



BUL 950

Targeted Tank Mixtures for Weed Control in Potatoes

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Introduction

MANAGING WEEDS IN POTATO FIELDS with an integrated approach—using all available cultural, mechanical, chemical, and biological tools—is critical. In fact, University of Idaho research shows that cultural and mechanical practices in potatoes combined with applications of the appropriate herbicides is much more effective than relying on any single weed control method alone.

Developing an effective potato herbicide program as part of an integrated approach requires careful consideration of a variety of factors, such as the weed species present in a field, soil characteristics, tillage and irrigation practices, crop rotation, and costs in time and money. Weed species and densities can vary greatly from one field to another, even those in close proximity to one another and/or those that historically have endured the same weed control program, crop rotation practices, etc. *In other words, the same weed management approach will not work in all fields.*

Herbicide tank mixtures can be customized to target the specific weed species in each field. Of course, keeping weed history records and knowing which weed species are present in each field is a must for success. Choosing herbicides that control the weed species in each field is another must-have. Perhaps not well understood, however, is that knowing how a herbicide controls a weed is just as important as knowing which herbicide controls that weed.

When choosing the right herbicide for the right tank mix, one of the most impactful factors is the herbicide **site of action** (SOA). Also referred to as target site or mechanism of action, SOA is the specific protein or biochemical site in a plant to which the active ingredient in a herbicide binds/interacts, i.e., where and how a herbicide's effect begins or initially occurs. **Active ingredient** (a.i.) is the chemical in a commercial herbicide product that is primarily responsible for controlling a weed species. Be careful because herbicides with different trade names might have the same

a.i. In order to prevent or delay development of herbicide-resistant weed populations, the tank mix should include more than one herbicide SOA for each weed species in a field. Fortunately, readily available charts and tables exist that group herbicide a.i.'s together according to SOA and in chemical families within SOA groups.

This publication will help you to decipher this information. Indeed, knowing a herbicide's SOA and which weed species a herbicide controls empowers you to customize tank mixtures, depending upon the specific weed species present in a potato field.

Herbicides Registered for Weed Control in Potatoes

As of 2021, twenty-three herbicide active ingredients are registered for use in potatoes grown in Canada. All but one of those are labeled for use in the United States (Table 1).

Depending upon the herbicide and how it is labeled for use in potatoes, application timing might be a) before planting, b) after planting but before potato emergence, c) after potato emergence, and d) at the end of the growing season for potato vine desiccation (vine kill) to prepare for harvest. Some herbicides are labeled for more than one application timing. Sequential applications of one herbicide (a combination of timings) also might be labeled. The combination of a hilling operation followed by application of the preemergence herbicides is more effective than either one performed without the other.

An effective combination of timely cultivation and herbicide application can provide season-long weed control.

- After planting but before potato emergence, perform a hilling operation, followed by application and sprinkler incorporation of tank mixtures of soil-active herbicides targeting specific weed species in the field.
- Set cultivation equipment to throw soil from the furrows onto the potato rows to build a hill that will prevent exposure of young tubers to light and thus discourage greening.

- Hilling also controls any weeds that have emerged after planting and creates a “clean bed” for application of the soil-active herbicides.
- If herbicides are not applied, or if applied but not sprinkler or rainfall incorporated as soon as possible after hilling, weeds and/or the potatoes may emerge. Many soil-active herbicides are only labeled for application before potato emergence. Some can damage emerged potatoes. Only metribuzin and rimsulfuron have activity on emerged broadleaf weeds.

Herbicide classification and groups. The Weed Science Society of America (<https://wssa.net/>) has created a classification system used in the United States and Canada that groups together herbicides with the same primary SOA. There are thirty known herbicide SOAs and each group has its own number. Herbicide SOAs have been required on Australian labels since 1994 and are voluntarily placed by herbicide manufacturers on Canadian and US labels. NOTE: The group numbering system is slightly different depending upon country. Group numbers of SOAs that are common to the United States are used in this publication.

Appropriate tank mixtures and sequential applications of herbicides with different SOAs can provide control of the multiple weed species present in a given field. Just as important as using more than one herbicide to control multiple weed species in a field is the combination of multiple herbicide SOAs to control the same weed species in order to prevent or delay the development of a herbicide-resistant population of that species. The goal is to have more than one effective SOA on the same weed species.

Herbicides with similar SOAs are grouped into the same herbicide class. The herbicides labeled for use in potatoes, SOAs, and corresponding SOA group numbers used in the United States are shown in Table 1.

Herbicide resistance is the inherited ability of a plant to survive a herbicide treatment to which the original population was susceptible. Some

individuals in the population, however, may be naturally resistant to a herbicide/herbicide SOA. The herbicide does not cause the resistance mutation:

- Although the occurrence of a resistant individual is “one in a million,” in a population of the same weed species, if the same herbicide/herbicide SOA is used repeatedly, those individuals continue to survive and reproduce while the susceptible are killed.
- Over time, this selection pressure results in resistance dominating the population and rendering the herbicide ineffective.
- Hence the need for using combinations of herbicides with different SOAs.

Knowing the SOA and herbicide class is key to planning a management strategy, especially one that reduces the development of herbicide-resistant weed populations.

Effectiveness Tables

Herbicides labeled for weed control in potatoes.

Broadleaf and grass/sedge weeds controlled or suppressed by the soil and foliar active herbicides labeled for use in potatoes and levels of control are listed in Tables 2A, 2B, and 3. Information for the tables was derived from herbicide labels and U of I potato field research trial results. Rates for many herbicides must be adjusted for soil texture, organic matter content, soil pH, weed species, potential for soil residue, and other herbicides used in a tank mixture. Please refer to the herbicide labels for this information.

