tactics including cultural management and, 3) herbicide mode of action rotation and use of mixtures.

In addition to the BMPs described above consider the following with regard to managing or delaying the onset of resistant weeds:

1) Use label rates and timings (helps in identifying potential weed resistance)
2) Continually monitor and test surviving weeds for resistance
3) Manage any surviving weeds remaining after application
4) Follow industry weed management resource guides

One example of a resistant weed problematic in certain U.S. regions is glyphosate-resistant kochia. For this particular weed, we recommend a pre-seed application of Stinger™ [1] (clopyralid) herbicide prior to canola planting. It is the best option for kochia and to help manage other challenging broadleaf weeds.

If the risk of developing glyphosate resistance in a specific field is high, consider herbicide resistance testing to confirm the status within the field and consider tactics in Table 6 to reduce the weed seedbank of resistant weed population(s) to the lowest level prior to growing Optimum® GLY herbicide tolerance trait. It may be that after considering the weed spectrum in the field, that an alternative crop should be considered. The purpose of using the best practices described in this document is to sustain the use of glyphosate herbicide and Optimum GLY herbicide tolerance hybrids by minimizing the risks associated with the evolution of glyphosate-resistant weeds in canola rotations and U.S. farming systems.

Table 4 below describes specific management tactics to consider as part of an integrated weed management system.

Table 4. Integrating BMPs for resistance management on your fields

BMP Timing	Herbicide	Cultural & Mechanical	Complementary
Start Clean (Pre-planting)	Utilize non-glyphosate pre-seed or pre-emergent weed control options with different MOAs		Farm hygiene (seed) Avoid feeding hay on cropping area Avoid spreading weed seeds with livestock
	Chem-Fallow weed control with appropriate tank-mixes	Pre-seed cultivation with minimal or full disturbance depending on weed type and populations	
	Use other MOAs with glyphosate when spraying Optimum GLY herbicide tolerance products for good stewardship	Crop Rotation – control tough weeds in your previous crops outside of Optimum GLY herbicide tolerance products	
Keep Clean (In Crop)	**Ensure effective weed control**	**Prevent viable weed seeds from developing**	Tramline/precision cropping system Crop nutrition Prevent weed seed set (fence line and roadside) Hand roguing
	Control weeds early to help maximize yield potential and enhance control	Mowing	
	Post emergent herbicide (sequences/tank mixes)	Crop competition e.g. row spacing/ seeding rate/row orientation/crop and variety selection in rotations	
	Use different herbicide modes of action to control weed escapes	Grazing and grain, green manure/brown manure, cutting crop for hay/silage	
Keep Clean (Harvest)	Pre-harvest application with herbicide	Swathing/windrowing	Farm hygiene (grain) Cleaning equipment before transport
		Harvest weed seed capture	
		Chaff carts	
		Bale direct	
Keep Clean (Post-Harvest)	Chem- fallow applications use different herbicide modes of action to control specific weed escapes	Tillage to control weeds in fallow	Plan a cropping system that drives down the weed seed bank -control tough to kill weeds in your cereal crops before canola
	Alternate pre-emergent herbicide in other rotation crops	Strategic Grazing	
	Adjust post-crop herbicides or pre-emergent herbicides the following season to account for cover crop use	A cereal rye cover crop can be used to reduce competitive weed pressure	A cover crop like rye can reduce weed biomass improving herbicide effectiveness

[1] Stinger® is not available for sale, distribution or use in Nassau and Suffolk counties in the state of New York. State restrictions on the sale and use of Stinger apply. Consult the label before purchase or use for full details. Always read and follow label directions.

Best Management Practices for Controlling Volunteer Canola

The key to preventing volunteer canola from becoming a problem is to plan and use the right tools. Volunteer canola is one of many weeds likely to be present in summer fallow or subsequent cropping systems following a canola crop. Volunteer canola plants may be present due to a number of circumstances:

- Seed lost/split at harvest.
- Incorrect herbicide application for fallow clean up (particularly when the volunteer canola plant has a herbicide tolerance trait).
- Seed movement around farm (e.g., spillage)
- Adventitious presence in seed

Control strategies need to consider the entire weed spectrum, resistance management objectives, tank mixtures, and timing of application.

