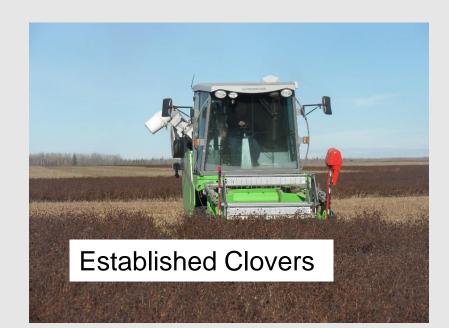




Herbicide Tolerance Trials on Grass and Legume Seed Crops







Recent Work

Herbicide Tolerance Trials and Minor Use Registrations

- HotShot and Conquer prior to seeding grasses
- Pixxaro, Paradigm, Infinity FX, Infinity FX+MCPA ester on seedling grasses
- Infinity FX, Infinty FX+MCPA ester and Cirpreme on herbicides on established grasses

Herbicide Screening Trials

- Zidua (pyroxasulfone)
- Annual crop desiccants on grasses
- Olympus (propoxycarbazone-sodium)

Future Work

- screening trials for grassy weed control in established grasses eg. Zidua, Avadex, Olympus, Edge.



Corteva broadleaf herbicides with new Group 4 active Arylex (halauxifen)

- Pixxaro (halauxifen+MCPA ester+fluroxypr)
- Paradigm (halauxifen+florasulam) + MCPA ester
- Cirpreme (halauxifen+florasulam+clopyralid) + MCPA ester

Halauxifen

- Works well across variable weather conditions, weed stages and cereal crop stages. Works well on many annual weeds and strong on large cleavers.
- Cirpreme and Paradigm+MCPA ester provide suppression of night-flowering catchfly, scentless chamomile and white cockle. Control of narrow-leaved hawk's-beard and dandelions. Also work well on volunteer alfalfa.
- Has some activity on barnyard grass.

Broadleaf Herbicides

URMULE

Attain

Buctril M

Curtail M

Infinity

Frontline XL

Lontrel

MCPA

Prestige XC

Spectrum

2,4-D

URMULE Submitted

Stellar (2018)

Minor Use Priority (PMC)

Pixxaro (2017)

Cirpreme XC (2019)

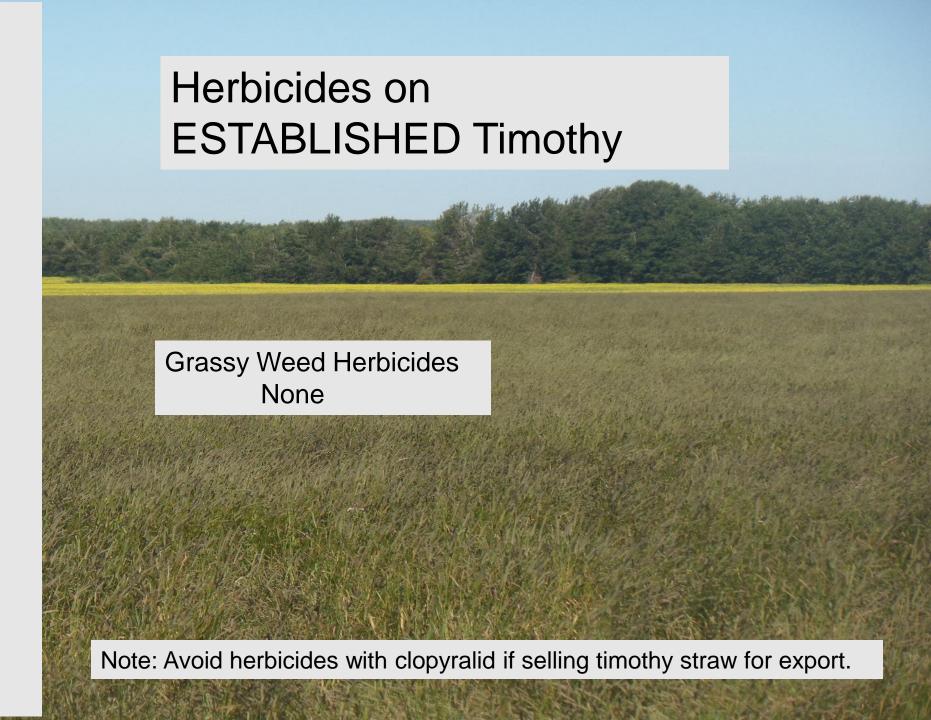
Collecting Data

Paradigm+MCPA ester

Cirpreme XC

Infinity FX

Infinity FX+MCPA ester



Herbicides on ESTABLISHED Bromegrasses

Broadleaf Herbicides

URMULE

Attain

Infinity

Lontrel

MCPA

Prestige XC

Spectrum

2,4-D

URMULE Submitted

Stellar (2018)

Minor Use Priority (PMC)

Enforcer M (2016) Cirpreme (2020)

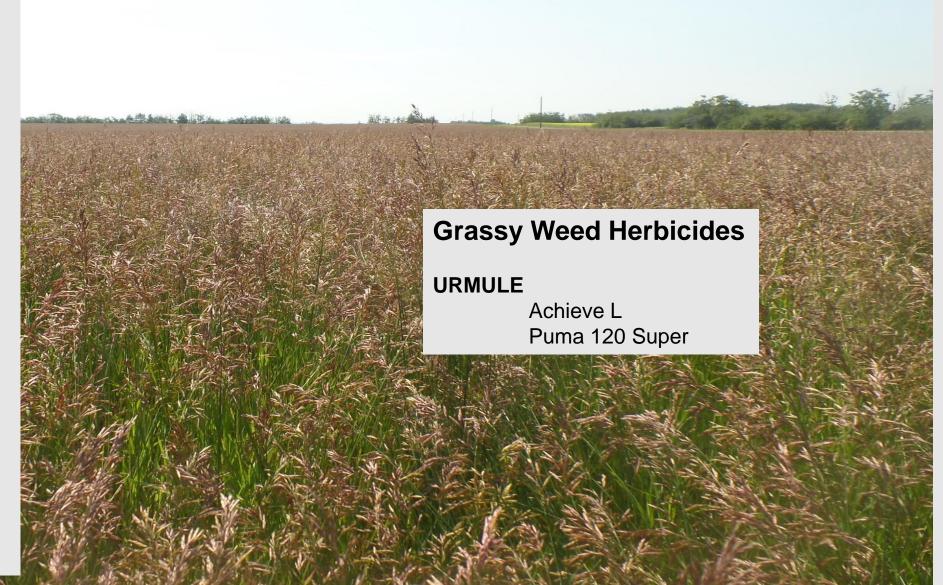
Collecting Data

Infinity FX

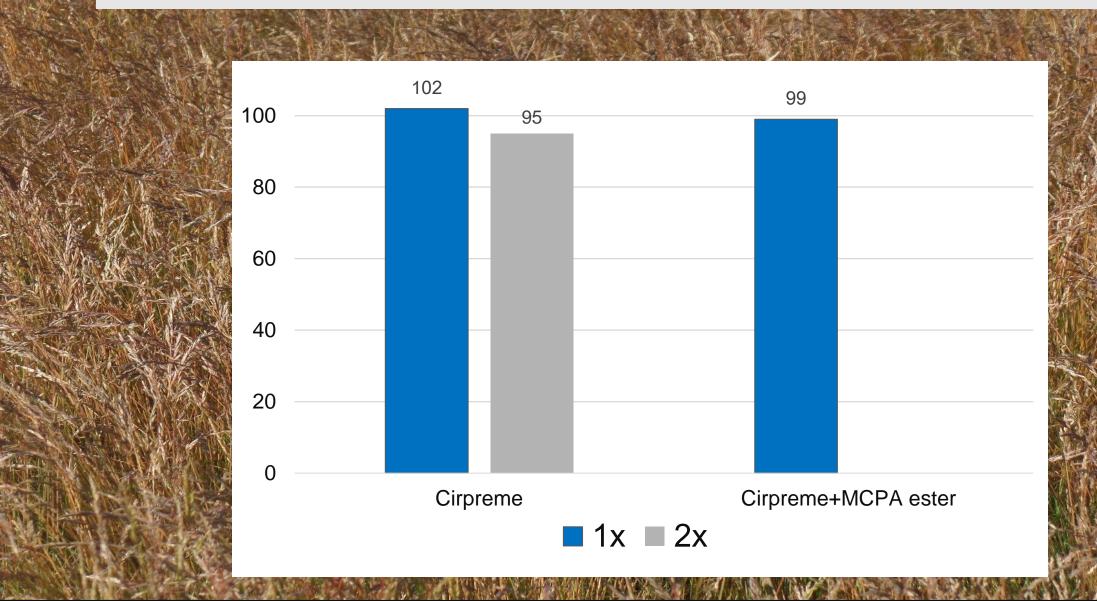
Cirpreme XC

Paradigm+MCPA ester

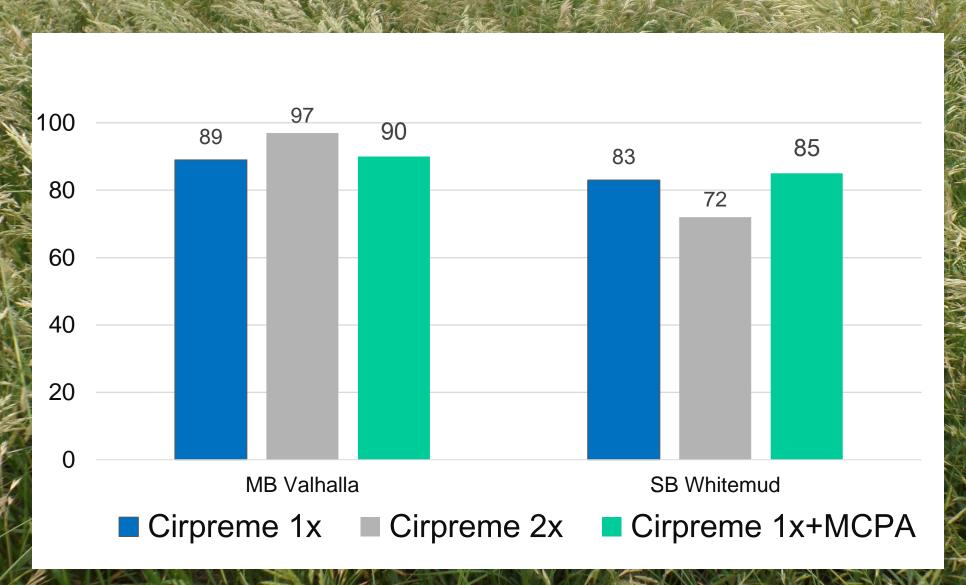
Pixxaro



Tolerance of Established Meadow Bromegrass to Cirpreme XC and Cirpreme XC+MCPA ester (% of Check), Rycroft 2018



Tolerance of Established Bromegrasses to Cirpreme XC (% of Check), 2019



Herbicides on Established Creeping Red Fescue

Grassy Weed Herbicides URMULE Assure II Poast Ultra

Broadleaf Herbicides

URMULE

Ally

Attain

Banvel II

Banvel II+2,4-D

Infinity

Frontline XL

Lontrel

MCPA

Prestige XC

PP 23235

2,4-D

Refine SG

URMULE Submitted

Stellar (2018)

Travallis (2020)

Minor Use Priority (PMC)

Cirpreme XC (2020)

Collecting Data

Cirpreme XC

Infinity FX

Infinity FX+MCPA ester

Precision Pac Mixes?

