Agriculture and Agri-Food Canada

Agriculture et Agroalimentaire Canada

Canada

Weed management in potato production

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Weed competition costs Canadian potato producers upwards of $83 million in lost yield potential annually

Weeds reduce potato yield by 44%

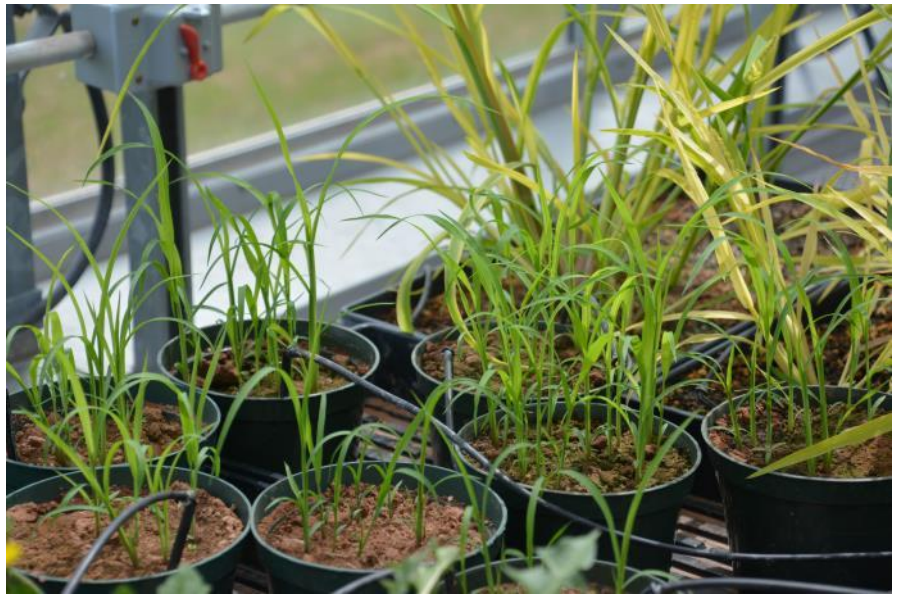
Minimal herbicide options

Reduced cultivation

Ganie et al (2023)