Restrictions and Limitations and Directions for Use

Read and follow applicable “Restrictions and Limitations and Directions for Use” included on all product labels in a tank mixture. The most restrictive labeling applies to use of tank mixtures. The label is a legal document. Always read and follow instructions on the herbicide label. When tank mixing herbicides, use the most restrictive label. Information such as rates, potato variety sensitivity, preharvest intervals, and rotational crop restrictions are not provided in this publication.

NOTE: Of the selective herbicides labeled for use in potato, **only Matrix (sold as Prism in Canada) and metribuzin have activity on emerged broadleaf weeds and can be applied to potatoes after emergence.** Select, Poast Plus and Poast Ultra, and Venture (Canada) only have foliar activity on emerged grassy weeds.

Planned Herbicide Programs

With proper scouting and weed species records, you can customize herbicide tank mixtures for a specific field. An overall timing and coordination plan is also required. The weed species present, herbicide SOA and effectiveness on those species, as well as other factors such as costs, equipment, and custom application requirements figure into the equation.

Examples of planned herbicide programs:

1. Preemergence (PRE) only: PRE-applied tank mixtures of soil active herbicides. In a planned PRE program, foliar active postemergence (POST)-applied herbicides are used only if weeds are not controlled by the PRE application.
2. PRE + POST: A planned, sequential application of PRE–soil-active herbicides followed by POST–applied foliar-active and/or soil-active herbicides.
3. POST only: No herbicide applications until after potato emergence. Herbicide combinations include herbicides that are only soil active but safe to emerged potatoes; the two potato herbicides with soil and foliar activity that can be applied POST, Matrix and metribuzin; foliar-active, grass-only herbicides; a combination of the POST–applied soil-active-only and foliar-active herbicides or a sequential POST followed by POST application.

Targeted Tank Mixtures

Even though time and money costs for a customized tank mix targeting weed species in one field may be higher or lower than a tank mix used across all fields, take into consideration the following not-so-tangible returns on investment:

- Crop competition with weeds uncontrolled all season will result in the reduction of tuber quality and yield loss, translating to a profit loss from the field. Higher weed densities create more

competition with the potato crop and greater profit loss.

- Weeds that survive produce seed that falls to the ground and is added to the “weed seed bank” in the field. More weed seeds can mean higher weed densities in the rotation crops and the next time potatoes are grown in the field.
- In addition, higher weed densities can lead to higher future input costs, including additional herbicides needed and time invested to control the weeds in the field.

For example, two hairy nightshade plants per meter row competing season long with the potato variety Russet Norkotah can reduce US No. 1 and total tuber yields by more than 25%.

- Those two plants can produce over 37,000 seeds/m² = 149 million seeds/acre.
- Hairy nightshade seed viability can remain greater than 90% for five years.

Even if the two per meter row are only competing during the first three weeks after potato emergence, a 5% or greater yield loss can occur.

Herbicide Tank-Mix Partner Choice Charts

Herbicide Tank Mix Partner (TMP) Choice Charts can be used to customize tank mixtures depending upon the weed species present in a given field and the herbicide SOA groups. If constructed appropriately, the chart can be used for many different mixtures of weed species. The progression of TMP Choice Charts 1–6 is an example of how to determine various herbicide tank mixtures customized to control a mixture of specific weed species present in two different fields of interest. Read and follow herbicide labels for how crop rotation and other factors, such as soil texture and pH, can impact herbicide choices and the timing required to target the weeds in the field.

Unless noted, tank-mix examples elucidate a planned, PRE timing program. Although examples of two- and three-way tank mixtures are given in this publication, the Charts can be used to design four-way mixtures that might be necessary depending upon the type and density of weeds in a field of interest.

Weed control goal for targeted tank mixtures:

- Best case: use a tank mix of herbicide that provide 90%–100% (G, good) control of all weeds present.
- Next best option: use at least one herbicide with 90%–100% (G, good) control matched up with a herbicide that can provide 80%–89% (F, fair) control.

Herbicide resistance management during the potato crop year should also be a goal:

- Choose herbicide tank mix partners with different SOAs that have overlapping control of a weed species present.
- The most effective tank mixes are those with different SOA herbicides that provide 90%–100% (G, good) control of the same species.
- If a two-way tank mixture is desired but the second herbicide only suppresses (S [suppression only] = 50% control) the same species, then at least there is activity by two different SOAs. However, a three-way tank mixture that includes two or more herbicides with 90%–100% control of the same species is more effective.
- Tank-mixing herbicides with different SOAs that control the same weed are more effective for preventing or delaying the development of herbicide-resistant weed populations than using a herbicide SOA only once or only when potatoes are planted during the crop rotation cycle.

How to Create and Use a TMP Choice Chart

TMP Choice Chart 1 includes all herbicides labeled for use in potatoes and the corresponding SOA, SOA group number, representative trade name (not all trade names are listed), and a.i. Herbicides in the same color row within each Chart have the same SOA. Preplant- and the PRE-applied burndown herbicides, as well as the aforementioned vine kill products, are not included but may be needed as part of an effective weed-control program. The sample chart provides space for listing up to seven weed species.

NOTE: Always list herbicide active ingredients in a TMP Choice Chart rather than, or in addition to, trade

names since multiple trade names might have the same a.i. In addition to listing the a.i., grouping the herbicides according to SOA is highly recommended in order to help you to design the most appropriate, multiple SOA tank mixture. Active ingredients are listed on all labels according to EPA standards. The SOA information can be found on most of those labels. The SOA Group Numbers, as well as chemical family names, are included only in Chart 1 for informational use. The SOA Groups in all Charts are color-coded. Numbers, chemical family names, and color coding are not necessary for your Charts.