Tips for controlling volunteer canola:

- Plan ahead.
- Be aware that most seeds germinate within two years, but could appear 4-7 years after your canola crop.
- Avoid deep cultivation as it can extend seed dormancy.
- Target plants for control while they are small – (< 4-leaf stage).
- Monitor volunteers and control before flowering to prevent seed set.
- Use complementary tools, such as non-chemical control methods.
- Know the field history and maintain good records as this will affect the herbicide selection. There are many herbicides that control volunteer canola in all stages of the crop rotation.
- Consider the following PRE-emergent herbicides for controlling volunteer canola: Acuron® Flexi, Authority® Assist, Authority® First/MTZ/Elite/BroadAxe® XC, Balance® Flexx, Fierce®, Realm® Q, Resolve® Q, Sharpen®, Sonic®, SureStart® II, Surveil®, and Verdict®[1] [2].
- Consider the following POST-emergent herbicides for controlling canola: Most ALS herbicides, SureStart® II [3] and Teammate™ [1] [2].
- It is crucial to maintain records of ALL herbicide tolerant traits within any GM canola crop as this will affect herbicide choices to ensure effective control of volunteers.
- Use all herbicides at full label rate for improved control.
- Observe minimum re-cropping intervals. Utilize non-chemical methods as part of Integrated Weed Management Plan.

[1] Please refer to product labels, the Corteva Agriscience Product Use Guide or the 2022 North Dakota Weed Control Guide.

[2] Not all products are registered for sale or use in all states. Contact your state pesticide regulatory agency to determine if a product is registered for sale or use in your state. Always read and follow label directions.

[3] SureStart® II is not registered for sale or use in all states. SureStart II is not available for sale, distribution or use in Nassau and Suffolk counties in the state of New York. Contact your state pesticide regulatory agency to determine if a product is registered for sale or use in your state. Always read and follow label directions.

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Appendix

- **Weeds controlled by Stinger®:** Canada thistle, perennial sowthistle, annual sowthistle, biennial wormwood, dandelion, curly dock, false chamomile, nightshade species, sunflower, and wild buckwheat
- **Weeds controlled by Realm® Q (partially controlled weeds not listed):** Powell and spiny amaranth, atriplex, barnyardgrass, annual bluegrass, buffalobur, burcucumber, carpetweed, wild carrot, common checkweed, common cocklebur, large crabgrass, dandelion, all foxtails, galinsoga, hemp, horsenettle, itchgrass, jimsonweed, kochia, common lambsquarters, venice mallow, morningglory, wild mustard, black, eastern black, and hairy nightshade, browntop, Texas and fall panicum, redroot, smooth, and tumble pigweed, volunteer potatoes, Florida pusley, common ragweed, giant ragweed, field & longspine sandbur, hemp sesbania, shattercane, smartweeds, album sorghum, common sunflower, timothy, velvetleaf, volunteer cereals, wild oats, wirestem muhly, witchgrass, and woolly cupgrass
- **Weeds controlled by Resolve® Q (partially controlled weeds not listed):** volunteer alfalfa and barley, barnyardgrass, bittercress, annual bluegrass, common buckwheat, smallflower buttercup, bedstraw catchweed, common & mouseear chickweed, common cocklebur, large crabgrass, woolly cupgrass, curly dock, dandelion, purple deadnettle, cutleaf eveningprimrose, field pennycress, all foxtails, Carolina geranium, common groundsel, poison hemlock, henbit, prostrate knotweed, kochia, common lambsquarters, black and birdsrape mustard, wild mustard, fall panicum, wild parsnip, redroot, smooth, and prostate pigweed, shattercane, shepherds purse, smartweeds, sunflower, velvetleaf, bushy wallflower, volunteer wheat, wild radish, and yellow rocket
- **Weeds controlled by Sonic®:** Palmer and spiny amaranth, spured anoda, Florida beggarweed, carpetweed, common cocklebur, hophornbeam copperleaf, topic croton, Ameican daisy, common dayflower, hairy galinsoga, clammy and cutleaf groundcherry, marestail, jimsonweed, kochia, ladysthumb, common lambsquarters, Venice mallow, Mexicanweed, all morningglory's, wild mustard, eastern black, hairy, and silverleaf nightshade, redroot, smooth, and tumble pigweed, poorjoe, common purslane, Florida pusley, common ragweed, giant ragweed, coffee