Grasses vs Broadleaves

Weeds can be divided into two large groups

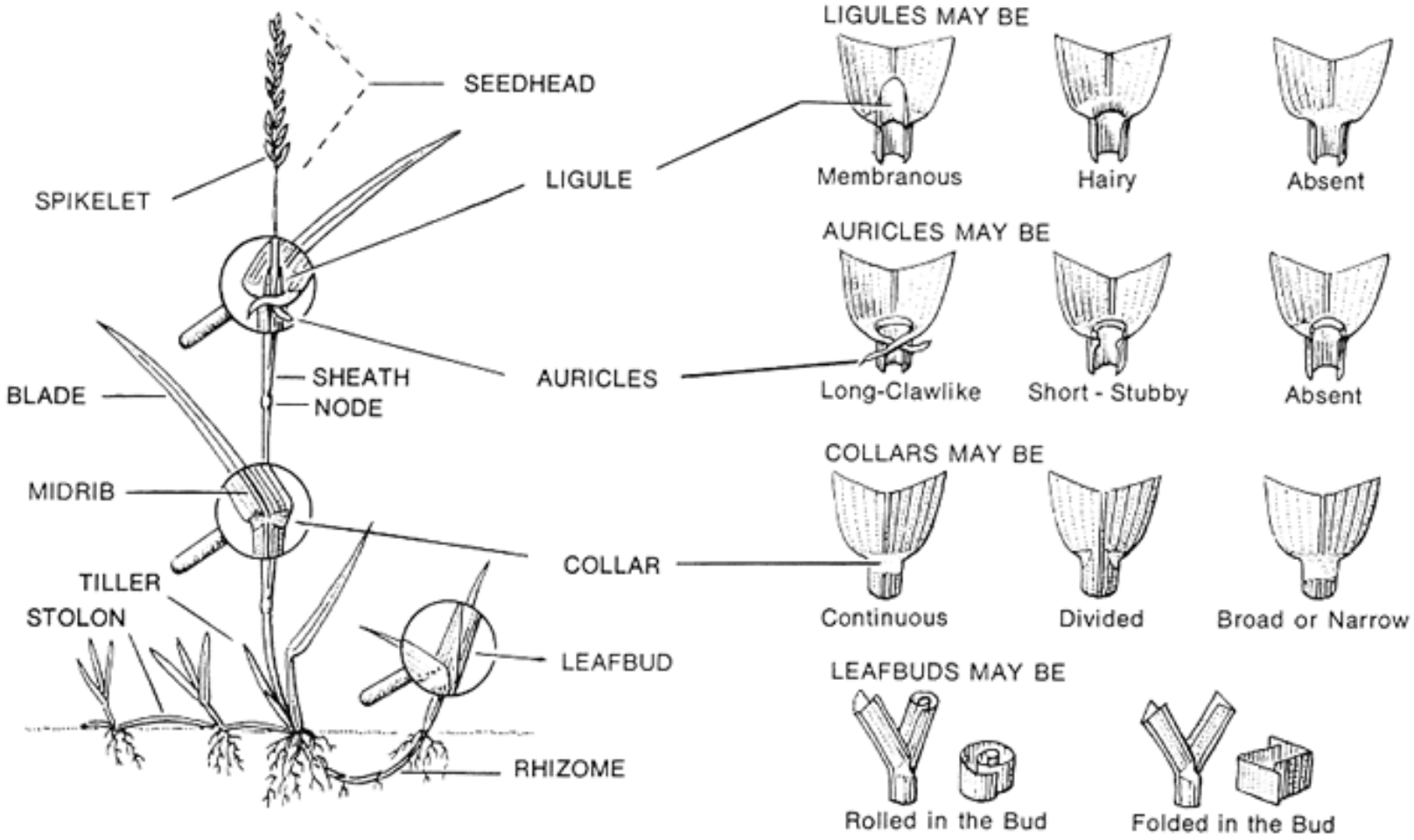


Monocots
Grasses

Dicots
Broadleaves

Identifying Grasses

Parts of a grass plant



University of Georgia, College of Agricultural and Environmental Sciences

Ligules

Hairy

Absent

Membranous

Auricles

Vegetative Growth

Rhizomes
Under-ground stems

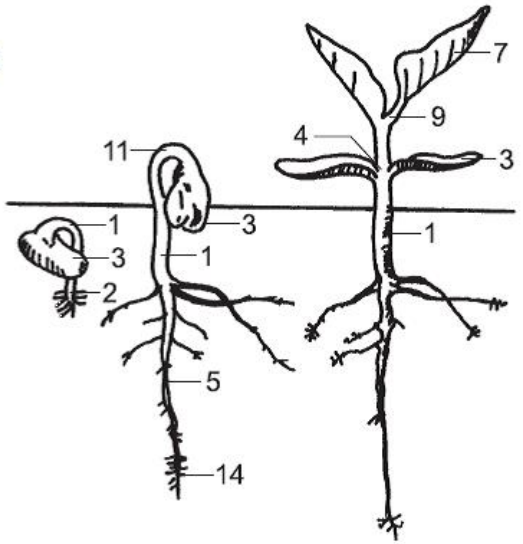
Tillers
Branches

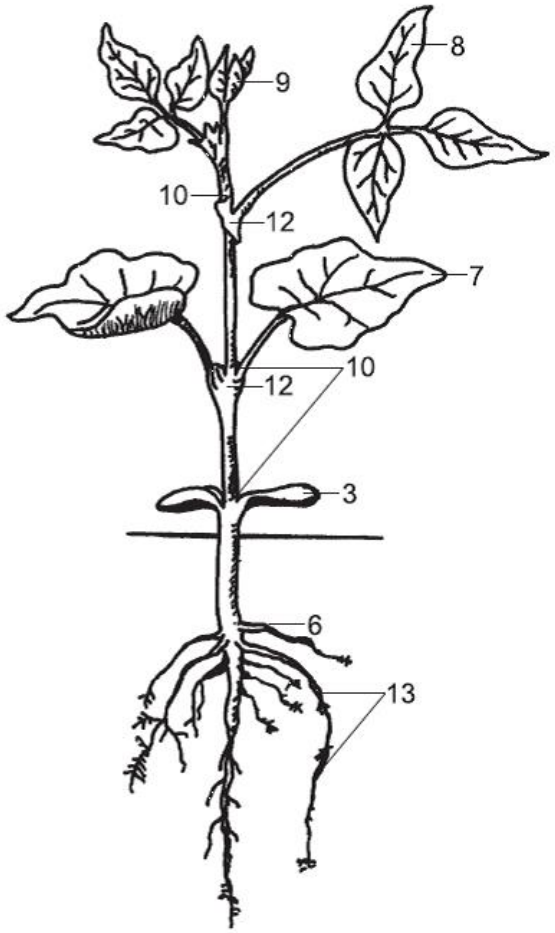
Identifying Broadleaves

Broadleaf Morphology

Figure 1. Plant description.

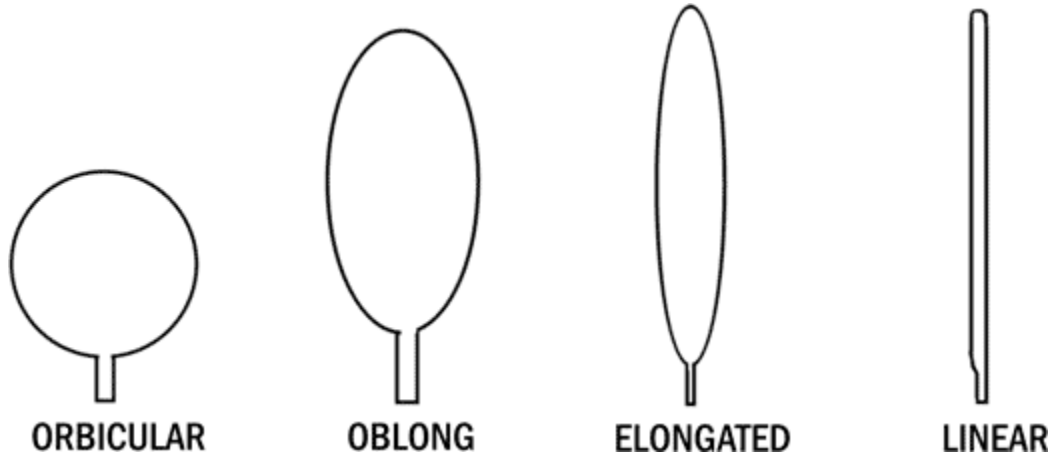
1. Hypocotyl
2. Radicle
3. Cotyledon (simple leaf)
4. Cotyledonary node
5. Tap root
6. Lateral (branch) root
7. First true leaf (unifoliolate)
8. Trifoliolate leaflet
9. Terminal bud
10. Axillary buds
11. Hypocotyl arch
12. Nodes (point of leaf attachment)
13. Nodules
14. Root hairs