Herbicides on ESTABLISHED Perennial Ryegrass

Broadleaved Herbicides

URMULE

Infinity

MCPA

Spectrum

2,4-D

URMULE Submitted

Stellar

Potential

Prestige Infinity FX

Grassy Weed Herbicides

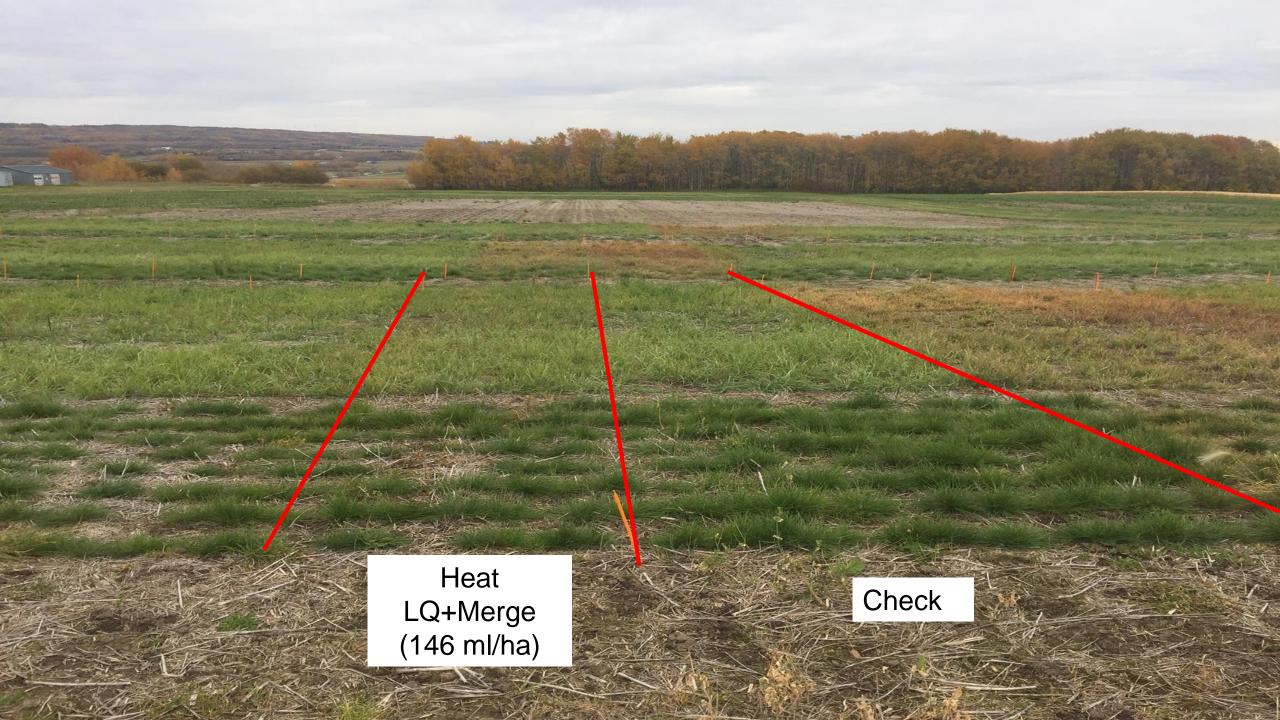
URMULE

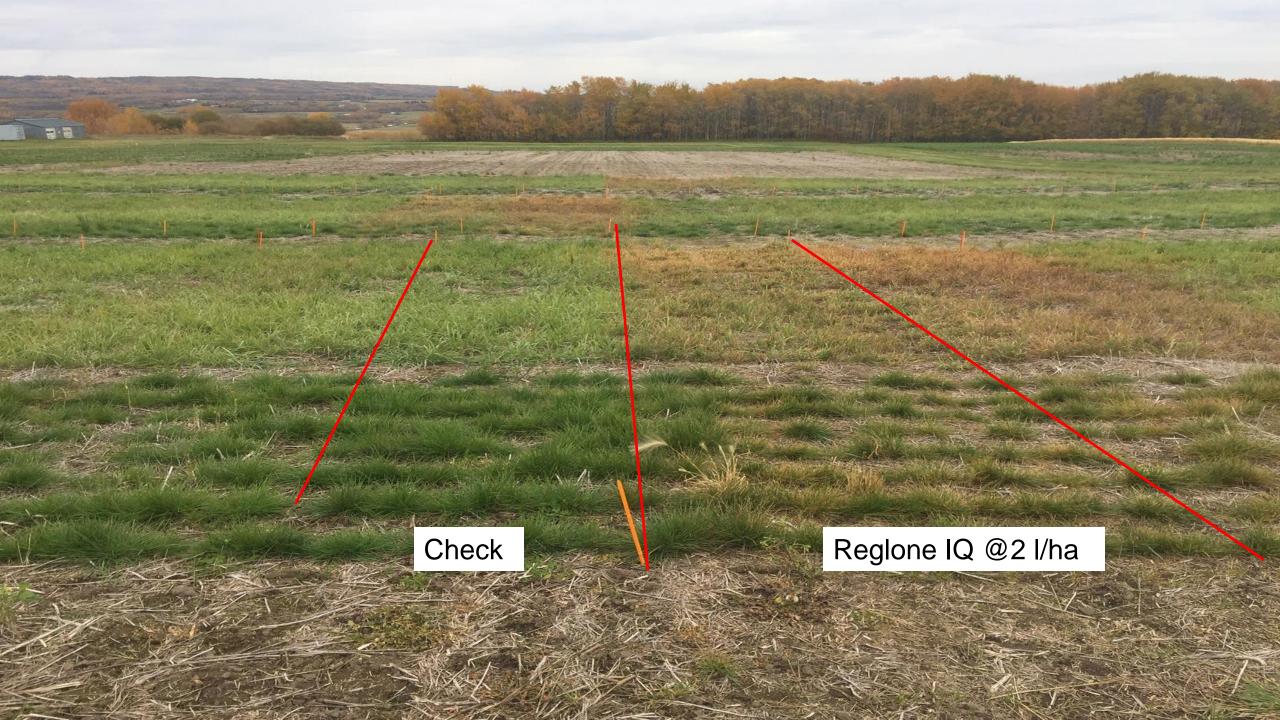
Puma Advance EC Assert 300 EC (no longer available)

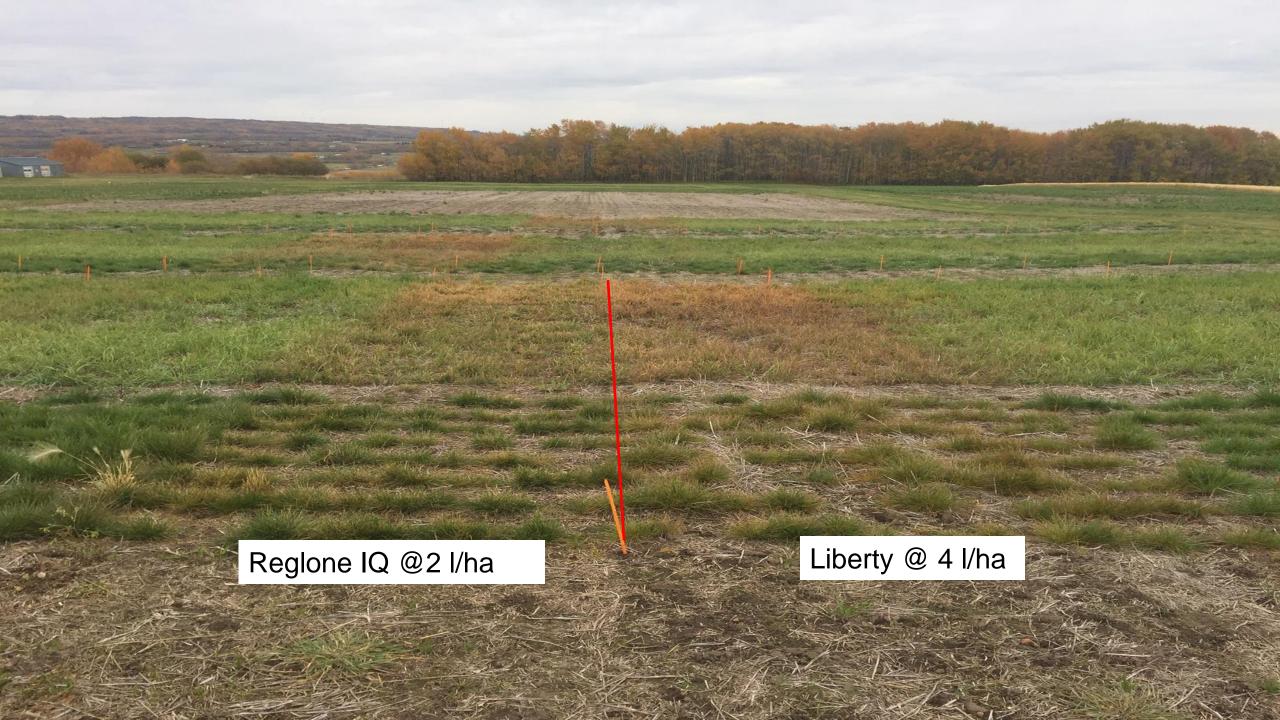
Pixxaro, Paradigm, Cirpreme XC???????

Effect of Crop Desiccants Regione IQ, Heat and Liberty on Grass Seed Crops

- Growers will sometimes underseed grasses to annual crops such as peas, canola or wheat.
- Grower questions in the fall on what desiccants could be used to dry down the annual crop and weeds but safe on the underseeded grass.
- Heat is registered on Oregon (Sharpen) grass seed crops as:
 - Pre-seed or pre-emergent application
 - Seedling grasses that have the first tiller established
 - Established grasses in fall or spring after greenup until boot stage
- Trial conducted at AAFC Beaverlodge Research Farm in Sept 2019 to evaluate the effects of 3 different dessicants (Heat, Regione and Liberty on newly established grasses







Summary-Dessicants on Grasses

- There was virtually no visual damage to the four grasses following the application of HEAT LQ.
- Regione ION and Liberty caused severe damage. Grasses will likley recover in 2020 but strong possibility seed yields would be affected.
- Liberty caused more damage to the grasses than Reglone.
- Visual ratings and possibly yield data will be collected in 2020.
- HEAT LQ would be a good option to desiccate canola or peas prior to harvest that have been underseeded to grasses.