1. Use field scouting records when possible. If weed-species records from scouting the field in the past exist, review and use them, especially if they note the last time potatoes were grown in the field.

2. As shown in TMP Choice Chart 2, enter as many weed species known to be present in the group of fields used by the grower or, if not known specifically, enter those present in the general potato production area. Consult Herbicide Effectiveness Tables 2A, 2B, and 3 to identify the level of control provided by a herbicide for each weed. The Chart 2 example includes **five major weeds** species that might exist in a potato production area where a field of interest is located: hairy nightshade (*Solanum physalifolium*), common lambsquarters (*Chenopodium album*), redroot pigweed (*Amaranthus retroflexus*), kochia (*Bassia scoparia*), and green foxtail (*Setaria viridis*).

NOTE: Follow these procedures, so that the TMP Choice Chart will already contain control information for all of the weeds in a grower's group of fields (or the general potato production area), thus giving more time to customize tank mixtures for the specific weed species in each one of those fields.

3. Determine the specific weed species present in a field of interest and then note the herbicides providing 90%–100% (G, good) season-long control of those weeds.

4. Choose tank mix partners with different SOAs that provide the highest control possible of all the weed species present in the field and have



Figure 1. A mixture of hairy nightshade, common lambsquarters, and green foxtail in a potato field.

overlapping control of the same species.

TMP Choice Charts 3–6 show examples of choosing appropriate tank mix partners for two fields with different combinations of weed species.

Fields

Field 1. The weed species known to be present in Field 1 are hairy nightshade, common lambsquarters, and green foxtail (Figure 1).

Circled in Chart 3 and listed here are herbicides providing 90%–100% (G, good) control of these weeds:

- Hairy nightshade: Chateau, sulfentrazone, Outlook, Eptam, or Matrix (PRE or POST).
- Common lambsquarters: Linex/Lorox, metribuzin (PRE or POST), or Prowl H2O.
- Green foxtail: Outlook, Dual Magnum, metolachlor, Eptam, Prowl H2O, Sonalan HFP, Treflan HFP, metribuzin, Linex/Lorox. POST-applied Poast Plus, Select, or Venture can control foxtail 90%–100% (G, good) control.
 - Sencor STZ, the co-pack of metribuzin and sulfentrazone or Sulfentrazone MTZ (pre-mix of sulfentrazone and metribuzin) could be used to control all three weeds or as a tank mix partner as long as the other herbicides have a different SOA.
 - Boundary, the pre-mix of s-metolachlor (Dual Magnum and others) and metribuzin could be included for common lambsquarters



Figure 2. Control of a mixture of hairy nightshade, common lambsquarters, and green foxtail provided by a three-way tank mixture of Outlook + metribuzin + Linex/Lorox applied PRE to potato and weeds after a hilling operation and sprinkler incorporated with 0.5 inches of water within 24 hours of application with overhead irrigation.



Figure 3. A mixture of common lambsquarters, redroot pigweed, and kochia in a potato field.



Figure 4. Control of a mixture of common lambsquarters, redroot pigweed, and kochia provided by a two-way tank mixture of Prowl H2O + Linex/Lorox applied PRE to potato and weeds after a hilling operation and sprinkler incorporated with 0.5 inches of water within 24 hours of application with overhead irrigation.

and green foxtail control. The tank mix partner for hairy nightshade control should have a different SOA than s-metolachlor and metribuzin. Additional metribuzin is sometimes included with Boundary in order to bring the metribuzin rate to that which is typically recommended.

Chart 4, Tank-mix example for Field 1: Outlook + metribuzin + Linex/Lorox (Figure 2).

- Hairy nightshade is controlled season long 90%–100% (G, good) and 80%–89% (F, fair) by Outlook and Linex/Lorox, respectively (metribuzin does not provide any level of control [N, no control]).
- Common lambsquarters is controlled by metribuzin and Linex/Lorox 90%–100% (G, good) (Outlook provides 0%–30% (P, poor) and in some cases, 0% (N, none) control.
- Green foxtail is controlled 90%–100% (G, good) by all three herbicides.

Chart 5, Tank-mix example for Field 1: Eptam + Prowl H2O.

- Hairy nightshade is controlled 90%–100% (G, good) by Eptam and suppressed by Prowl H2O.
- Common lambsquarters is controlled 90%–100% (G, good) by Prowl H2O and suppressed by Eptam although suppression might not last season long.
- Green foxtail is controlled 90%–100% (G, good) by both Eptam and Prowl H2O.

NOTE: *Weed control and herbicide-resistant management goals are reached with both tank mixtures.* The herbicides in a tank mixture have different SOAs with overlapping control of a weed species present. The tank mixtures customized to target hairy nightshade, common lambsquarters, and green foxtail are examples of *how it may not be possible to have herbicides with 90%–100% (G, good) control of every weed species in the field.* What is important is that if one herbicide does provide 90%–100% (G, good) control, then at least some control activity from the other herbicide is better than no control.

As in the real world, not all fields have the same spectrum.

Field 2. The weed species known to be in Field 2

are common lambsquarters, redroot pigweed, and kochia such as what is shown in Figure 3. No hairy nightshade or green foxtail are present.