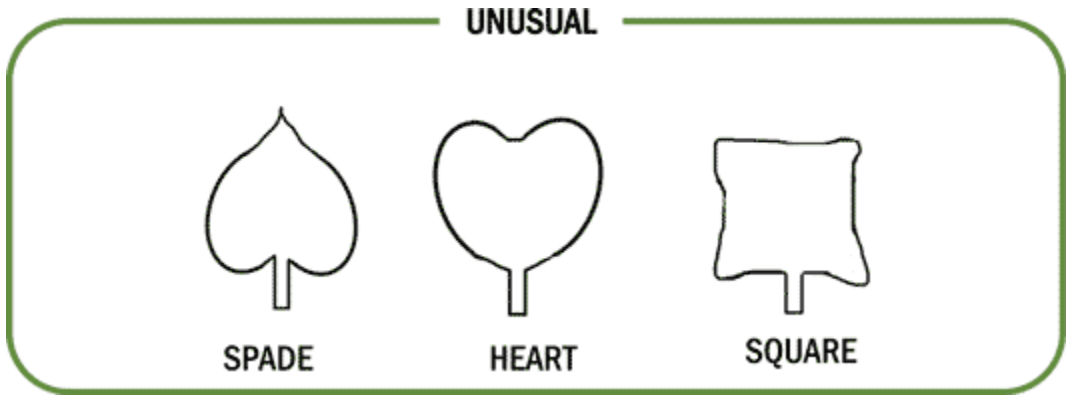


North Dakota State University Extension

Cotyledon morphology



OMAFRA



OMAFRA

Leaf morphology

Compound

Leaf architecture

Opposite

Alternate

Rosette

Whorled

Vegetative reproduction

Stolons
Above-ground stems

Tubers- storage organs

Adventitious root system

Rhizomes
Below-ground stems

Other distinguishing features

Clasping leaves

Presence or absence of hair

Ocrea

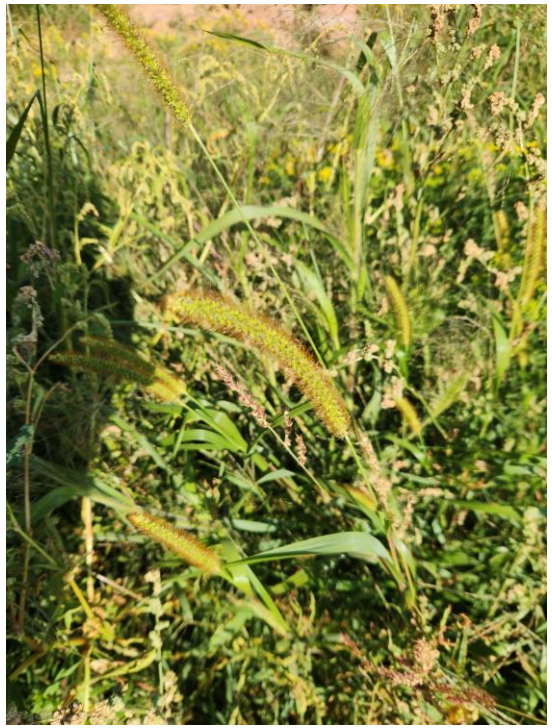
Spines or thorns

Problem weeds of PEI

Annual Grasses

Barnyardgrass
Echinochloa crus-galli
No auricles
No ligule

Foxtails
Setaria spp.
Hairy ligule
Distinctive seed head



Annual Grasses

Crabgrasses (*Digitaria spp.*)