Pyroxasulfone

- Zidua BASF product
- Also component of Heat Complete and Focus.
- Zidua registered in Western Oregon on ESTBALISHED tall fescue and perennial ryegrass.
- Used in western Canada in a number of different mixtures as a pre-seed/pre-emergent field peas, lentils wheat, soyabeans and corn.
- Residual control and requires ½ inch of rainfall for activation.
- Partial control or suppression of a number of grassy weeds including wild oats, Downy brome, Japanese brome, green foxtail, yellow foxtail.
- Excellent control of annual bluegrass
- Control of weeds would be rate and moisture dependent.
- Potential for fall or spring applications on established grasses??????

% Visual Control of annual bluegrass following late fall and early spring applications of pyroxasulfone on Smooth bromegrass field, 2013/14.

	May 28	June 18	August 6
Fall-Pyroxasulfone	85	92	92
Spring-Pyroxasulfone	67	74	88
Fall-Granular Edge	85	85	90

VISUAL SCREENING TRIALS on Tolerance of Grasses To Pyroxasulfone (.150 g/ha ai) Fall and Spring Applied

SEEDLING GRASSES

- Eliminates seedling grasses when applied pre-seed

ESTABLISHED GRASSES

- Creeping red fescue tolerance has been variable. Spring applications have caused considerable damage.
- Timothy, smooth bromegrass, and meadow bromegrass have shown fairly good tolerance to fall and spring applications.
- Crested wheatgrass and slender wheatgrass have shown excellent tolerance to date.
- Requires much more tolerance data collection

Thank-you

Peace Region Forage Seed Association Agriculture and Agri-Food Canada – AgriScience And Agri-Innovation Program Smoky Applied Research and Demonstration Association AAFC Beaverlodge Research Farm Nitya Khanal, Pat Ganselves, Rahmon Azooz



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Vic Gauthier, SARDA - Falher

Jennifer Otani, AAFC - Beaverlodge

Henry Klein-Gebbinck, AAFC – Beaverlodge

Rahman Azooz, AAFC – Beaverlodge

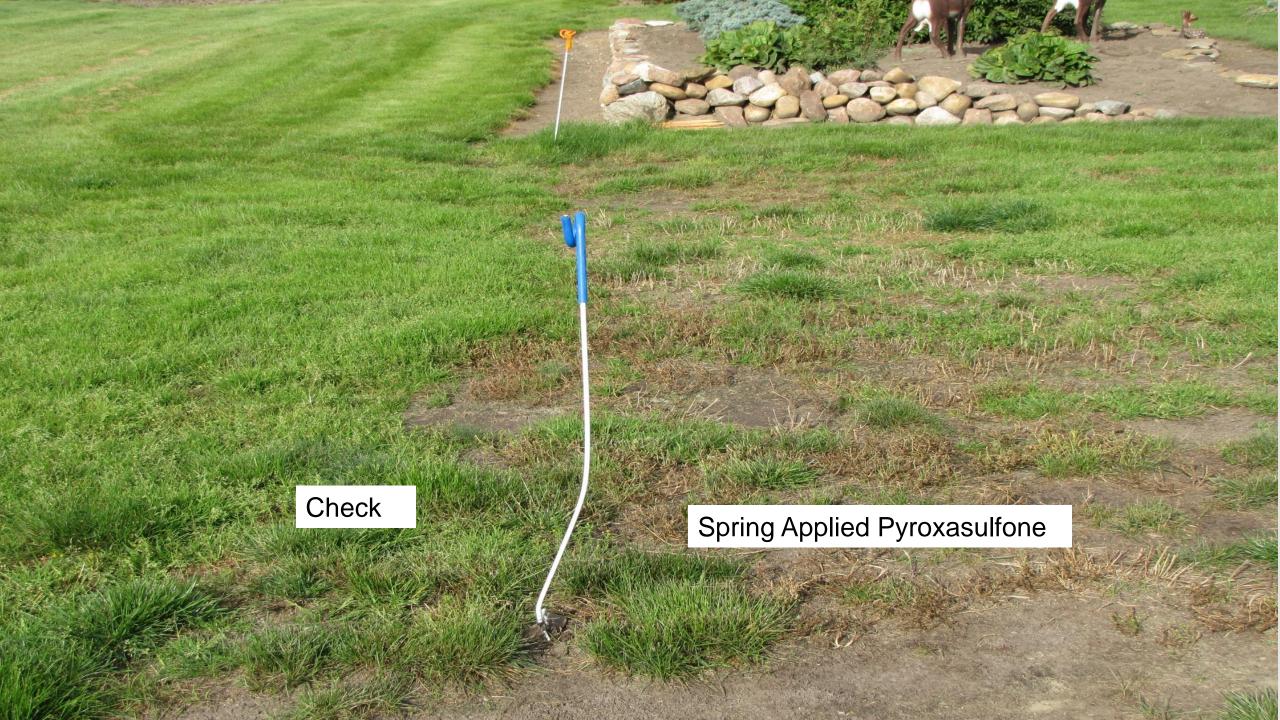
Pat Gansevles, AAFC – Beaverlodge

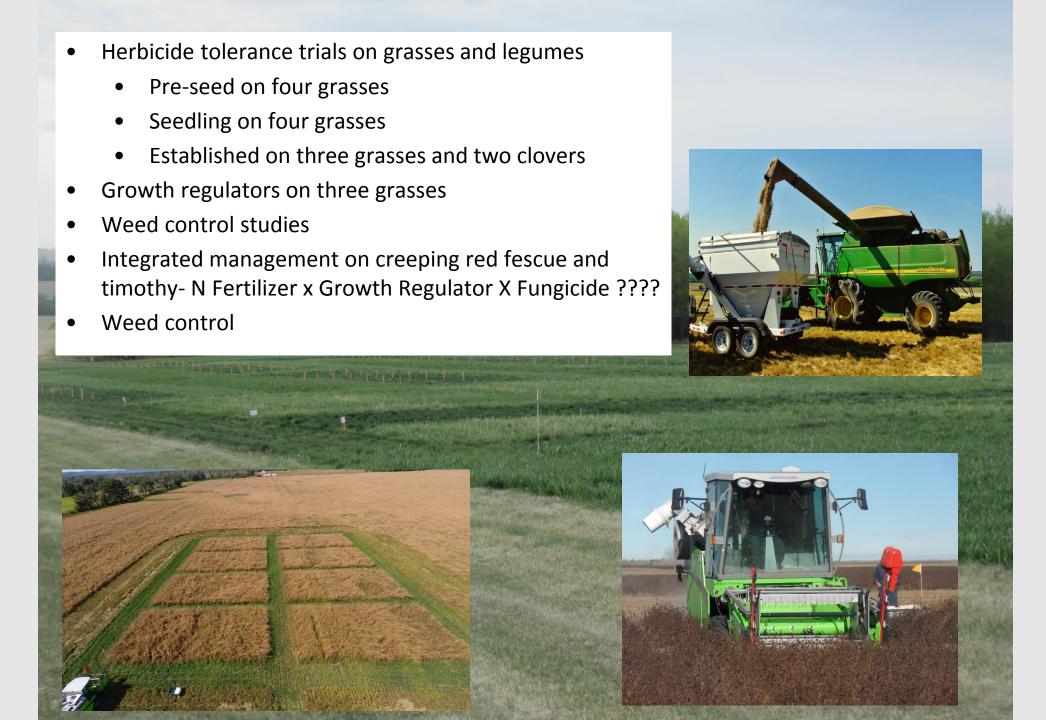
Mike Leighton, AAFC – Beaverlodge

Noabur Rahman, AAFC – Beaverlodge

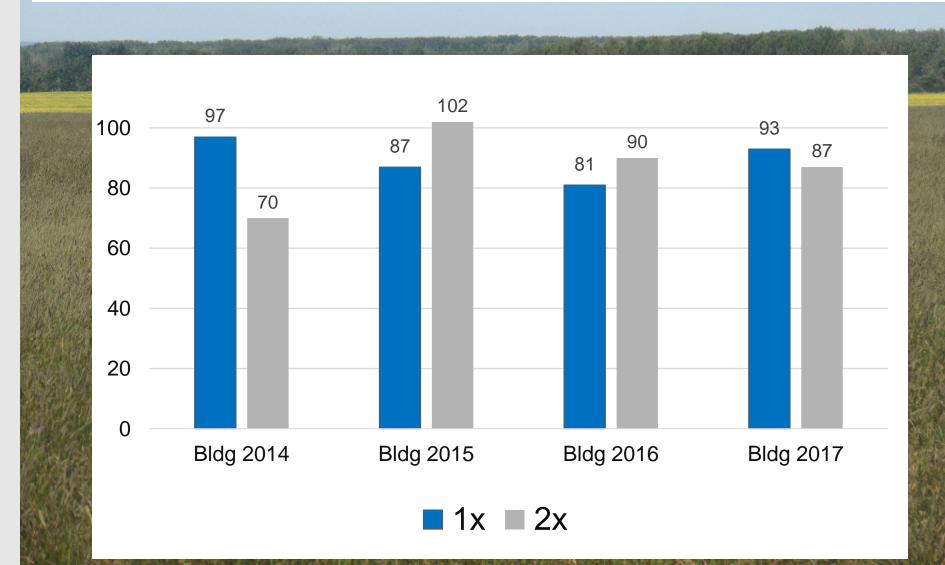
Nathan Logan, AAFC - Beaverlodge



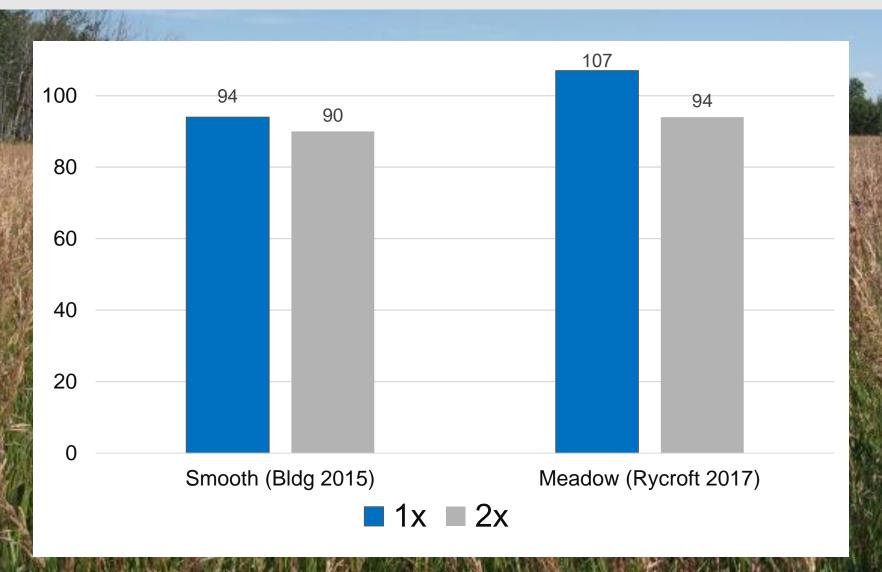




Tolerance of Established Timothy to Pixxaro (% of Check)