Tank-mix examples for Field 2 are in Chart 6 and listed below:

- Linex/Lorox + metribuzin (PRE only or PRE + POST)
- Prowl H2O + Linex/Lorox (Figure 4)
- Prowl H2O + metribuzin (PRE only)
- Prowl H2O applied PRE + metribuzin applied POST
- PRE-applied pre-mixes of Boundary or Sencor STZ/Sulfentrazone MTZ

Summary

No weed management approach is comprehensive. In fact, the same approach will not succeed in all fields because the predominant weed species varies greatly from one field to another, even for those in close proximity. Hence, use the Tank Mix Partner Choice Charts in this publication to create a customized herbicide tank mixture to target the specific weed species in each field of interest. Remember:

- Tank mixtures with two or more herbicides can be designed.
- Custom tank mixes help achieve the ideal weed control goal: 90%–100% (G, good) of all species in a field throughout an entire season.
 - Note that a combination of G, good (90%–100%) herbicide with F, fair (80%–89%) or S, suppression (50%) herbicides might be acceptable. However, *if the density of a particular weed is high, it is important that more than one herbicide in the tank mixture controls that species 90%–100% (G, good) season long.*
- Meet the following herbicide-resistance management goal: control each weed species in a field with at least two different herbicide SOAs in a tank mixture.
- Design tank mixtures for PRE-only, PRE + POST, or POST-only application timings.
- Even though a targeted tank mix might cost

more in terms of time and money, the returns are worth it when you discover an effective combination, since weeds that compete with a potato crop reduce yields and profit weed seed added to the seed bank in the soil results in higher weed densities in rotation crops the next time potatoes are planted.

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ALWAYS read and follow the instructions printed on the pesticide label. The pesticide recommendations in this UI publication do not substitute for instructions on the label. Pesticide laws and labels change frequently and may have changed since this publication was written. Some pesticides may have been withdrawn or had certain uses prohibited. Use pesticides with care. Do not use a pesticide unless the specific plant, animal, or other application site is specifically listed on the label. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

Trade Names—To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

Groundwater—To protect groundwater, when there is a choice of pesticides, the applicator should use the product least likely to leach. individuals in the population, however, may be naturally resistant to a herbicide/herbicide SOA. The herbicide does not cause the resistance mutation:

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CHART 1: TANK-MIX PARTNER CHOICE CHART

		WEED SPECIES PRESENT IN THE AREA						
SOA Group # ¹	HERBICIDES ²	WEED 1	WEED 2	WEED 3	WEED 4	WEED 5	WEED 6	WEED 7
14	Chateau (flumioxazin)							
	Reflex (fomesafen)							
	Sulfentrazone (various trade names)							
15	Dual Magnum ³ (S-metolachlor)							
	Metolachlor (various trade names)							
	Outlook (dimethenamid-p)							
	Zidua (pyroxasulfone)							
2	Matrix ⁴ (rimsulfuron)							
8	Eptam (EPTC)							
3	Prowl H2O (pendimethalin)							
	Sonalan HFP (ethalfluralin)							
	Treflan HFP (trifluralin)							
5	Metribuzin (various trade names)							
7	Linex/Lorox (linuron)							
15 +5	Boundary (S-metolachlor + metribuzin)							
14 +5	Sencor STZ ⁵ Sulfentrazone MTZ (metribuzin + sulfentrazone)							
1	Poast (Plus or Ultra) (sethoxydim)							
	Select (clethodim)							
	Venture ⁶ (fluazifop-P-butyl)							

¹Refer to Table 1 for information about each herbicide SOA group.

²Not all trade names are listed. Mention of a trade name in no way endorses that product.

³ Also sold as Dual II Magnum in some regions.

⁴ Matrix is sold as Prism in Canada where it is only labeled for POST-application timing.

⁵Sencor STZ is the metribuzin + sulfentrazone premix sold in Canada.

⁶ Venture is sold in Canada and not labeled for use in US potato production.

NOTE: Preplant herbicides and the PRE-applied burndown herbicides, glyphosate, paraquat, and Aim EC are not included but may be needed as part of a herbicide control program.

CHART 2: TANK-MIX PARTNER CHOICE CHART

HERBICIDES ¹	WEED SPECIES PRESENT IN THE AREA						
	Hairy nightshade	C. lambs-quarters	Redroot pigweed	Kochia	Green foxtail		
Chateau (flumioxazin)	G	P	G	S	N		
Reflex (fomesafen)	F	P	G	F	S		
Sulfentrazone (various trade names)	G	P	G	G	N		
Dual Magnum (S-metolachlor)	F	P	G	F	G		
Metolachlor (various trade names)	F	P	G	F	G		
Outlook (dimethenamid-p)	G	P	G	F	G		
Zidua (pyroxasulfone)	G	P	G	S	F		
Matrix² (rimsulfuron)	G	P	G	F	F		
Eptam (EPTC)	G	S	G	F	G		
Prowl H2O (pendimethalin)	S	G	G	F	G		
Sonalan HFP (ethalfluralin)	P	F	G	F	G		
Treflan HFP (trifluralin)	P	F	G	F	G		
Metribuzin (various trade names)	N	G	G	G	G		
Linex/Lorox (linuron)	F	G	G	F	G		
Boundary (S-metolachlor + metribuzin)	F	G	G	F	G		
Sencor STZ³ Sulfentrazone MTZ (metribuzin + sulfentrazone)	G	G	G	G	G		
Poast (Plus or Ultra) (sethoxydim)							
Select (clethodim)	N	N	N	N	G		
Venture⁴ (fluazifop-P-butyl)							

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89% **P** (poor) = 0%–30% **N** (none) = 0%

S (suppression only) = approximately 50% – = no information available

¹ Not all trade names are listed. Mention of a trade name in no way endorses that product.

² Matrix is sold as Prism in Canada where it is only labeled for POST-application timing.

³ Sencor STZ is the metribuzin + sulfentrazone premix sold in Canada.

⁴ Venture (fluazifop-P-butyl), sold in Canada (not labeled for use in US potato production), is another herbicide with this SOA.