Membranous ligule

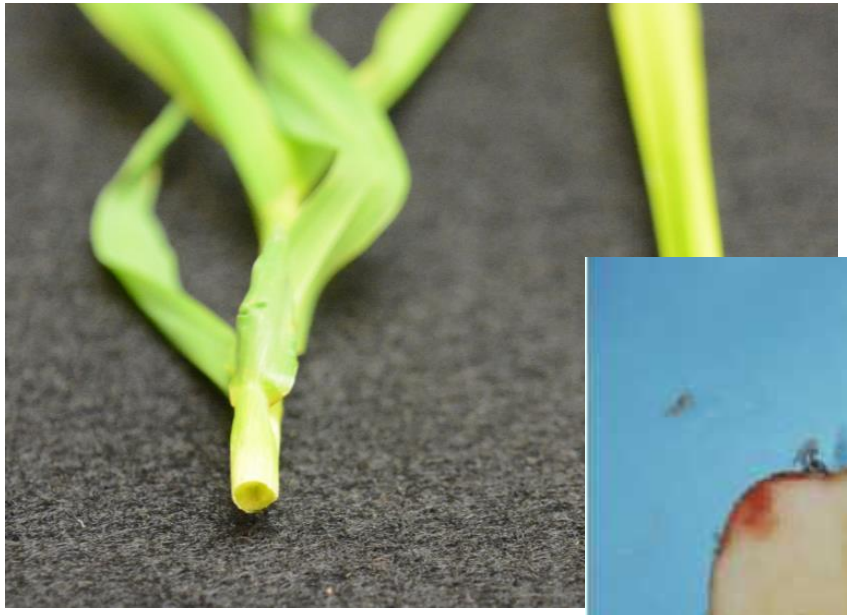
Smooth crabgrass may have hairs

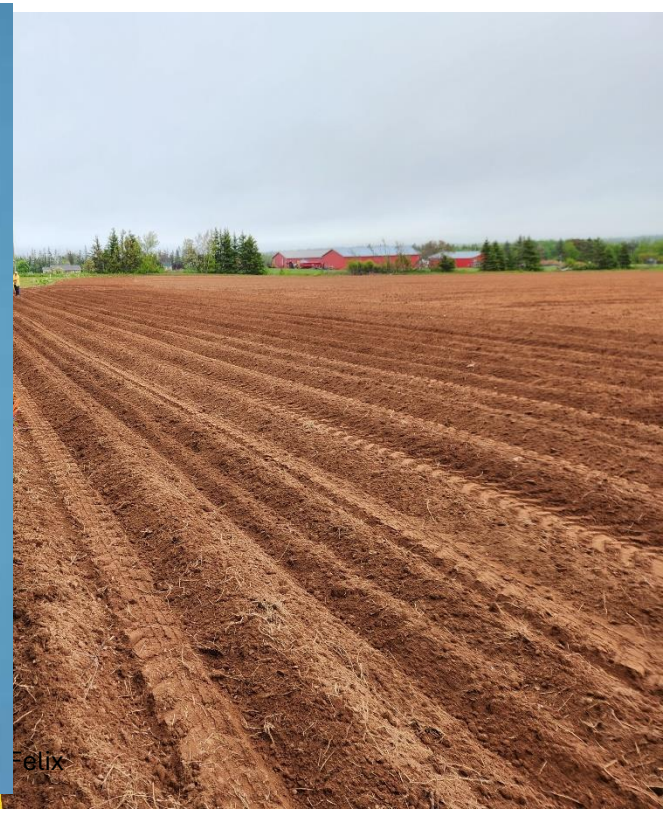
Large crabgrass hairy on both leaf surfaces

Perennial Grasses

Quackgrass or Couchgrass
(*Agropyron repens*)
Membranous ligule
Clasping auricles
Rhizomes
Hair may be present or absent

Yellow nutsedge





PEI invasive species council

Prince Edward Island CANADA

Chickweeds (*Caryophyllaceae*)

Mouse-ear chickweed
Cerastium fontanum

Stitchwort
Stellaria graminea

Common chickweed
Stellaria media

Corn Spurry (*Caryophyllaceae*)

Mint Family (*Lamiaceae*)

Hemp-nettle (*Galeopsis tetrahit*)

Field mint (*Mentha arvensis*)

Bedstraw, Cleavers (*Galium spp.*)

Lambsquarters & Pigweed

Lambsquarters (*Chenopodium album*)

Redroot pigweed (*Amaranthus retroflexus*)

Mustard Family (*Brassicaceae*)

Wild mustard *Sinapis arvensis*

Shepard's Purse *Capsella bursa-pastoris*

Stinkweed *Thlaspi arvense*

Brown mustard *Brassica juncea*

Smartweed Family (*Polygonaceae*)

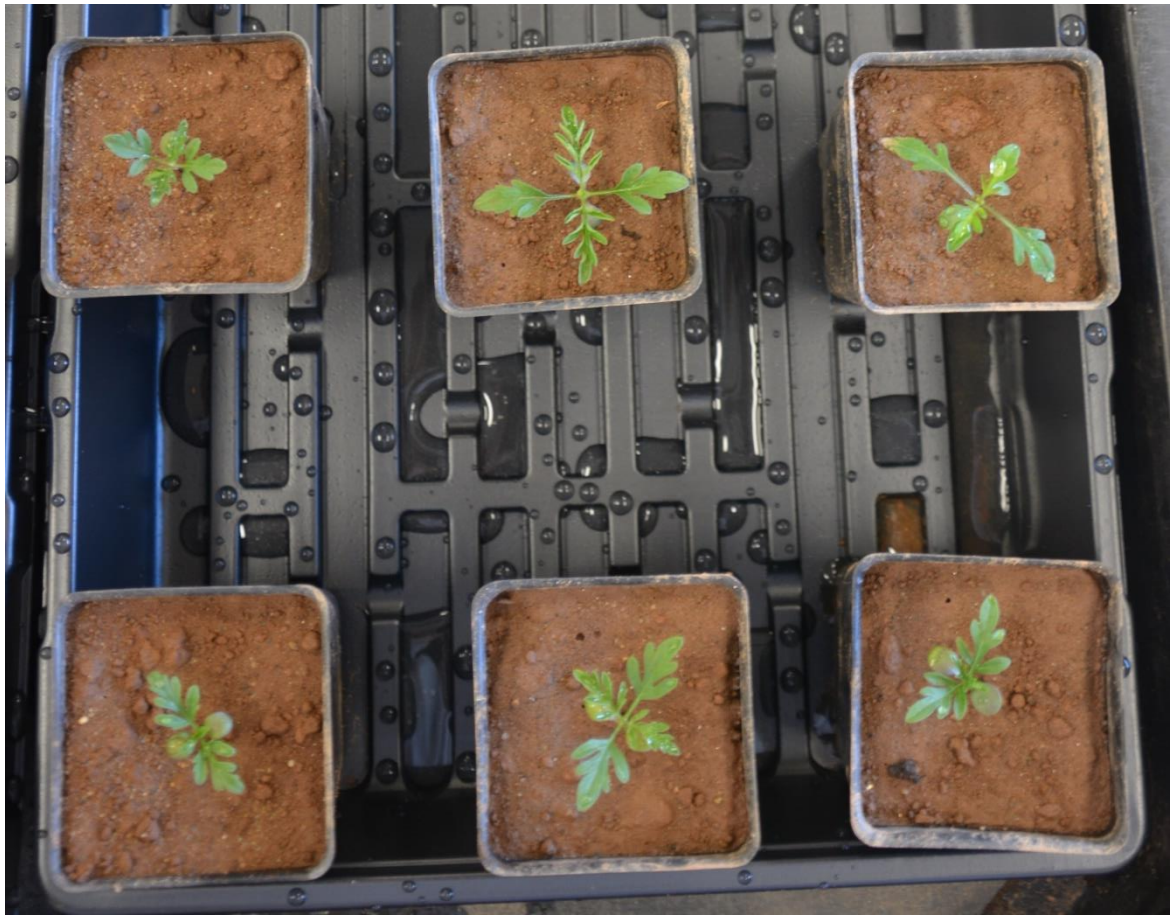
Wild buckwheat
Polygonum convolvulus

Lady's thumb
Persicaria maculosa

Smartweed
Polygonum spp.