Tolerance of Established Bromegrass to Pixxaro (% of Check)



Established Crested Wheatgrass

Broadleaved Herbicides

Registered

Ally

Attain

Lontrel

MCPA

Prestige XC

Refine SG

Spectrum

2,4-D

Minor Use Submitted

Collecting Data

Potential Grassy Weed Herbicides

Achieve L



Weed Control With Several Herbicides Applied to Seedling Grass Seed Stands 2016 and 2017

Methods

- 2016 on seedling meadow bromegrass (Rycroft) and 2017 on seedling creeping red fescue (Hythe)
- Herbicides applied at 2-5 leaf stage
- Visual % weed control ratings taken 10 -14 DA-A and 30 DA-A
- Weeds: Volunteer canola, wild buckwheat, lamb's quarters, cleavers, hemp-nettle, narrow-leaved hawks'beard.
- Treatments
 - Check
 - Refine SG
 - Stellar
 - Enforcer M
 - Infinity + AS
 - Infinity FX
 - Infinity FX+MCPA ester
 - Pixxaro
 - Paradigm+MCPA ester

Update on Tolerance of Grass And Legume Seed Crops to Herbicides April 2019

Calvin Yoder, Forage Specialist Alberta Agriculture and Forestry Spirit River, AB Phone# (780) 864-3879 E-Mallealvin.yoder@gov.ab.ca

The following is information on tolerance of grass and legume seed crops to herbicides that are applied at the recommended rate used in cereal, oilseed or pulse crops. Please note the information provided is a summary of products registered under the Milnor Use Program and also products which show potential. The products that show potential are not registered. These products are currently being tested but results are limited at this point in time. The information is to be used as a goide only and is the information available at the time of printing. The authors involved in summarizing this information cannot be held responsible for publication errors or any consequences resulting from the use of this summary. Consult product labels for final detailed instruction before using any product.

User Requested Minor Use Label Expansion (URMULE)

The User Requested Minor Use Label Expansion system is designed to help producers register pest control products for which the volume of use and/or sales may not be sufficient to persuade a manufacturer to test, register and sell the product in Canada. Grower groups generally decide on what products would have potential for accountrolling pests in specific minor use crops. The product must be registered in Canada. Grower groups and government institutions generally conduct the tolerance trials. Once sufficient data is collected and the manufacturer agrees to place the crop on the label a URMULE is submitted. Once approved the crop is placed on the label as a "Minor Use Registration".

Note that companies will state on the label that the product is registered under the User Requested Minor Use Label Expansion and the company itself makes no representation or warranty with respect to product performance and crop tolerance. The buyer and user assume all risks related to the performance and crop tolerance on the minor use crop.

Herbicides on Creeping Red Fescue for Seed Production

SEEDLING (0-3 months after seeding)

Broadleaved Weed Herbicides		Grasty Weed Herbicides		
Minor Use Registered	Potendal	Minor Use Registered	Potential	
Attain	Curtail M	Achieve L	Axial*	
Banvel II (alone or	DyVef DS	Araute II	Horizon	
with 2,4-D or MCPA)	Enforcer M	Poast Ultra	Puma 120 Super	
Basagran	Promiline XL		-	
Buctrll M	Frontline 2,4-D			
Embulox 625**	Infinity FX			
Infinity	Paradigm			
Lontrel	Pixxaro			
MCPA	Stellar*			
Pardner	Target**			
Prestige XC	Trophy			
Retine SG				
Spectrum				
Turget**				
2,4-D				
Tropotox Plus				

Notes:

- Don not use Ally on seedling creening red fescue.
- Fall (September) applied 2.4-D of the seedling year can result in 25-50% yield loss the next year.
- Select, Everest, Simplicity and Velocity can cause extensive damage to seedling creeping red fescue and should not be recommended.
- Enforcer M, Paracigm, Pixxaro and Infinity PX have shown good tolerance on seedling creeping red fescure in trials conducted to date.

ESTABLISHED (spring applications)

Broadleaved Weed Herbicides		Grassy Weed Herbicides		
Minor Use Registered	Potential	Minor Use Registered	Potential	
Ally Attain Banvel II Banvel III Banvel III Infinity Lontrel MCPA Prostigo XC PP 23235 Spectrum 2,4-D Refine SG	Barricade Curtuil M Enforcer M Frontline XI. Paradigm Pixxaru Statlar* Travallis Trophy	Assure II AssureII+Refine SG Assure II: Ally Poast Ultra		

Notes

- Spring applications of 2,4-D or Benvel can sometimes cause injury to creeping red fescue.
- Some tank mixes of a broadleaf berbicide and Assure II may result in reduced grassy weed control.
- -Clethodim causes damage to established creeping red fascue and should not be recommended.
- Spring applications of quinclored on established creeping red feature have resulted in seed yield loss without visual damage.
- Equinox applied to sociding and established creeping red fescue causes significant damage.

3

^{*}Minor Use Proposal Submitted **Registered For Forage Production

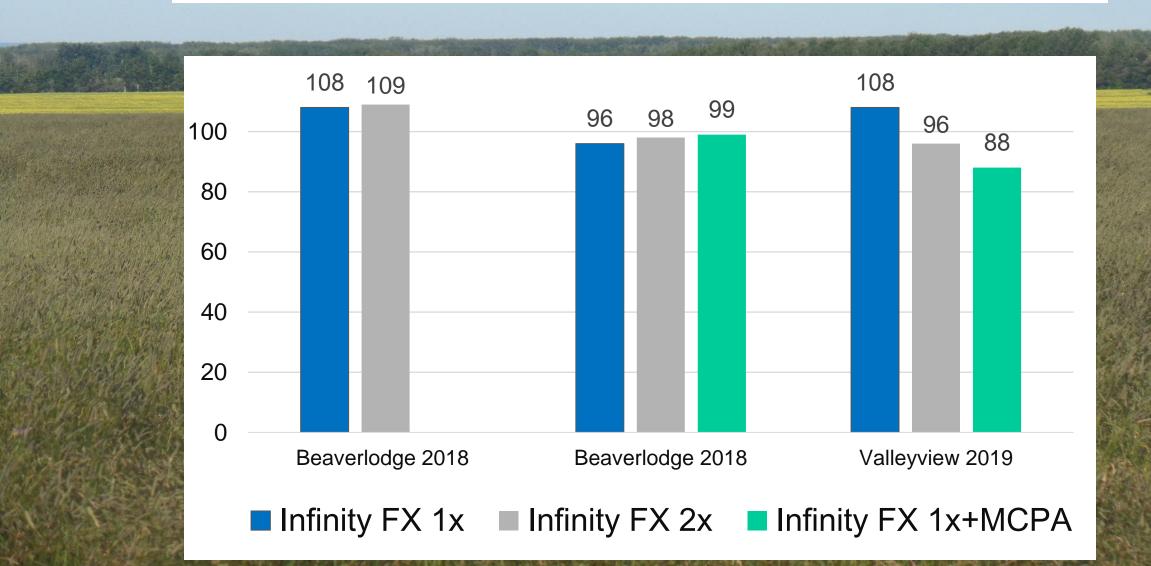
PRE-SEED Herbicide Options When Direct Seeding GRASSES Into Stubble Glyphosate alone MCPA or 2,4-D + Glyphosate PrePass XC URMLE on creeping red fescue, timothy, smooth bromegrass and meadow bromegrass. Submission made to add crested wheatgrass and meadow fescue.

- **Express SG+Glyphosate**
 - URMULE on creeping red fescue, timothy, smooth bromegrass and meadow bromegrass. Submission made to add crested wheatgrass, slender wheatgrass, meadow fescue, tall fescue and hybrid bromegrass.
- Heat/Heat LQ + Glyphosate
 - Minor Use Registration on Bromegrasses, timothy and creeping red fescue.
- HotShot (florasulam+bromoxynil)+glyphosate.
 - Has showed good potential prior to seeding grasses in trials to date.
- Goldwing (pyraflufan+MCPA ester)+glyphosate.
 - Has showed good potential prior to seeding grasses in trials to date.
- Tested Zidua (pyroxasulfone) applied prior to seeding grasses. Resulted in significant stand reduction.

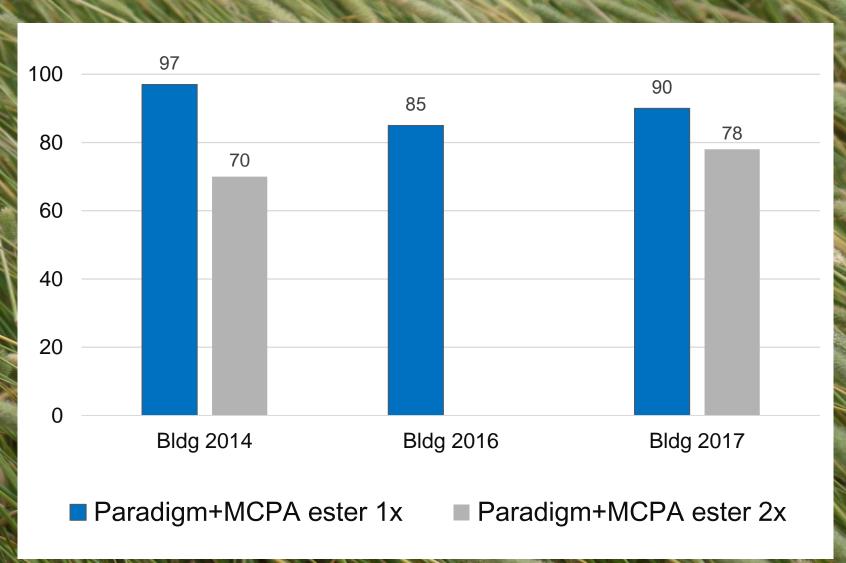
Visual Percent Control of RR CANOLA Following Applications of Herbicides Applied Prior to Seeding Grasses