senna, Pennsylvania smartweed, smellmelon, spotted spurge, bristly sarbur, common sunflower, prickly sida, Russian thistle, velvetleaf, common and tall waterhemp, large and smooth crabgrass, broadleaf signalgrass, green foxtail, goosegrass, orchardgrass, fall and Texas panicum, purple, and yellow nutsedge, and annual sedge.

- **Weeds controlled by SureStart® II (partially controlled weeds not listed):** Palmer amaranth, Florida beggarweed, wild buckwheat, carpetweed, common checkweed, red clover, cocklebur, galinsoga, henbit, marestail, jimsonweed, kochia, ladysthumb, common lambsquarters, Venice mallow, ivyleaf and tall morningglory, wild mustard, nightshade species, redroot and smooth pigweed, wild poinsettia, punturevine, common purslane, Florida pusley, common and giant ragweed, shepherd's purse, sicklepod, prickly sida, Pennsylvania smartweed, nodding, prostrate, and spotted spurge, common sunflower, Canada thistle, velvetleaf, waterhem species, biennial wormwood, barnyardgrass, crabgrass species, crowfootgrass, prairie, southwestern, and wooly cupgrass, bristly, giant, green, robust, and yellow foxtail, goosegrass, johnsongrass, foxtail millet, wild proso millet, yellow nutsedge, browntop, fall, and Texas panicum, red rice, field sandbur, shattercane, broadleaf signalgrass, red sprangletop, and witchgrass.
- **Weeds controlled by Surveil® (partially controlled weeds not listed):** carpetweed, common and mouseear chickweeds, dandelion, eclipta, cutleaf eveningprimrose, Florida pusley, hemp sesbania, henbit, jimsonweed, kochia, common lambsquarters, little mallow, marestail, all morningglory species, wild mustard, black, eastern black & hairy nightshade, redroot, smooth, spiny amaranth, and tumble pigweeds, Palmer amaranth, prickly sida, puncturevine, common purslane, common ragweed, redmaids, shepherdspurse, smallflower, ladysthumb and Pennsylvania smartweed, spotted spurge, velvetleaf, Venice mallow, waterhemp, bristly starbur, cocklebur, coffee senna, copperleaf, golden crownbeard, Florida beggarweed, hairy indigo, giant ragweed, Russian thistle, spurred anoda, tropic croton, and wild poinsettia.
- **Weeds controlled by Teammate® (partially controlled weeds not listed):** cleavers, hairy bittercress, spotted burclover, smallflower buttercup, volunteer canola, common and mouseear chickweed, white clover, smallseed falseflax, coast fiddleneck, flixweed, Carolina geranium, corn gromwell, common hempnettle, common lambsquarters, black, blue, tumble, wild, & wormseed mustard, field pennycress, Virginia pepperweed, redroot pigweed, shepherdspurse, annual smartweed, pinnate tansymustard, Russian thistle, hairy vetch, bushy wallflower, barnyardgrass, blackgrass, bulbous bluegrass, Japanese & ripgut brome, cheat, hairy chess, volunteer corn, Persian darnel, yellow foxtail, wild oat, Italian ryegrass, and windgrass

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