Sheep sorrel
Rumex acetosella

Ragweed (*Ambrosia artemisiifolia)*



Common Mugwort (Asteraceae)

Sow Thistles (*Asteraceae)*

Perennial sow thistle
Sonchus arvensis

Spiny annual sow thistle
Sonchus asper

Annual sow thistle
Sonchus oleraceus

Goldenrod & Canada thistle

Canada goldenrod
Solidago canadensis

Canada thistle
Cirsium arvense

Less common

Eastern black nightshade
Solanum ptychanthum

Field violet
Viola arvensis

Sand spurry
Spergularia rubra

Corn speedwell
Veronica arvensis

Tufted vetch
Vicia cracca

Green pigweed
Amaranthus powellii

Oxeye daisy
Leucanthemum vulgare

Volunteer Crops


JUNE20 SENCAR

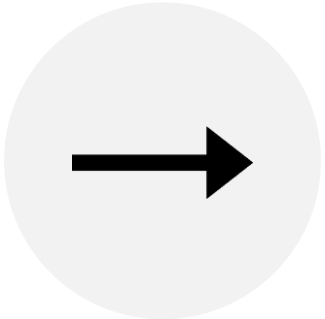
Nearly half of potato fields surveyed have an herbicide resistant weed

McKenzie-Gopsill et al. (2020); Heap (2025)

Reduced cultivation

Shorter crop rotations

Reliance on single modes of action



Herbicide Resistance

Scouting for Herbicide Resistance

Has the same herbicide mode of action been used repeatedly on this field?

Did the same rate previously control this weed?

Are there live and dead weeds following application?

Noticed a recent decline in control?

Are other weed species being controlled by this rate?

Spotting signs of PSII-inhibitor resistance

If resistance is suspected switch up your pre-emerge

Reflex

Frontier Max

Boundary LQD

Herbicide options for managing group 5 resistant broadleaves prior to potato emergence

Product	Preemergent activity	Postemergent activity	Controls group 5 resistant species?
Sencor 75DF	X	X	No
Lorox L	X	X	Depends
Dual II Magnum	X		Better on pigweed Suppression of lambsquarters
Frontier Max	X		No
Boundary LQD	X	X	Suppression of both
Reflex	X	X	Pigweed control Suppression of lambsquarters
Prism SG		X	Suppression (4 cm max) of both
Glyphosate (various)		X	Yes

McKenzie-Gopsill et al. (2020)

Herbicide options in potato

Pre-weed and potato emerge products can be applied from planting up to prior to ground crack

Post-weed emerge, pre-potato emerge can be applied from planting up to prior to ground crack

Post-weed, post-potato emerge products applied postemergence

Sencor
Lorox
Dual II Magnum
Boundary LQD
Frontier Max
Reflex

Sencor
Reflex
Lorox
Reflex
Glyphosate
Reglone

Sencor
Prism
Group 1s

Dual II Magnum (s-metolachlor)

- Group 15 – Inhibition of cell division
- Use rates between 1.25 and 1.75 L ha^{-1}
- Can apply from pre-planting all the way up to ground crack
- ***Has variety issues*** - potato variety responses not well studied
- Pre-emergent weed control
- Uptake in grasses through ***germinating shoot***, absorbed in ***shoots and roots of germinating broadleaves***
- Controls annual grasses and some broadleaf weeds (nightshade, suppression of pigweed)
- ***Rainfall within 10 days is required*** for maximum pre-emergence activity
- Can be soil incorporated to improve pre-emergent activity
- Provides 10-14 weeks of residual control
- Winter cereals can be planted 4-5 months post-application

Boundary LQD (s-metolachlor + metribuzin)

- Group 5 + Group 15
- Use rates of Boundary LQD between 1.85 and 2.5 L ha^{-1}
- Refer to label of Sencor and Dual if tank-mixing
- Broad spectrum of annual grass and broadleaf control
- ***Will not*** control PSII-inhibitor resistant weeds
- Resistance to s-metolachlor documented in pigweed species in the US

Results from our trials (Dual II Magnum)

Poor control of

- Lambsquarters

Moderate control of

- Redroot pigweed
- Shepard's purse
- Wild buckwheat & smartweeds
- Smooth crabgrass

Marketable yield equivalent to weed-free

Heavy weed pressure

Light weed pressure

Results from our trials (Boundary LQD)

Minimal control of PSII-inhibitor resistant species

Excellent control of all other species

See late season grasses

Marketable yield equivalent to weed-free

Heavy weed pressure

Light weed pressure

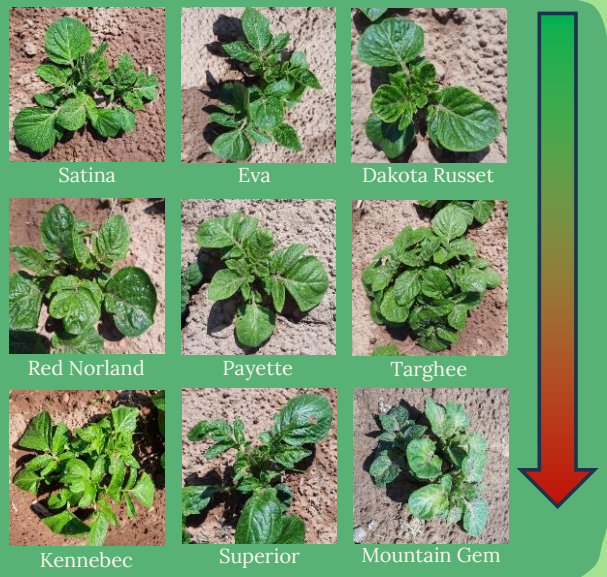
TOLERANCE OF POTATO CULTIVARS TO S-METOLACHLOR

s-Metolachlor (sold under the trade names Dual II Magnum, Komodo, and others) is a group 15 herbicide that inhibits synthesis of long-chain fatty acids which restricts cell growth. Most uptake is by the emerging shoots of seedlings. s-Metolachlor is registered for pre-emergence applications in potato prior to ground crack

s-Metolachlor is effective on many grasses and some small-seeded broadleaves including species resistant to other potato herbicides. Yet, potato cultivars have varying tolerance to s-metolachlor, from no injury up to complete plant death. Minimal information is currently available on potato cultivar tolerance.