And the second second					
Treatment	Webster 2014	Grimshaw 2010	Falher 2008	Baldonnel 2008	Blueberry 2004
Glyphosate	0	0	0	0	0
Heat+Glyphosate 1x	78	41	N/A	N/A	N/A
Heat+Glyphosate 2x	88	N/A	N/A	N/A	N/A
Expess+Glyphosate	69	65	80	90	63
MCPA ester+ Glyphosate 1x	81	64	85	88	63
Pre-Pass	95	95	93	100	98
2,4-D + Glyphosate	N/A	N/A	82	80	N/A
					The state of the s

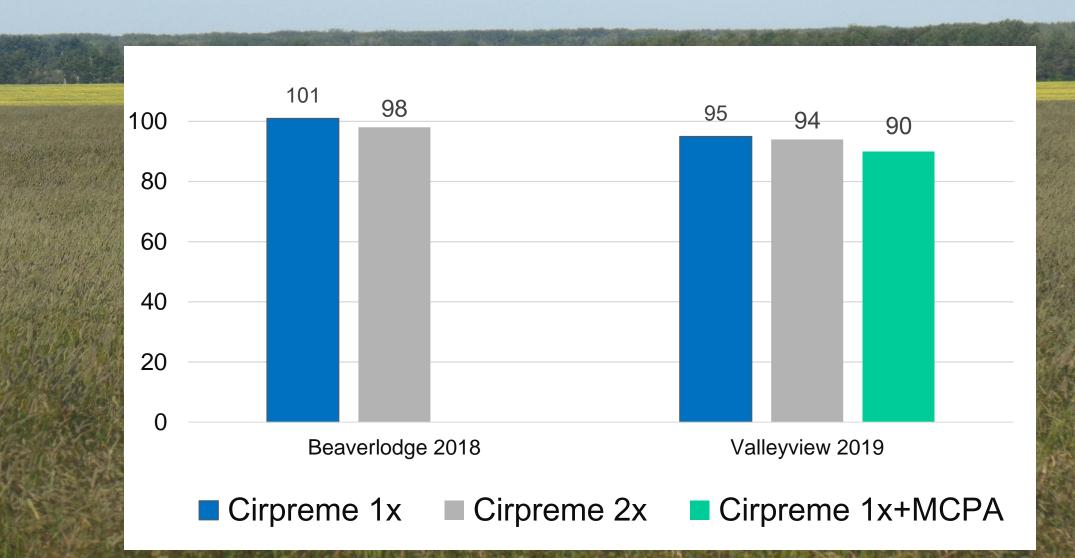
Tolerance of Established Timothy to Infinity FX and Infinity FX+MCPA (% of Check)



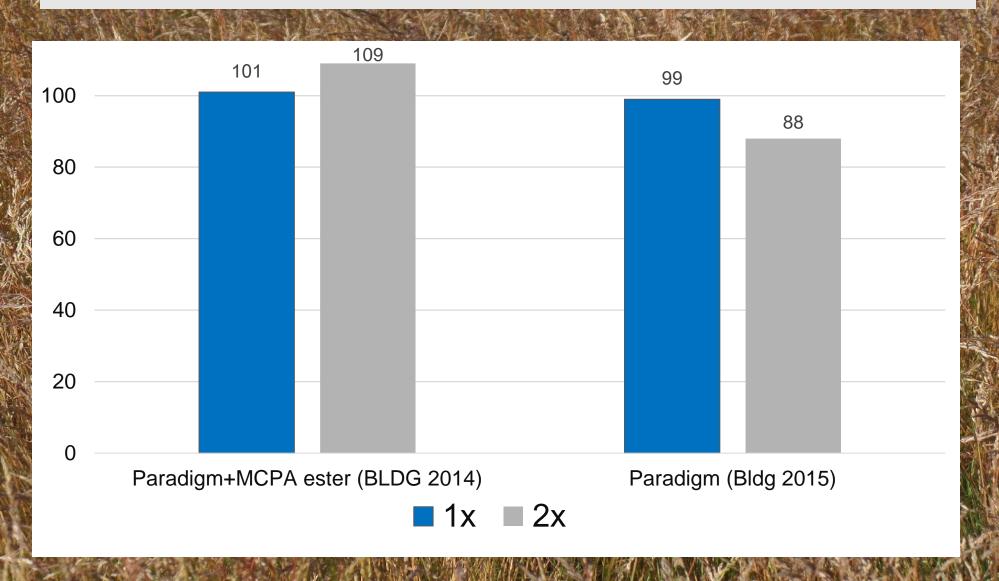
Tolerance of Established Timothy to Paradigm+MCPA (% of Check)



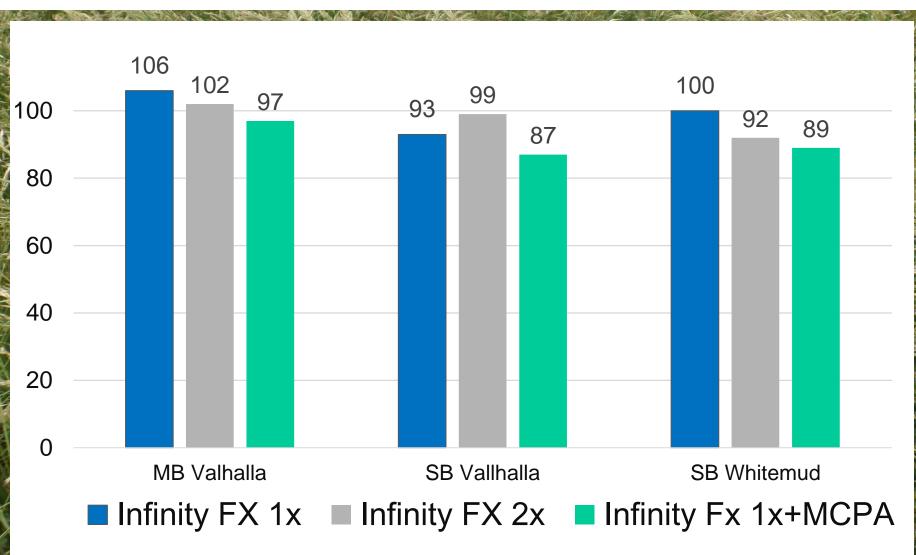
Tolerance of Established Timothy to Cirpreme XC (% of Check)



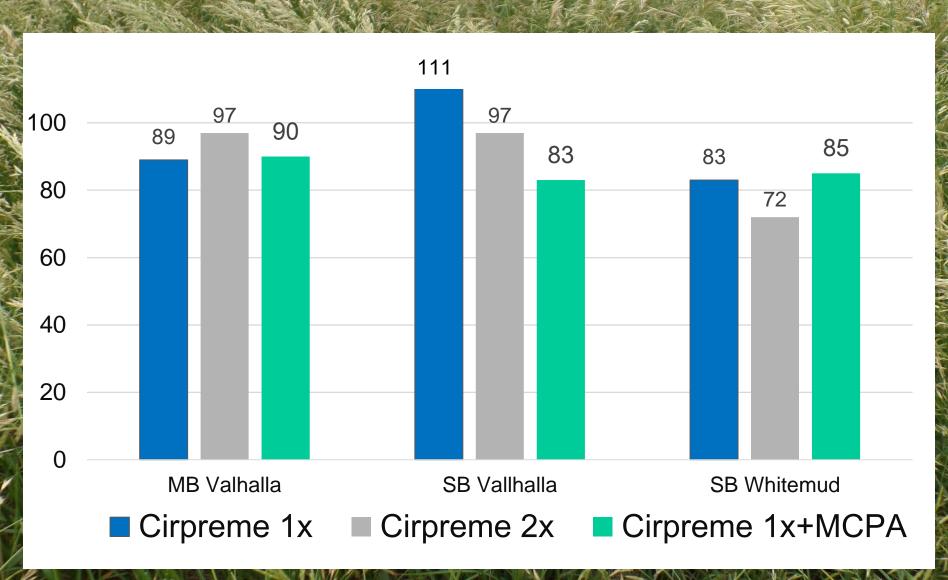
Tolerance of Established Smooth Bromegrass to Paradigm (% of Check)



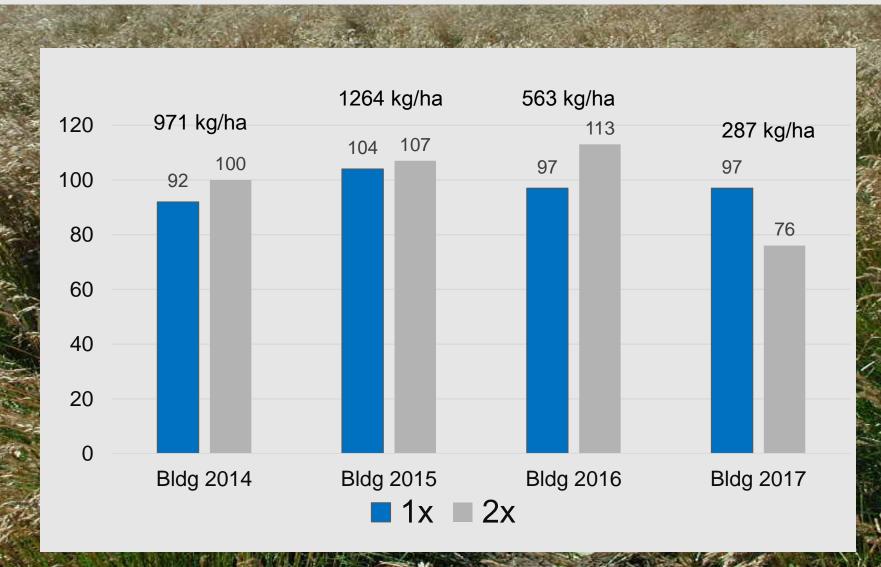
Tolerance of Established Bromegrasses to Infinity FX and Infinity FX+MCPA (% of Check)



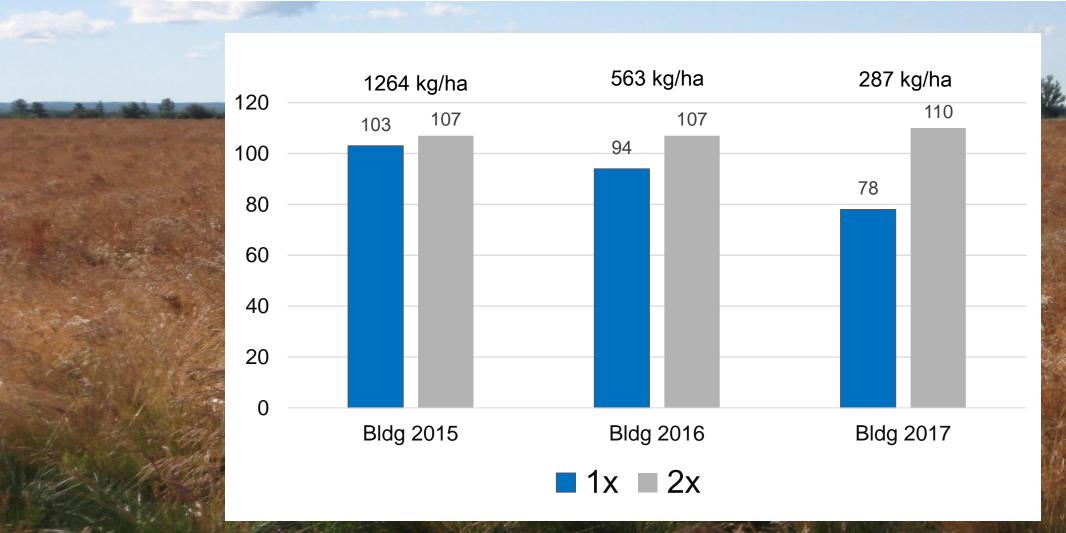
Tolerance of Established Bromegrasses to Cirpreme XC (% of Check), 2019