NOTE: PRE-applied burndown herbicides, glyphosate, paraquat, and Aim EC are not included but may be needed as part of a herbicide control program.

CHART 3: TANK-MIX PARTNER CHOICE CHART FOR FIELD 1

HERBICIDES ¹	WEED SPECIES PRESENT IN THE AREA					
	Hairy nightshade	C. lambs-quarters	Redroot pigweed	Kochia	Green foxtail	
Chateau (flumioxazin)	G	P			N	
Reflex (fomesafen)	F	P			S	
Sulfentrazone (various trade names)	G	P			N	
Dual Magnum (S-metolachlor)	F	P			G	
Metolachlor (various trade names)	F	P			G	
Outlook (dimethenamid-p)	G	P			G	
Zidua (pyroxasulfone)	G	P			F	
Matrix² (rimsulfuron)	G	P			F	
Eptam (EPTC)	G	S			G	
Prowl H2O (pendimethalin)	S	G			G	
Sonalan HFP (ethalfluralin)	P	F			G	
Treflan HFP (trifluralin)	P	F			G	
Metribuzin (various trade names)	N	G			G	
Linex/Lorox (linuron)	F	G			G	
Boundary (S-metolachlor + metribuzin)	F	G			G	
Sencor STZ³ Sulfentrazone MTZ (metribuzin + sulfentrazone)	G	G			G	
Poast (Plus or Ultra) (sethoxydim)						G
Select (clethodim)	N	N				
Venture⁴ (fluzifop-P-butyl)						

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89% **P** (poor) = 0%–30% **N** (none) = 0%
S (suppression only) = approximately 50% – = no information available

¹ Not all trade names are listed. Mention of a trade name in no way endorses that product.

² Matrix is sold as Prism in Canada where it is only labeled for POST-application timing.

³ Sencor STZ is the metribuzin + sulfentrazone premix sold in Canada.

⁴ Venture (fluzifop-P-butyl), sold in Canada (not labeled for use in US potato production), is another herbicide with this SOA.

NOTE: PRE-applied burndown herbicides, glyphosate, paraquat, and Aim EC are not included but may be needed as part of a herbicide control program.

CHART 4: TANK-MIX PARTNER CHOICE CHART FOR FIELD 1 – OUTLOOK + METRIBUZIN + LINEX

HERBICIDES ¹	WEED SPECIES PRESENT IN THE AREA					
	Hairy nightshade	C. lambs-quarters	Redroot pigweed	Kochia	Green foxtail	
Chateau (flumioxazin)	G	P			N	
Reflex (fomesafen)	F	P			S	
Sulfentrazone (various trade names)	G	P			N	
Dual Magnum (S-metolachlor)	F	P			G	
Metolachlor (various trade names)	F	P			G	
Outlook (dimethenamid-p)	G	P			G	
Zidua (pyroxasulfone)	G	P			F	
Matrix² (rimsulfuron)	G	P			F	
Eptam (EPTC)	G	S			G	
Prowl H2O (pendimethalin)	S	G			G	
Sonalan HFP (ethalfluralin)	P	F			G	
Treflan HFP (trifluralin)	P	F			G	
Metribuzin (various trade names)	N	G			G	
Linex/Lorox (linuron)	F	G			G	
Boundary (S-metolachlor + metribuzin)	F	G			G	
Sencor STZ³ Sulfentrazone MTZ (metribuzin + sulfentrazone)	G	G			G	
Poast (Plus or Ultra) (sethoxydim)						
Select (clethodim)	N	N	G			
Venture⁴ (fluazifop-P-butyl)						

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89% **P** (poor) = 0%–30% **N** (none) = 0%
S (suppression only) = approximately 50% – = no information available

¹ Not all trade names are listed. Mention of a trade name in no way endorses that product.

² Matrix is sold as Prism in Canada where it is only labeled for POST-application timing.

³ Sencor STZ is the metribuzin + sulfentrazone premix sold in Canada.

⁴ Venture (fluazifop-P-butyl), sold in Canada (not labeled for use in US potato production), is another herbicide with this SOA.

NOTE: PRE-applied burndown herbicides, glyphosate, paraquat, and Aim EC are not included but may be needed as part of a herbicide control program.

CHART 5: TANK-MIX PARTNER CHOICE CHART FOR FIELD 1 – EPTAM + PROWL H2O

HERBICIDES ¹	WEED SPECIES PRESENT IN THE AREA						
	Hairy nightshade	C. lambs-quarters	Redroot pigweed	Kochia	Green foxtail		
Chateau (flumioxazin)	G	P	[Redacted]	[Redacted]	N		
Reflex (fomesafen)	F	P			S		
Sulfentrazone (various trade names)	G	P			N		
Dual Magnum (S-metolachlor)	F	P			G		
Metolachlor (various trade names)	F	P			G		
Outlook (dimethenamid-p)	G	P			G		
Zidua (pyroxasulfone)	G	P			F		
Matrix² (rimsulfuron)	G	P			F		
Eptam (EPTC)	G	S			G		
Prowl H2O (pendimethalin)	S	G			G		
Sonalan HFP (ethalfluralin)	P	F			G		
Treflan HFP (trifluralin)	P	F			G		
Metribuzin (various trade names)	N	G			G		
Linex/Lorox (linuron)	F	G			G		
Boundary (S-metolachlor + metribuzin)	F	G			G		
Sencor STZ³ Sulfentrazone MTZ (metribuzin + sulfentrazone)	G	G			G		
Poast (Plus or Ultra) (sethoxydim)							
Select (clethodim)	N	N	G				
Venture⁴ (fluazifop-P-butyl)							

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89% **P** (poor) = 0%–30% **N** (none) = 0%
S (suppression only) = approximately 50% – = no information available

¹ Not all trade names are listed. Mention of a trade name in no way endorses that product.