Common injury from s-metolachlor including failure to emerge, drawstring effect, leaf malformation, and chlorosis

Researchers at AAFC in Charlottetown have screened a variety of potato cultivars for tolerance to s-metolachlor. Potatoes were hilled right after planting and s-metolachlor applied at a rate of 1.25 L/ ha. Potato visual injury was rated six weeks after application



Potato cultivars displayed a wide range of symptoms to s-metolachlor with typical injury involving leaf malformations including stunting, puckering, the drawstring effect, and chlorosis. In addition to Russet Burbank, Satina, Eva, and Dakota Russet also showed good tolerance to s-metolachlor. Varieties such as Kennebec, Superior, and Mountain Gem, however, were severely injured and sometimes failed to emerge. These results highlight the varied tolerance of potato cultivars to s-metolachlor. Producers should still evaluate this product on a small area when using it on a new variety and as always refer to the manufacturer's label before using any herbicide.

Contact Dr. Andrew McKenzie-Gopsill for more information:
andrew.mckenzie-gopsill@agr.gc.ca

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Satina

Eva

Dakota

Red Norland

Payette

Targhee

Kennebec

Superior

Mountain Gem

Frontier Max (dimethenamid-P)

- Group 15 – Inhibition of cell division
- Use lower rates with reduced OM (OM~3% use 756 g ha^{-1}, consult label)
- Applied anytime after planting as long as ***potatoes have not emerged***
- ***Pre-emergent*** control
- ***Uptake via shoots and roots*** but primarily through developing ***coleoptile***
- Effective on annual grasses and some broadleaf weeds (pigweed, nightshade)
- Provides ***season-long*** weed control
- ***Rainfall is required*** within 7-10 days
- Can use shallow cultivation in absence of rainfall to move product to moist soil zone

Frontier Max (dimethenamid-P)

- In cold, wet conditions, potato emergence may be delayed or stunted
- If crop fails, ***do not*** re-plant potato – plant corn, soybean or dry bean
- Only ***a single application*** may be made per year
- Do not apply within 40 days of harvest
- Re-cropping intervals –
  - 100 days for cereals
  - Next spring for potato, corn, soybean, dry bean, cabbage
  - 11 months for all other crops
- 2016 resistance documented in pigweed species in Illinois
- Consult the label before using

Results from our trials

Poor control of

- Lambsquarters
- Shepard's purse
- Wild buckwheat & smartweeds
- Smooth crabgrass

Small marketable yield boost over weed-free (~10%)

Heavy weed pressure

Light weed pressure

Reflex (fomesafen)

- Group 14 – Inhibition of protoporphyrinogen oxidase (PPO)
- Use 1.0 L ha^{-1}, if weeds are emerged add Agral 90 @ 0.1% v/v
- Can be applied at planting up to potato emergence
- Provides ***pre-*** and ***post-***emergent control of pigweed and suppression of lamb's quarters
- ***Post-emergent*** control of ragweed, wild mustard, lady's-thumb, Eastern black nightshade, canola
- For post-emergent control – max of 4 leaves for most weeds, 3 for lamb's quarters

Reflex (fomesafen)

- ***Do not*** cultivate within 7 days after application
- ***Do not*** apply to soils >5% OM or fine textured soils
- ***Do not*** apply Reflex to a field more than once every two years
- ***Do not*** harvest potatoes within 70 days of application
- Resistance documented in pigweed species across the soybean/ corn belt of US
- Consult the label for using

Results from our trials

Good control of early emerging weeds but doesn't get that second flush

We noted,

- Lambsquarters
- Smooth crabgrass
- Field mint
- Common chickweed

Marketable yield equivalent to weed-free

Heavy weed pressure

Light weed pressure

A single inter-row cultivation pre-hilling can reduce broadleaf weed biomass

Treatment	Weeks after planting	Lambsquarters ($g\ m^{-2}$)	Wild buckwheat ($g\ m^{-2}$)	Corn spurrey ($g\ m^{-2}$)	Yield ($Cwt\ ac^{-1}$)
Single Cultivation	Three	4	19	9	312
Two Cultivations	Four	4	12	15	286
Three Cultivations	Five	8	28	19	277
Hilling only	Six	24	37	54	268
Boundary LQD	One	0	0.3	0	330

Felix et al. (2009)