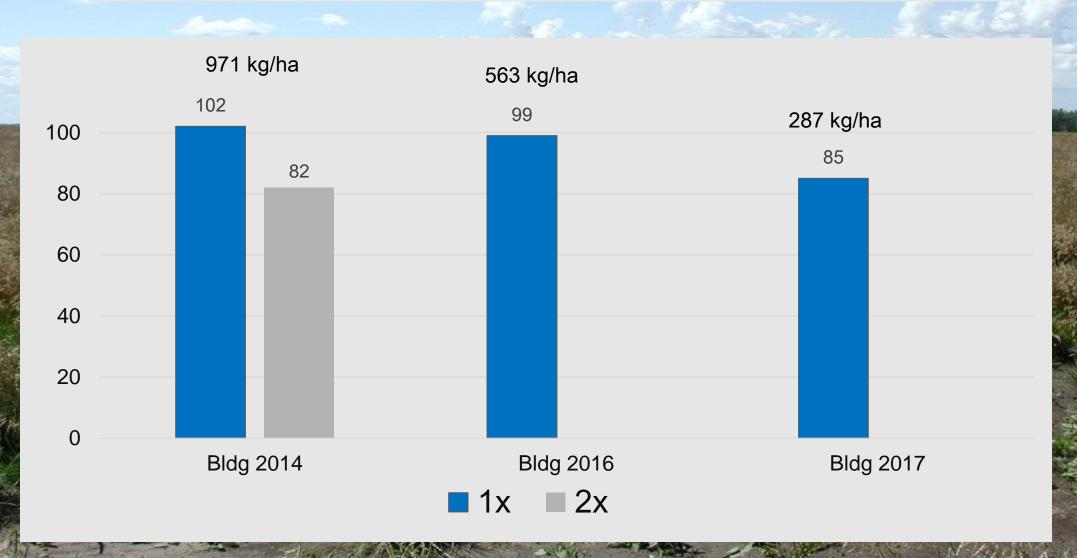
Tolerance of Established Creeping Red Fescue to Pixxaro (% of Check)



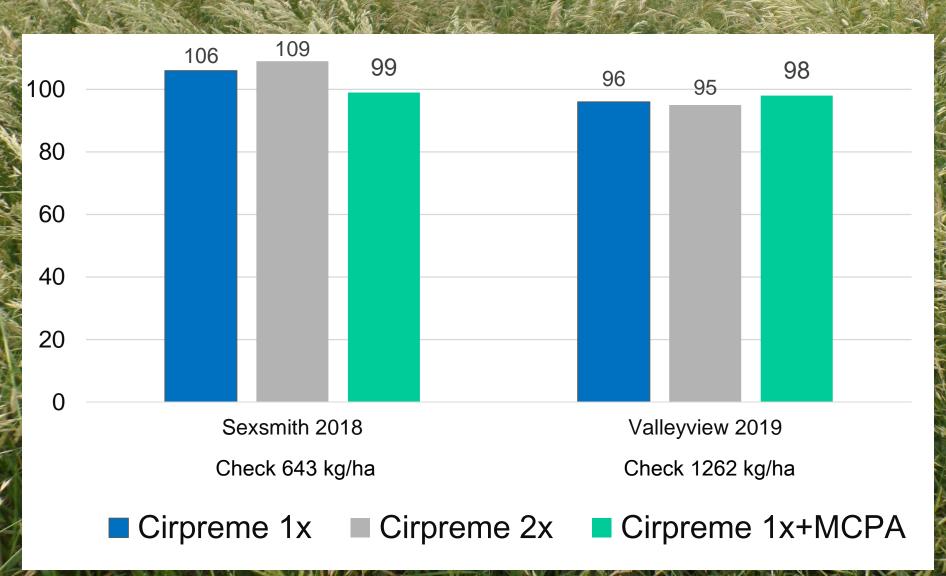
Tolerance of Established Creeping Red Fescue to Paradigm (% of Check)



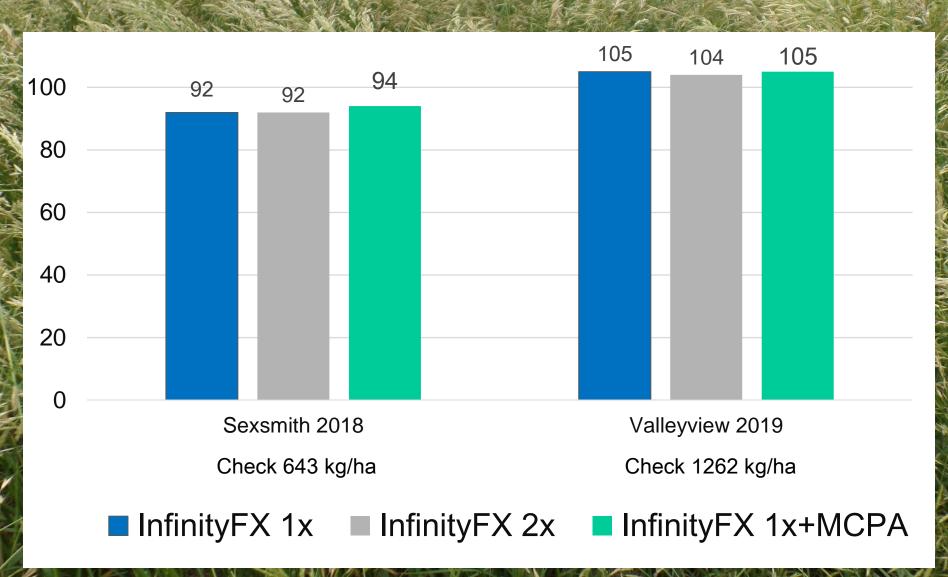
Tolerance of Established Creeping Red Fescue to Paradigm+MCPA (% of Check)



Tolerance of Creeping Red Fescue to Cirpreme XC (% of Check)



Tolerance of Creeping Red Fescue to Infinity FX (% of Check)

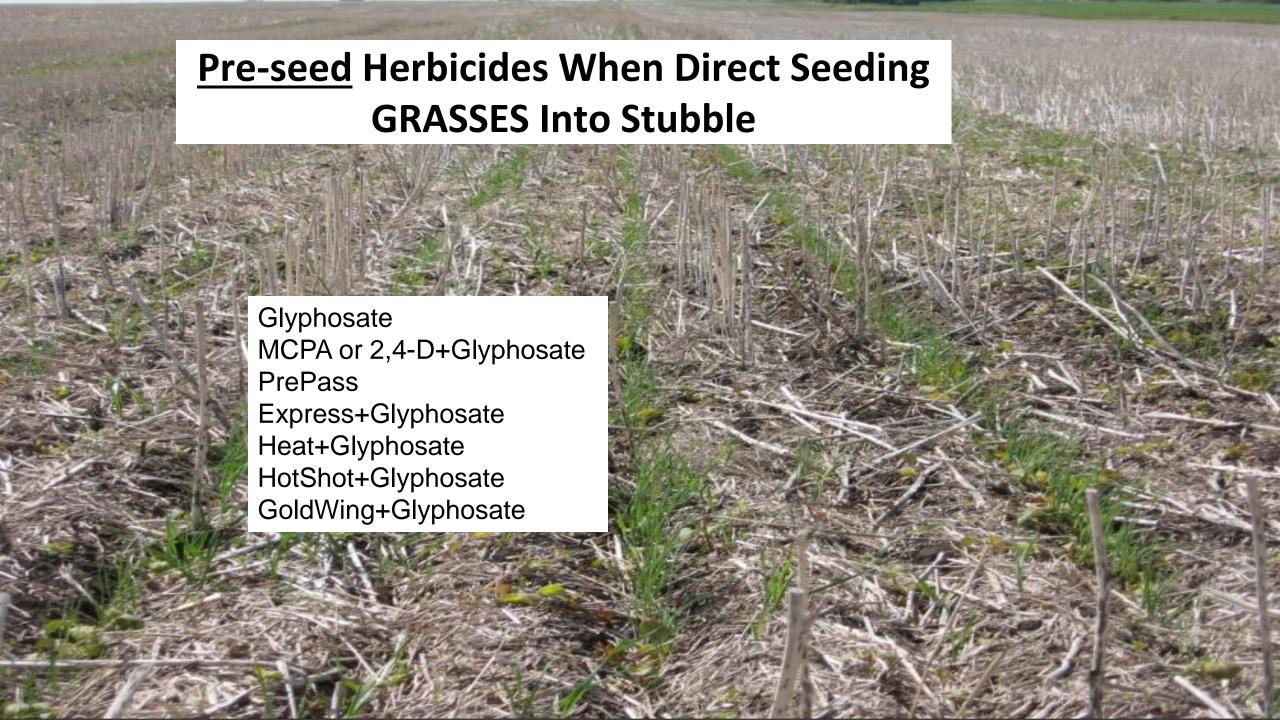






SUMMARY TO DATE ON WEED CONTROL IN SEEDLING GRASS SEED STANDS

- All products tested to date are generally decent and have good control of annual weeds.
- Infinity FX and Infinity FX+MCPA ester show good activity on a wide range of annual weeds. Works quickly on weeds but some weeds do out grow some of the initial damage. May also see some leaf burn on seedling grasses but they outgrow it quickly.
- Stellar is a nice option. If PrePass was used prior to seeding may want to consider herbicides without florasulam.
- Infinity FX, Stellar, Paradigm+MCPA ester and Pixxaro quite good on cleavers. Paradigm and Pixxaro also good on big cleavers.
- Long term fescue growers should avoid Refine SG on seedling stands.
 Consider other herbicides without Group 2 actives eg. Group 2 resistant NLHB
- If horsetail is present consider herbicides containing MCPA ester.