² Matrix is sold as Prism in Canada where it is only labeled for POST-application timing.

³ Sencor STZ is the metribuzin + sulfentrazone premix sold in Canada.

⁴ Venture (fluazifop-P-butyl), sold in Canada (not labeled for use in US potato production), is another herbicide with this SOA.

NOTE: PRE-applied burndown herbicides, glyphosate, paraquat, and Aim EC are not included but may be needed as part of a herbicide control program.

CHART 6: TANK-MIX PARTNER CHOICE CHART FOR FIELD 2 – Prowl H2O + Metribuzin; Prowl H2O + Linex; Metribuzin + Linex; Premixes

HERBICIDES ¹	WEED SPECIES PRESENT IN THE AREA					
	Hairy nightshade	C. lambs-quarters	Redroot pigweed	Kochia	Green foxtail	
Chateau (flumioxazin)		P	G	S		
Reflex (fomesafen)		P	G	G		
Sulfentrazone (various trade names)		P	G	F		
Dual Magnum (S-metolachlor)		P	G	F		
Metolachlor (various trade names)		P	G	F		
Outlook (dimethenamid-p)		P	G	F		
Zidua (pyroxasulfone)		P	G	S		
Matrix ² (rimsulfuron)		P	G	F		
Eptam (EPTC)		S	G	F		
Prowl H2O (pendimethalin)		G	G	F		
Sonalan HFP (ethalfluralin)		F	G	F		
Treflan HFP (trifluralin)		F	G	F		
Metribuzin (various trade names)		G	G	G		
Linex/Lorox (linuron)		G	G	F		
Boundary (S-metolachlor + metribuzin)		G	G	F		
Sencor STZ ³ Sulfentrazone MTZ (metribuzin + sulfentrazone)		G	G	G		
Poast (Plus or Ultra) (sethoxydim)						
Select (clethodim)		N	N	N		
Venture ⁴ (fluazifop-P-butyl)						

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89% **P** (poor) = 0%–30% **N** (none) = 0%
S (suppression only) = approximately 50% – = no information available

¹ Not all trade names are listed. Mention of a trade name in no way endorses that product.

² Matrix is sold as Prism in Canada where it is only labeled for POST-application timing.

³ Sencor STZ is the metribuzin + sulfentrazone premix sold in Canada.

⁴ Venture (fluazifop-P-butyl), sold in Canada (not labeled for use in US potato production), is another herbicide with this SOA.

NOTE: PRE-applied burndown herbicides, glyphosate, paraquat, and Aim EC are not included but may be needed as part of a herbicide control program.

TABLE 1: HERBICIDES LABELED FOR USE IN POTATOES

SOA Group #	Trade Names ¹	Active Ingredient	Chemical Family ²	Site of Action (SOA)
1	Poast Plus or Poast Ultra	sethoxydim	Cyclohexanedione (DIMs)	Acetyl CoA carboxylase (ACCase) inhibitor
	Select	clethodim		
	Venture (sold in Canada)	fluazifop-P-butyl	Aryloxyphenoxy-propionate (FOPs)	
2	Matrix and others (labeled as Prism in Canada)	rimsulfuron	Sulfonylurea (SUs)	Inhibits Acetolactate synthase (ALS) (a.k.a. Acetohydroxyacid synthase [AHAS])
3	Prowl H2O	pendimethalin	Dinitroaniline (DNAs)	Microtubule assembly inhibitor
	Sonalan HFP	ethalfluralin		
	Treflan HFP	trifluralin		
5	Metribuzin (various trade names)	metribuzin	Triazinone	Inhibits photosynthesis at Photosystem II (PS II) Site A
7	Linex/Lorox	linuron	Urea	Inhibits photosynthesis at PSW II Site A; different behavior from Group 5
8	Eptam	EPTC	Thiocarbamate	Lipid synthesis inhibitor (not ACCase inhibition)
9	Roundup PowerMAX, Touchdown, and others	glyphosate	Glycine	EPSP synthase inhibitor
10	Rely (and others)	glufosinate (for vine kill only)	Phosphinic acid	Glutamine synthetase inhibitor
14	Chateau	flumioxazin	N-phenylphthalimide	Protoporphyrinogen oxidase (PPO) inhibitor
	Sulfentrazone (various trade names)	sulfentrazone	Triazolinone	
	Reflex	fomesafen	Diphenyl ether	
	AIM EC	carfentrazone-ethyl	Triazolinone	
	Vida	pyraflufen ethyl (for vine kill only)	Phenylpyrazole	
15	Dual Magnum/Dual II Magnum	S-metolachlor	Chloroacetamide	Mitosis inhibitor
	Metolachlor (various trade names)	metolachlor		
	Outlook	dimethenamid-p		
	Zidua	pyroxasulfone	Isooxazoline	
22	Gramoxone and others	paraquat dichloride	Bipyridilium	Photosystem I (PSI) electron diverter
	Reglone and others	Diquat dibromide (for vine kill only)		
Formulated pre-mixes/co-packs				
15	Boundary (pre-mix)	S-metolachlor	Chloroacetamide	Mitosis inhibitor
+ 5		+ metribuzin	Triazinone	+ PS II inhibitor
2	Titus Pro (co-pack two containers [sold in Canada])	rimsulfuron	Sulfonylurea (SUs)	ALS inhibitor
+ 5		+ metribuzin	Triazinone	+ PS II inhibitor

SOA Group #	Trade Names ¹	Active Ingredient	Chemical Family ²	Site of Action (SOA)
14	Sencor STZ (co-pack two containers [sold in Canada]) or Sulfentrazone MTZ (pre-mix)	sulfentrazone	Triazolinone	PPO inhibitor
+ 5		+ metribuzin	Triazinone	+ PS II inhibitor
15	Sequence (pre-mix)	S-metolachlor	Chloroacetamide	Mitosis inhibitor
+ 9		+ glyphosate	Glycine	+ EPSP synthase inhibitor

¹ Not all trade names are listed. Mention of a trade name in no way endorses that product. Always read and follow instructions on the herbicide labels.