Hilling at planting demands more of your herbicide

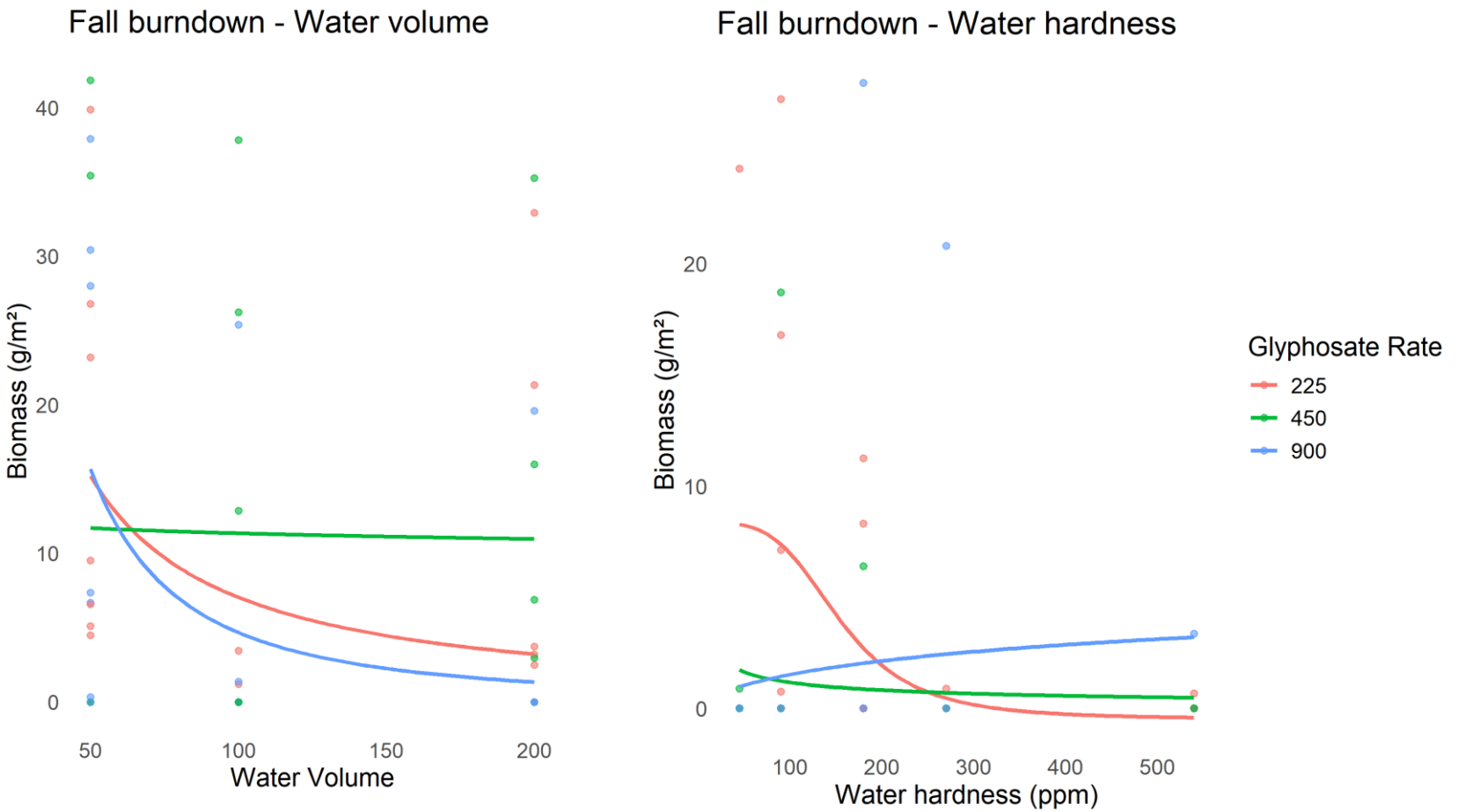
Residual activity and efficacy of many products used in potato is reduced in low OM, low pH soils

Evaluation of pre-potato but post-weed emergence options and products is ongoing

Critical potatoes are not at ground crack or emerged at time of application

Product	Timing	Product Rate
Sencor	Weekly	140 g/ ha/ application
Reflex	14-21 DAP	1 L/ha
Sencor	14-21 DAP	200 g/ ha/ application
Reglone	14-21 DAP	1.5 L/ha

There are limited post-emergent chemical options available in potato



Fall & spring burndowns can be used to control perennials & winter annuals

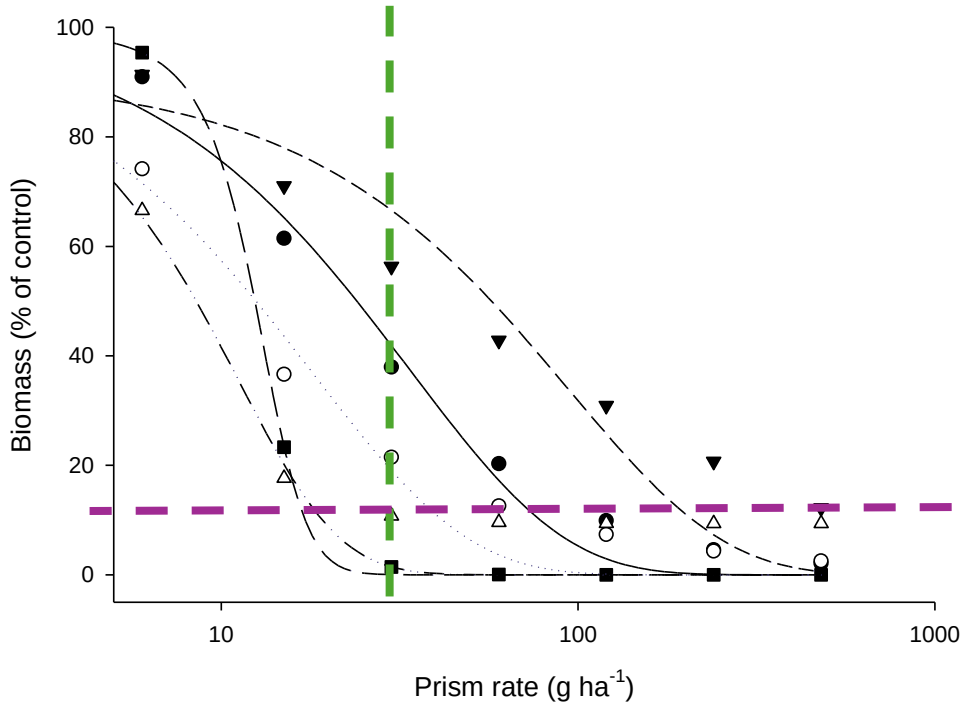
Grass Herbicides

- Group 1 – ACCase inhibitor
- Post-emergent control
- Use rates vary
- Widespread resistance has been documented Worldwide
- Consult the label