Herbicide Tolerance Trials and Minor Use Process

Identify Potential Products and Weed Issues

Priorize List With AB, Sask and Manitoba

Conduct Tolerance Trials

Submit Reports to PPMUC

Minor Use Submitted

Product Approved

Residue Data

Minor Use Priority Setting Meeting in Ottawa

AAFC Pest Management Centre

Trials Conducted

Minor Use Submitted

Product Approved

Add Additional Species

Broadleaf Herbicides on SEEDLING Grasses

Minor Use Applications Submitted

- Stellar 2018 (8 grass species)

- MCPA ester*
- Lontrel*
- Buctril M*
- Attain*
- Curtail M
- Prestige XC*
- Refine SG (CRF only)
- Infinity*
- * URMURL

Data Has Been Collected

- Paradigm (halauxifen/florasulam) +MCPA ester on 7 grasses
- Pixxaro (halauxifen/fluroxypyr/MCPA) on 7 grasses
- Enforcer M on 7 grasses
- Infinity FX and Infinity FX+MCPA ester on 7 grasses

Selected Minor Use Priority (AAFC)

- Enforcer M on Smooth bromegrass (2016)
- Pixxaro on Timothy (2017)
- Cirpreme XC on Timothy (2019)
- Cirpreme XC on Bromegrass (2020)
- Cirpreme XC on Creeping Red Fescue (2020)

Herbicide Tolerance Trials on Established Grass Seed Crops

- Apply 1 and 2 x recommended rate used in annual crops
- Small plot replicated trials
- Collect seed yield, 1000 kwt and germination.
- Usually need a minimum of 3-4 trials to submit for a minor use registration
- Co-ordinate trials and data with Sask. and Manitoba



Fall Weed Control on Grass Seed Stands

- Dandelions, clovers, narrow-leaved hawks'beard, winter annuals, Canada thistle?.

Fall Applied Herbicides

- Ally timothy and creeping red fescue.
- Prestige XC
- Curtail M
- Spectrum (no longer available)
- Cirpreme XC+MCPA ester???

Herbicide options and weed control ratings for fall spraying of creeping red fescue seed fields.

Herbicide	NLHB**	NLHB** (group 2 resistant)	Volunteer Clover	Dandelion	Canada Thistle	Rough Cinquefoil
Curtail M	Excellent	Excellent	Excellent	Poor	Poor to Fair	Excellent
Prestige	Excellent	Excellent	Excellent	Fair	Poor to Fair	Excellent
Spectrum	Excellent	Good	Excellent	Very Good	Poor to Fair	Fair
Ally	Excellent	Poor	Very Good	Excellent	Poor	Poor

^{*}E=Excellent G=Good F=Fair P=Poor

^{**}narrow-leaved hawks'beard

Visual % Control of Dandelions and Clovers Following Fall Applied Herbicides – Whitemud 2018/19

TREATMENT	DANDELIONS	ALSIKE CLOVER
Prestige	50	100
Spectrum	100	100
Cirpreme+MCPA	100	100
Ally	100	100
Curtail M	42	100
Check	0	0

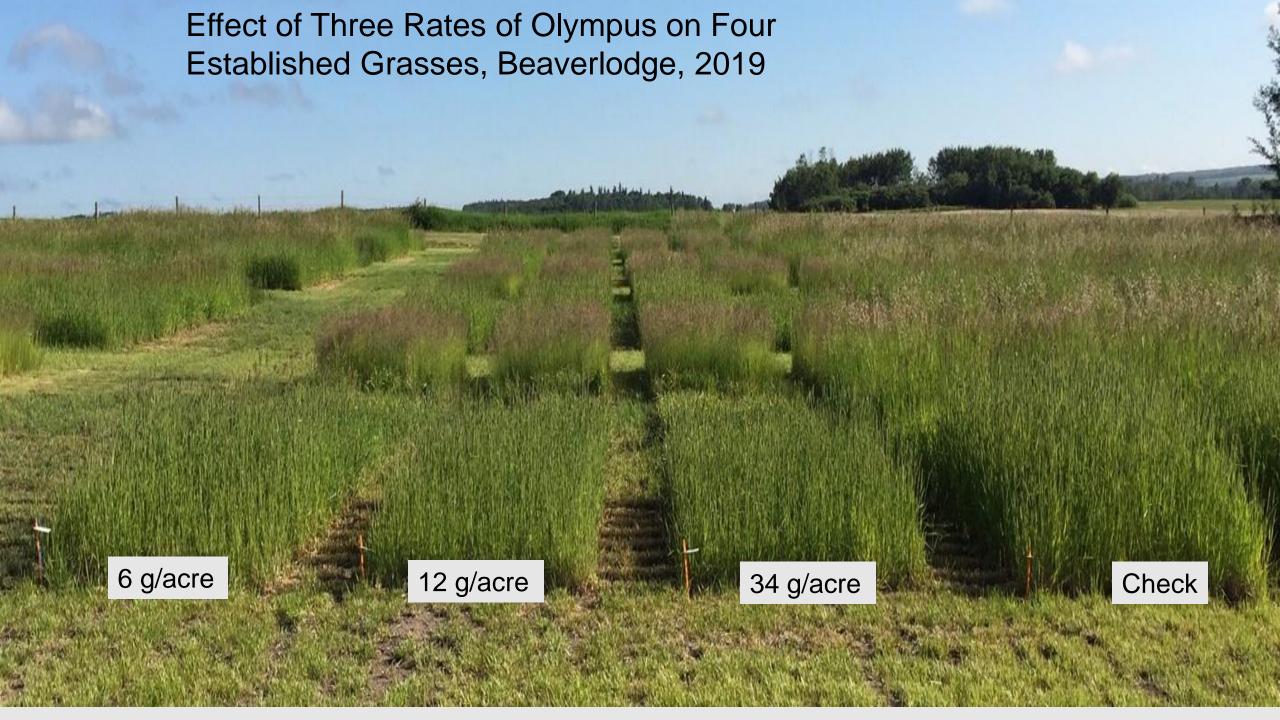
Effects of Olympus on Four ESTABLISHED Grasses-Beaverlodge 2019

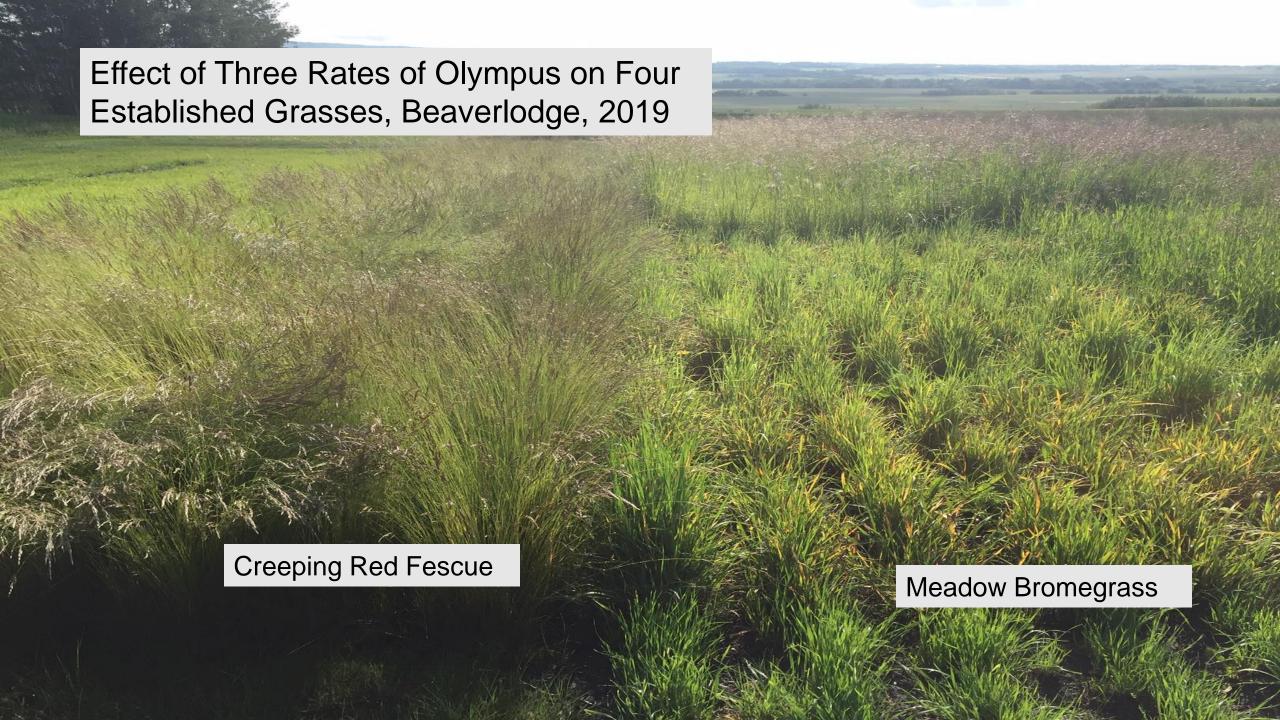
Olympus

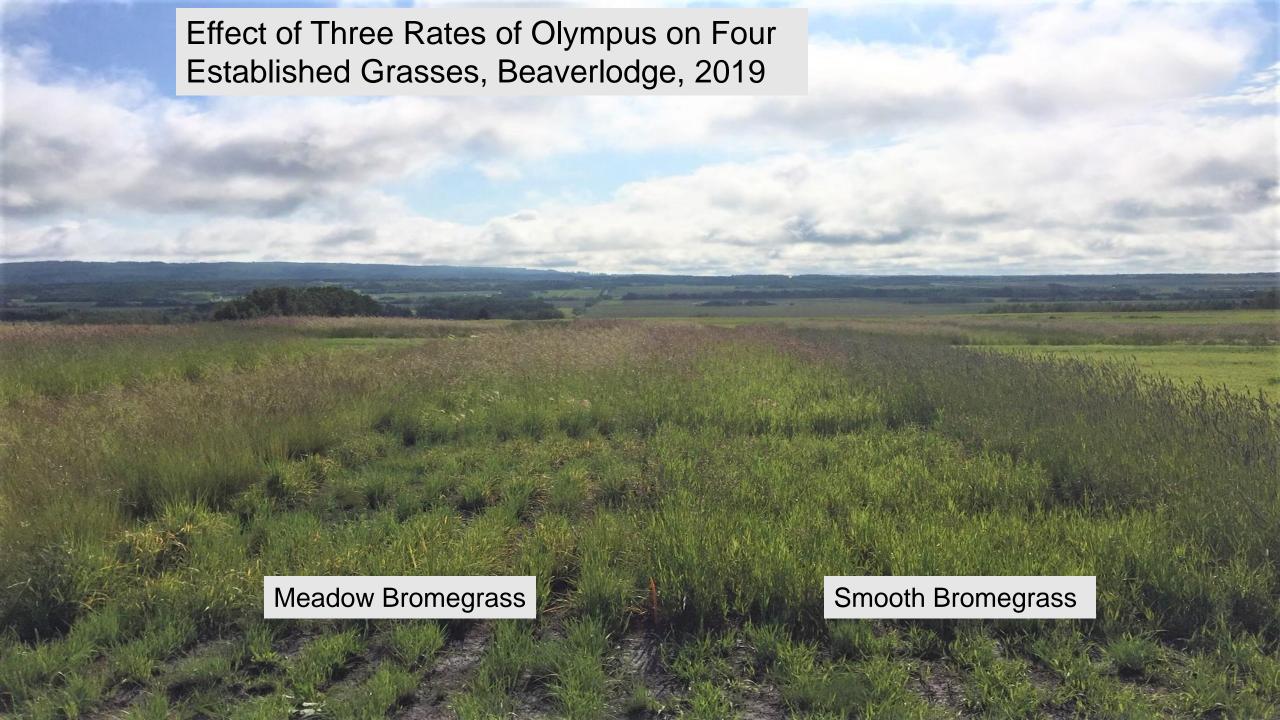
- A.I. herbicide propoxycarbazone-sodium (Bayer Crop Sciences)
- Registered with glyphosate as a pre-seed herbicide prior to seeding wheat.
- 6 g/acre and has some residual activity on flushing foxtail barley, Japanese brome, downy brome, wildoats and volunteer canola.
- Registered in the U.S. on rangeland, pasture and CRP programs for some grassy and broadleaved weed control at 30 or 34 g/acre.
- Registered in the U.S. on spring wheat at 17 to 25 g/acre.