² Only the chemical families for the potato herbicides are listed. Visit www.weedscience.com for information on more chemical families that may be included in each Group.

Adapted from information in Hutchinson 2021, Campbell et al. 2011, and other sources such as Heap 2019 (www.weedscience.com).

TABLE 2A: HERBICIDES LABELED FOR USE IN POTATOES: EFFECTIVENESS ON BROADLEAF WEEDS

Herbicides	Annuals										Perennials	
	Kochia	Common lambs-quarters	Mustard spp.	Cutleaf nightshade	Black nightshade	Eastern black nightshade	Hairy nightshade	Redroot pigweed	Russian thistle	Canada thistle	Field bindweed	
Chateau (flumioxazin)	S	S	S	S	G	G	G	S	-	N	-	
Dual Magnum/Dual II Magnum (S-metolachlor)	F	F	P	F-G	F	F	F	G	P	N	-	
Eptam (EPTC)	P-F	G	P	F-G	G	G	G	F-G	P	P	P	
Linex/Lorox (linuron)	F	G	G	-	-	S	F	G	-	P	-	
Matrix or others (rimsulfuron) PRE/POST	G/G	P/F	G/G	N/N	G/G	G/G	G/G	G/G	P/P	-/F	P/P	
Prism¹ (rimsulfuron) POST only, Canada only	F-G	S	-	N	-	-	F-G	-	-	-	P	
Metribuzin (various trade names) PRE/POST	G/G	G/G	G/G	P/P	P/F	P/F	P/P	G/G	G/G	P/F	P/P	
Outlook (dimethenamid-p)	P-F	P	P	F-G	G	G	G	G	-	-	P	
Prowl 3.3 or H2O (pendimethalin)	F-G	F-G	-	P-F	P-F	P-F	P-F	F-G	G	-	P	
Reflex (fomesafen)	-	P	G	F	G	G	F	G	-	N	-	
Sonalan HFP (ethalfluralin)	F-G	F-G	P	-	F	F	F	G	F-G	-	-	
Metolachlor (various trade names)	F	F	P	F	F	F	F	G	P	N	-	
Sulfentrazone (various trade names)	G	G	G	G	G	G	G	F-G	G	-	P	

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89% **P** (poor) = 0%–30% **N** (none) = 0%

S (suppression only) = approximately 50% control - = no information available

Herbicides	Annuals										Perennials	
	Kochia	Common lambs-quarters	Mustard spp.	Cutleaf nightshade	Black nightshade	Eastern black nightshade	Hairy nightshade	Redroot pigweed	Russian thistle	Canada thistle	Field bindweed	
Treflan HFP or others (trifluralin)	F-G	F-G	P	P	P	P	P	G	F-G	P	P	
Zidua (pyroxasulfone)	P-F	P	-	F-G	F-G	F-G	F-G	F-G	-	-	-	
Boundary (S-metolachlor + metribuzin)	F	F-G	F	F-G	F	F	F	G	F-G	P-F	P	
Sencor STZ (Canada), Sulfentrazone MTZ , and other trade names (metribuzin + sulfentrazone)	G	G	G	G	G	G	G	G	G	F	P	

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89% **P** (poor) = 0%–30% **N** (none) = 0%

S (suppression only) = approximately 50% control - = no information available

Adapted from Hutchinson 2021; herbicide effectiveness chart and control ratings are also derived from herbicide labels and potato field research trial results. Response of weeds to any of the listed herbicides may be altered by growing conditions, weed populations, type of irrigation, genetic variations, soil type, pH, organic matter (OM), time of application, and application rate. Ratings may vary from season to season and from site to site. Weed control generally decreases as the season progresses.

¹Product used only in Canada. The Prism rate in Canada is 60 g/ha (0.86 oz/A) POST only. Matrix rate range in the United States is 1–1.5 oz/A PRE or POST.

TABLE 2B: HERBICIDES LABELED FOR USE IN POTATOES: EFFECTIVENESS ON ANNUAL BROADLEAF WEEDS NOT INCLUDED IN TABLE 2A

Herbicides	Annuals									
	Wild buckwheat	Common cocklebur	Prostrate knotweed	Common mallow	Common purslane	Smartweed spp. (annual)	Annual sowthistle	Wild sunflower		
Chateau (flumioxazin)	-	-	-	-	-	-	-	-		
Dual Magnum/Dual II Magnum (S-metolachlor)	P	N	-	F	G	P	P	P		
Eptam (EPTC)	F	P	G	P	G	P	F	P		
Linex/Lorox (linuron)	G	S	F	-	G	G	F	-		
Matrix or others (rimsulfuron) PRE/POST	P/P	F/F	N/-	-/-	-/F	-/F	-/-	G/F-G		
Prism¹ (rimsulfuron) POST only, Canada only	P	F	-	-	-	-	-	-		
Metribuzin (various trade names) PRE/POST	G/F	F/G	G/G	G/G	G/G	F/G	G/G	F/F		
Outlook (dimethenamid-p)	P	-	-	-	G	P	P	-		
Prowl 3.3 or H2O (pendimethalin)	-	-	G	F	G	F	P	P		
Reflex (fomesafen)	N	S	-	-	G	P	-	-		
Sonalan HFP (ethalfluralin)	F-G	P	-	-	G	-	-	-		
Metolachlor (various trade names)	P	N	-	F	G	P	P	P		
Sulfentrazone (various trade names)	F	F	-	-	G	G	-	-		