Herbicide	Grasses Controlled
Clethodim	Annual grasses
Excel	Annual grasses including crabgrass
Venture	Annual grasses including crabgrass & Couch grass
Poast	Annual grasses including crabgrass & Couch grass

Prism (rimsulfuron)

- Group 2 – ALS inhibitor
- Use rate of 60 g ha^{-1} - ***use a surfactant***
- Can apply from emergence up to initiation of flowering
- Control of
  - Annual grasses
  - Mustards
  - Pigweed
- Suppression of
  - Lambsquarters
  - Corn spurrey



Preventative weed management
The potato vine crusher

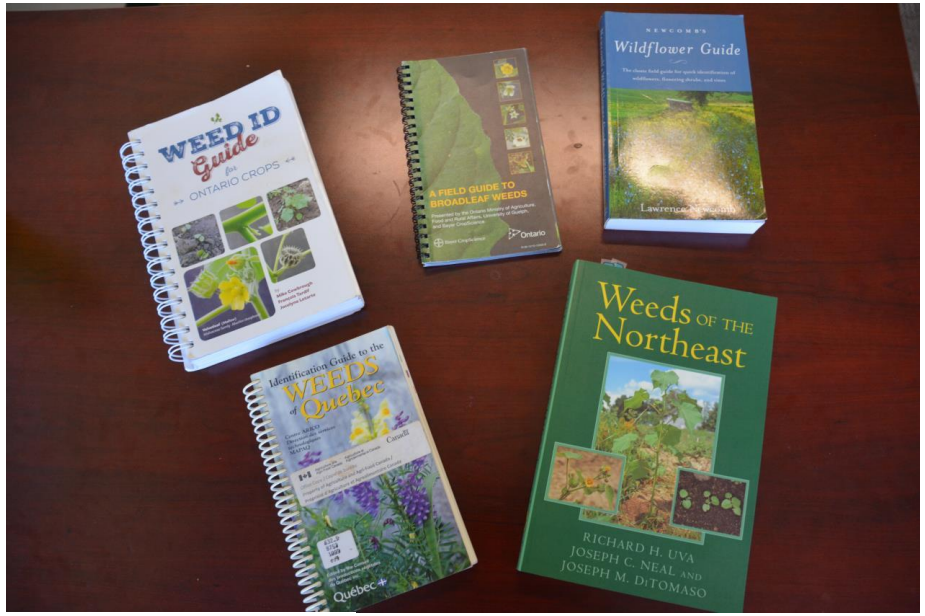
Unprocessed control

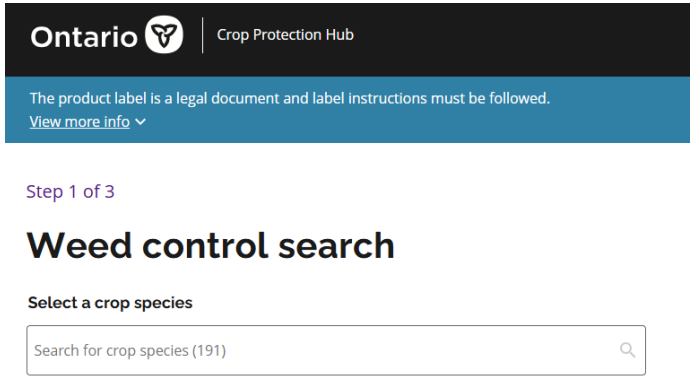
Processed with PVC





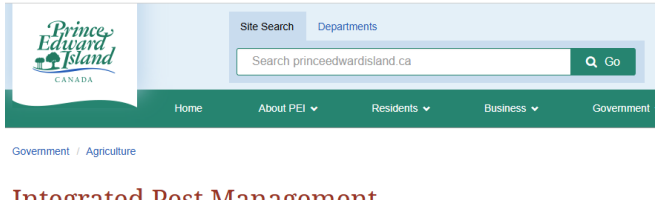

Weed ID & management resources

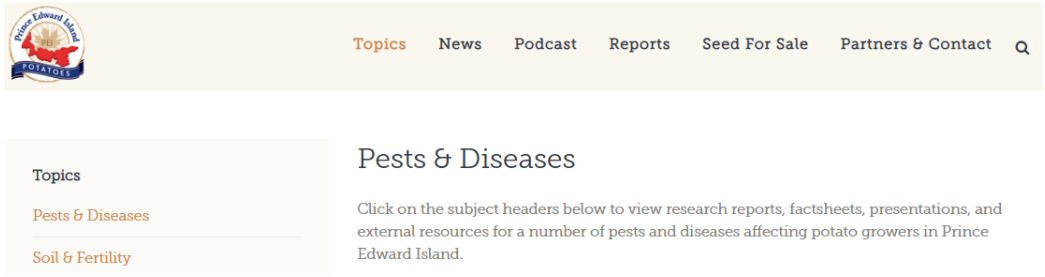




Canada

PMRA
Label Search





iNaturalist

Pl@ntNet

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Questions?

Charlottetown Weeds Lab

- Peter Webb
- Summer students
- Nicolle MacDonald

Harrington Farm Crew

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