2019 Screening Trials

- ESTABLISHED GRASSES 6, 12 and 34 g/acre sprayed on May 22
- across creeping red fescue, meadow bromegrass, smooth bromegrass and timothy. Visual injury ratings, seed and forage yield collected.
- PRE-SEED GRASSES 6 and 12 g/acre sprayed prior to seeding creeping red fescue, meadow bromegrass, smooth bromegrass and timothy. Visual % stand reduction ratings.



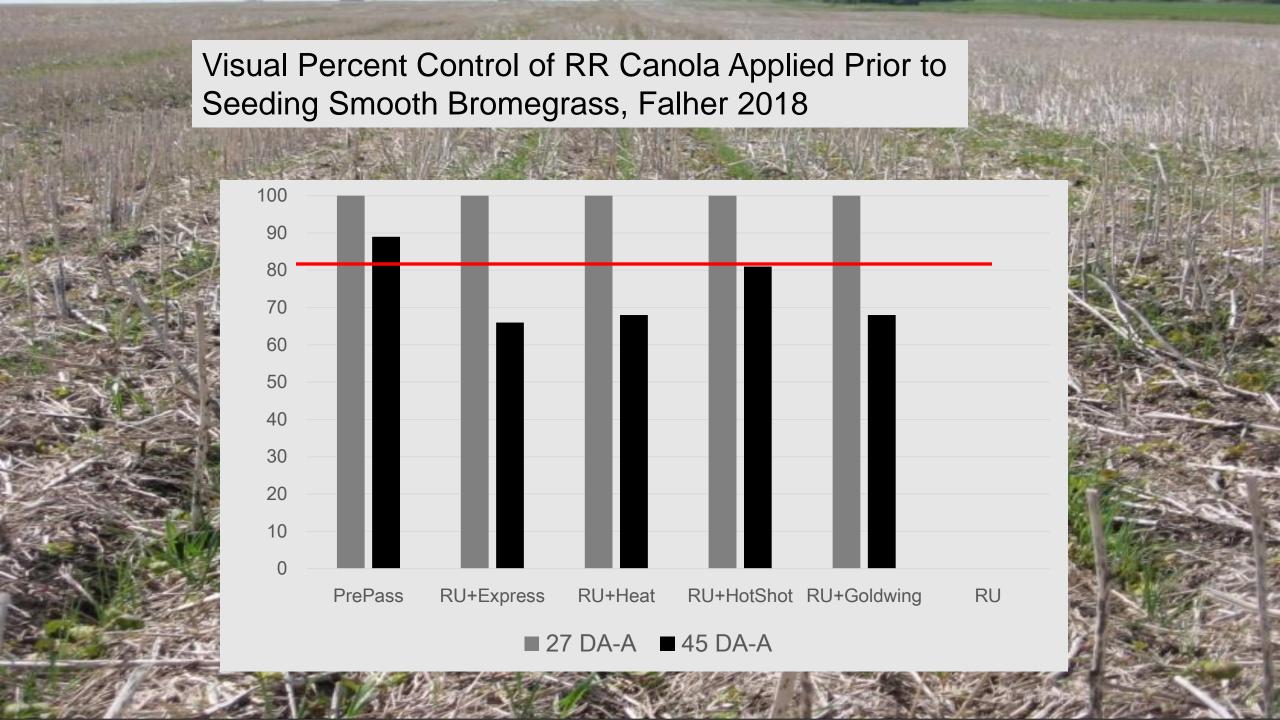




Seed and dry matter yields (kg/ha) following a spring application of Olympus to established creeping red fescue and timothy, Beaverlodge 2019.

	Creeping R	Red Fescue	Timothy		
	Seed	Dry Matter	Seed	Dry Matter	
6 g/acre	674	5158	358 a*	4658 b	
12 g/acre	675	4999	298 b	4040 b	
34 g/acre	677	5475	253 b	4182 b	
Check	720	5198	405 a	5655 a	
LSD P=.05	NSD	NSD	59.4	627	
CV%	20.3	5.7	11.3	8.5	

^{*}Means followed by the same letter do not significantly differ (P=.05, Student-Newmans-Keuls



Herbicides Prior to Seeding Grasses.

	PrePass XC	Express + Glyphosate	Heat+ Glyphosate	HotShot+ Glyphosate	GoldWing+ Glyphosate
Creeping Red Fescue	X	X	X	XXX	XXX
Timothy	X	X	X	XXX	XXX
Meadow Bromegrass	X	X	X	XXX	XXX
Smooth Bromegrass	X	X	X	XXX	XXX
Crested Whetagrass	XX	XX		XXX	XXX
Slender Wheatgrass	XX	XX		XXX	XXX
Meadow Fescue		XX		XXX	XXX
Hybrid Bromegrass		XX			
Tall Fescue		XX			
Perennial Ryegrass					

X - URMULE
XX-URMULE Submitted
XXX- Data Collected and Potential For URMULE

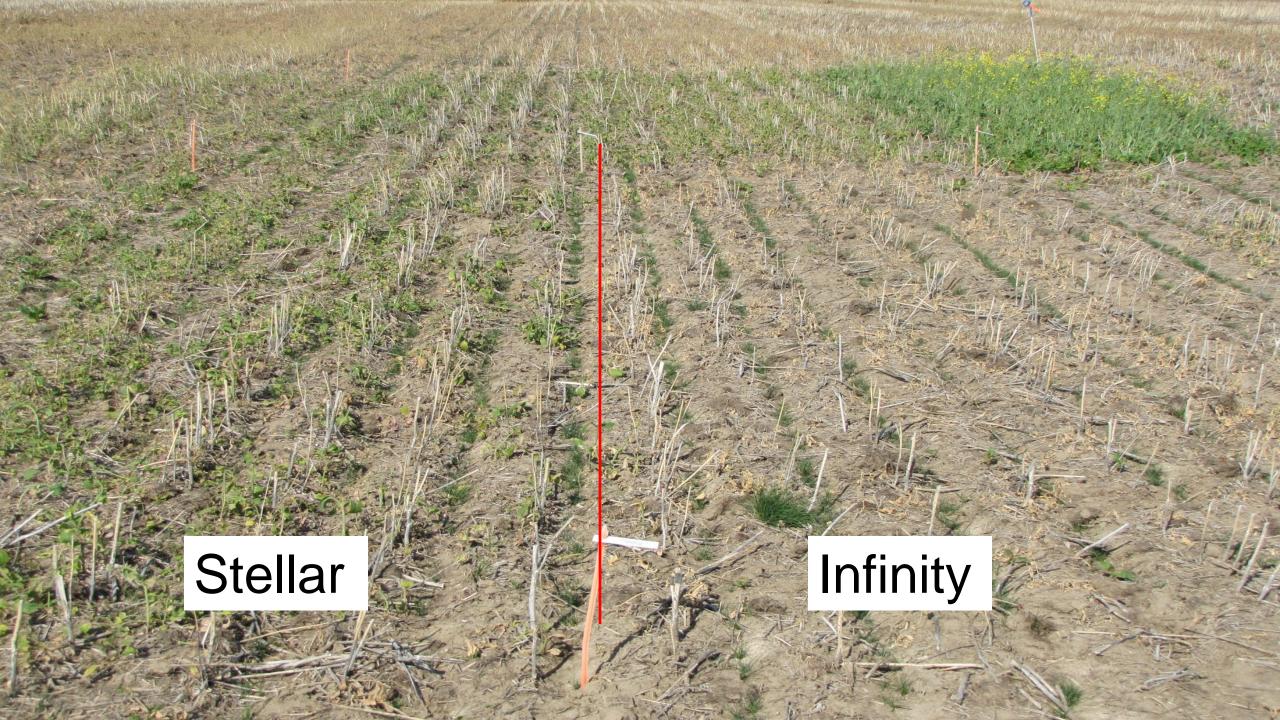
Broadleaf Herbicides on SEEDLING Grasses



Broadleaf Herbicides on Seedling Grasses.

	Infinity	Stellar	Enforcer M	Infinity FX (alone or with MCPA)	Pixxaro	Paradigm+ (alone or with MCPA)
Creeping Red Fescue	X	XX	XXX	XXX	XXX	XXX
Timothy	Χ	XX	XXX	XXX	XXX	XXX
Meadow Bromegrass	X	XX	XXX	XXX	XXX	XXX
Smooth Bromegrass	X	XX	XX	XXX	XXX	XXX
Crested Wheatgrass	X	XX	XXX	XXX	XXX	XXX
Slender Wheatgrass	XX	XX	XXX	XXX	XXX	XXX
Meadow Fescue	XX	XX	XXX	XXX	XXX	XXX
Hybrid Bromegrass	XX	XX				
Tall Fescue	XX	XX				
Perennial Ryegrass	X	XX				

X - URMULE
XX-URMULE Submitted
XXX- Data Collected and Potential For URMULE





GRASSY Weed Herbicides on SEEDLING Grasses

Creeping Red Fescue

- Achieve Liquid*
- Assure II*
- Poast Ultra*
- Horizon
- Axial**
- Puma

Bromegrasses

- Achieve Liquid*
- Puma*
- Axial**

Wheatgrasses - Achieve Liquid*

Perennial Ryegrass

- Puma Advance*

Tall Fescue

- Puma*

Meadow Fescue

- Puma

Timothy

Puma*

- Nothing

*URMULE Submitted