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89%

P (poor) = 0%–30%

N (none) = 0%

S (suppression only) = approximately 50% control

- = no information available

	Annuals									
Herbicides	Wild buckwheat	Common cocklebur	Prostrate knotweed	Common mallow	Common purslane	Smartweed spp. (annual)	Annual sowthistle	Wild sunflower		
Treflan HFP or others (trifluralin)	F	P	G	P	G	P-F	P	P		
Zidua (pyroxasulfone)	-	-	-	-	-	-	-	-		
Boundary (S-metolachlor + metribuzin)	F	S	F	F	G	P-F	F	S		
Sencor STZ (Canada), Sulfentrazone MTZ , and other trade names (metribuzin + sulfentrazone)	G	F	G	G	G	G	G	F		

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89% **P** (poor) = 0%–30% **N** (none) = 0%

S (suppression only) = approximately 50% control

- = no information available

Adapted from Hutchinson 2021; herbicide effectiveness chart and control ratings are derived from herbicide labels and potato field research trial results. Response of weeds to any of the listed herbicides may be altered by growing conditions, weed populations, type of irrigation, genetic variations, soil type, pH, organic matter (OM), time of application, and application rate. Ratings may vary from season to season and from site to site. Weed control generally decreases as the season progresses.

¹Product used only in Canada. The Prism rate in Canada is 60 g/ha (0.86 oz/A) POST only. Matrix rate range in the United States is 1–1.5 oz/A PRE or POST.

TABLE 3: HERBICIDES LABELED FOR USE IN POTATOES: EFFECTIVENESS ON GRASS AND SEDGE WEEDS

Herbicides	Annual grasses										Perennial grasses	Sedge (perennial)
	Barnyardgrass	Crabgrass	Foxtail spp.	Field sandbur	Volunteer barley	Volunteer oat	Wild oat	Volunteer wheat	Quackgrass	Yellow nutsedge		
Chateau (flumioxazin)	N	N	N	N	N	N	N	N	N	N	-	
Dual Magnum/Dual II Magnum (S-metolachlor)	G	G	G	F	-	-	P-F	-	P	F-G	F-G	
Eptam (EPTC)	G	G	G	G	F-G	F-G	F-G	F-G	F-G	F	F	
Linex/Lorox (linuron)	F-G	G	G	-	-	-	-	-	P	-	-	
Matrix or others (rimsulfuron) PRE/POST	G/G	F/G	F-G/ F-G	-/-	G/G	F/G	F/G	G/G	N/G	-/F	-/F	
Prism¹ (rimsulfuron) POST only, Canada only	G	G	G	-	-	-	-	-	G	-	-	
Metribuzin (various trade names) PRE/POST	F/P	F/P	G/F	P/P	P/P	G/F	F-G/ F-G	P/P	P-F/ P-F	P/P	P/P	
Outlook (dimethenamid-p)	G	G	G	P-F	F-G	F-G	F-G	F-G	P	F	F	
Prowl 3.3 or H2O (pendimethalin)	G	G	G	-	-	-	P-F	-	-	P	P	
Reflex (fomesafen)	S	S	S	-	S	S	S	S	N	S	S	
Sonalan HFP (ethalfluralin)	G	G	G	G	P	G	F-G	F	P	-	-	
Metolachlor (various trade names)	G	G	G	G	-	-	F	-	P	F-G	F-G	
Sulfentrazone (various trade names)	N	N	N	N	N	N	N	N	N	N	G	

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89%

P (poor) = 0%–30% **N** (none) = 0%

S (suppression only) = approximately 50% control

- = no information available

Herbicides	Annual grasses										Perennial grasses	Sedge (perennial)
	Barnyardgrass	Crabgrass	Foxtail spp.	Field sandbur	Volunteer barley	Volunteer oat	Wild oat	Volunteer wheat	Quackgrass	Yellow nutsedge		
Treflan HFP or others (trifluralin)	G	G	G	G	P	G	F	F	P			P
Zidua (pyroxasulfone)	F-G	F-G	F-G	P	-	-	-	-	-			-
Boundary (S-metolachlor + metribuzin)	G	G	G	F	P	F	F	P	P			F-G
Metribuzin STZ (Canada), Sulfentrazone MTZ , and other trade names (metribuzin + sulfentrazone)	F	F	G	P	P	G	F	P	P			G
Select (clethodim)	G	G	G	G	G	G	G	G	G			N
Poast Plus (sethoxydim)	G	F	G	G	G	G	G	G	F			N
Venture (fluzifop-P-butyl) (Canada)	F	F	G	F	G	G	G	G	G			N

SEASON-LONG CONTROL:

G (good) = 90%–100% **F** (fair) = 80%–89% **P** (poor) = 0%–30% **N** (none) = 0%

S (suppression only) = approximately 50% control - = no information available

Adapted from Hutchinson 2021; herbicide effectiveness chart and control ratings are derived from herbicide labels and potato field research trial results. Response of weeds to any of the listed herbicides may be altered by growing conditions, weed populations, type of irrigation, genetic variations, soil type, pH, organic matter (OM), time of application, and application rate. Ratings may vary from season to season and from site to site. Weed control generally decreases as the season progresses.

¹Product used only in Canada. The Prism rate in Canada is 60 g/ha (0.86 oz/A) POST only. Matrix rate range in the United States is 1–1.5 oz/A PRE or POST.

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