Exploring Novel Ways to Manage Downy Brome

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REACCH
Regional Approaches to Climate Change
Pacific Northwest Agriculture

What is Downy Brome?

An annual bunchgrass that germinates in autumn and flowers in the spring

It typically reaches 40–90 centimeters tall

With an average of 300 seeds per plant

It is a cleistogamous plant

Seeds are dispersed to various locations

Valliant et al. 2007. Mack et al. 2007. Novak et al. 2007

The Issue

Difficult to manage because:

- Grows in all sort of crop rotations and farm management
- Difficult to get rid of once it settles to an area
- Known to reduce crop yield up to 92% in winter wheat
- Adapts to changes in resource availability and environment, and interferes with the growth of other established plants

Limited herbicide mode of actions that are specific to brome that will not kill grass crops, i.e. wheat

The herbicide Beyond is the best way to control downy brome

Project Importance

To address how dormancy scenarios can be manipulated to ensure effective management and rotation based on weed biology, rather than herbicides.

Research Question(s)

Diversity in dormancy scenario makes it challenging to determine emergence timing.

1. Can we alter the timing of germination or inhibit it all together?
2. Is there a practice and inhibitor that will prevent the brome seed from germinating?

Can we alter the timing of germination or inhibit it all together?

Nevin Lawrence developed a Growing Degree Day model that looks at diversity and estimates maturity based on climate

Population collected from PNW

Amber Hauvermale became interested in the differences in seed dormancy

- Across PNW
- Within field locations

Screened Nevins' core collection and Jonathan Witkops' collection from 8 locations

Can we alter the timing of germination or inhibit it all together?

My project(s):

- Creating developmental stages for brome
- Hormone screening of Nevin and Amber’s collections for seed dormancy

Two novel experiments:

- Plant hormone
- Seed fungicide

Background on GA Signaling

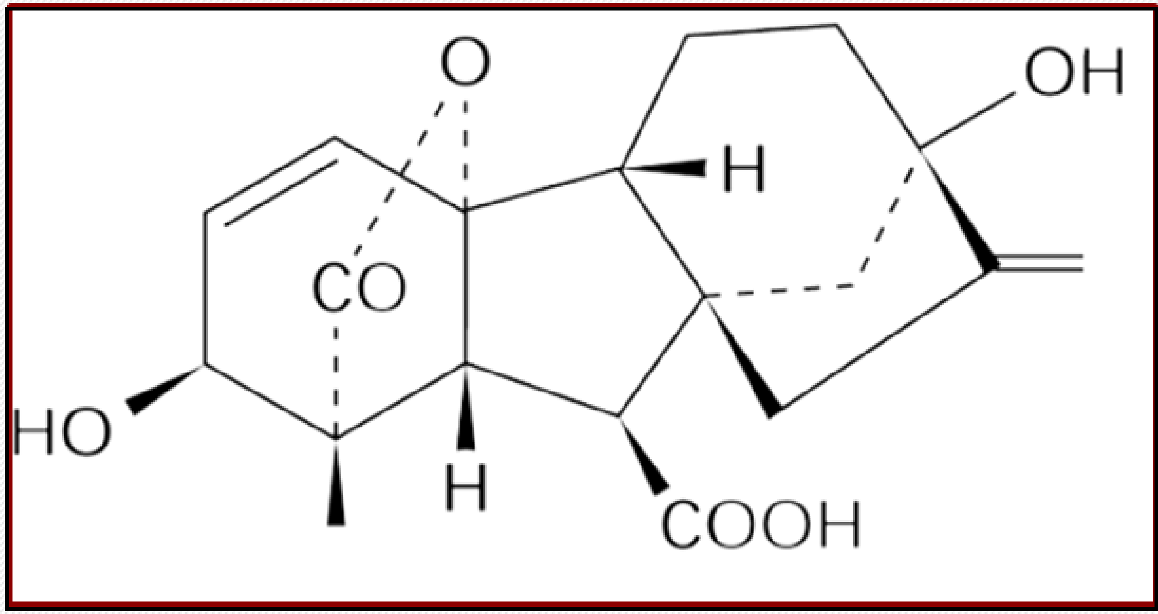
Seed dormancy:

- Inability for a seed to germinate, even in favorable conditions

Gibberellin is a plant hormone

Important for:

- Breaking seed dormancy
- Germination
- Cell Elongation
- Flowering
- Fertility

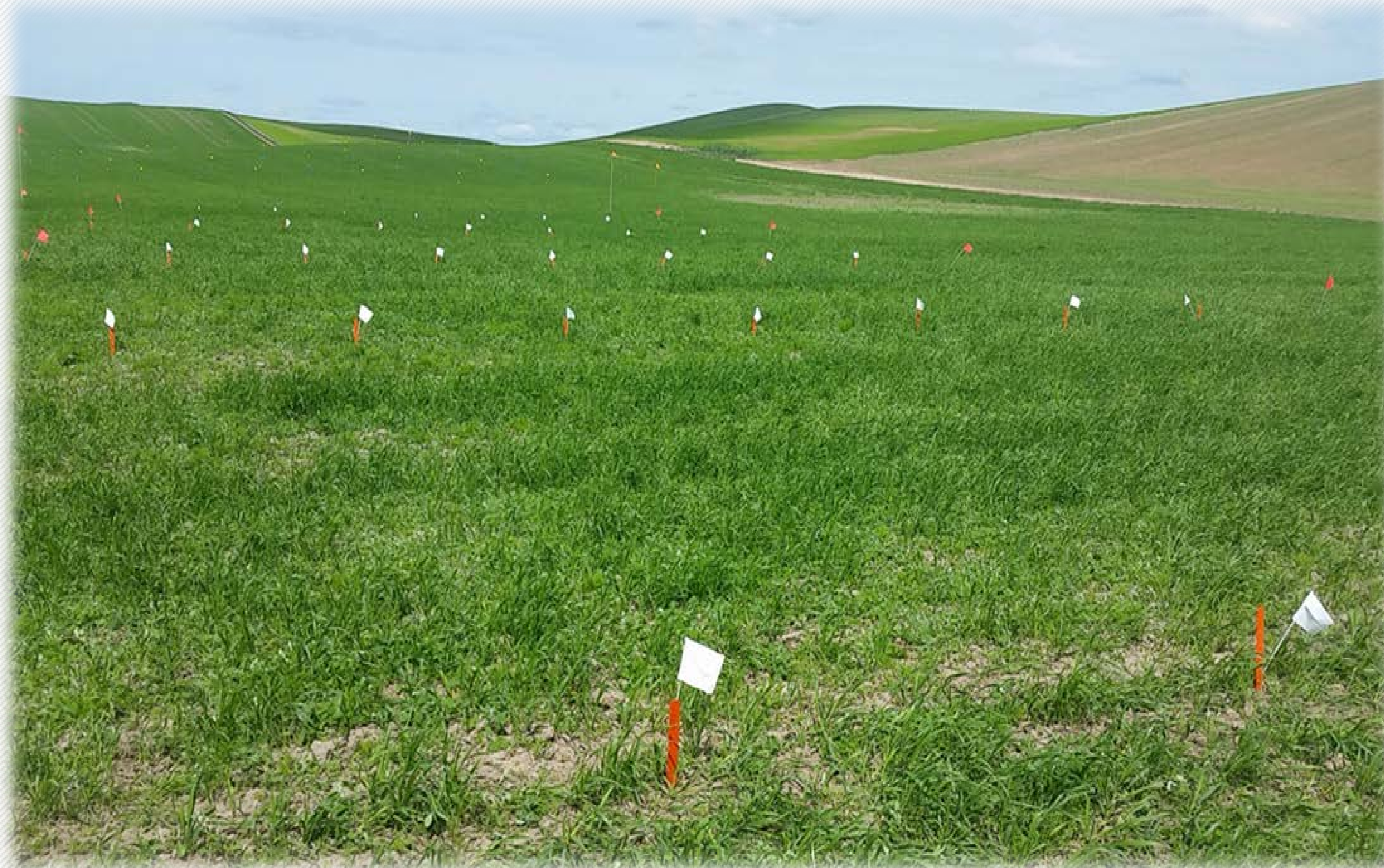


Silva et al. 2013. Rodrigues et al. 2013.

Hormone screens showed brome response to GA and there are at least five dormancy scenarios

Greenhouse and Field Experiments

Will GA stimulate seed germination?



HCL001 Greenhouse Experiment

We planted downy brome seed in 52 cone containers

Sprayed soil with GA

- Six different concentrations

No increase emergence

Based on results, we wanted to know effect on vegetative tissue

HCL002 Field Study

Using a log boom

The log sprays GA solution at different concentrations throughout whole plot

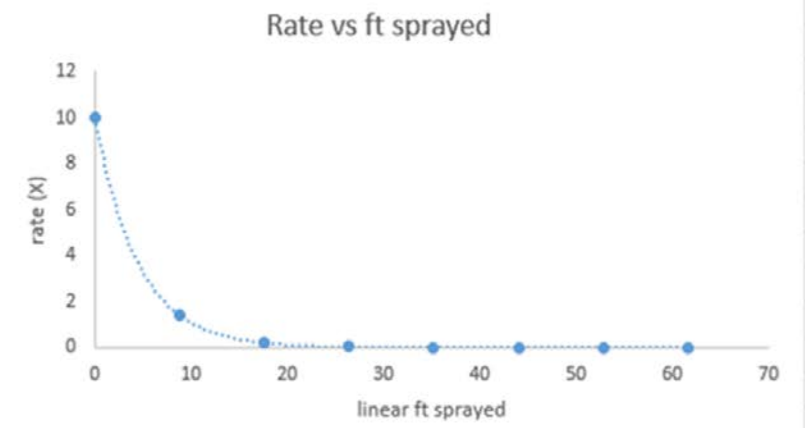
Looking at various concentrations of Gibberellin

Logarithmic boom excel spreadsheet

Initial Concentration C(0)	100							
volume of mix chamber (ml)	39							
Number of nozzles	4							
nozzle spacing (inches)	20							
mph	3							
gpa	15							
rate (X)	10	1.407694	0.19816	0.027895	0.003927	0.000553	7.78E-05	1.1E-05
seconds sprayed	0	2	4	6	8	10	12	14
linear ft sprayed	0	8.8	17.6	26.4	35.2	44	52.8	61.6
actual concentration in chamber (%)	100	14.07694	1.981603	0.278949	0.039268	0.005528	0.000778	0.00011
log of Concentration in chamber (C)	2	1.148508	0.297017	-0.55447	-1.40597	-2.25746	-3.10895	-3.96044
Volume of Flow (V) in ml	0	76.46465	152.9293	229.3939	305.8586	382.3232	458.7879	535.2525

Sprayer Calibration	
gpm	0.151515
ml/15 sec per nozzle	143.3712
ml/sec	9.558081
log e	0.434294

seconds sprayed	5.68
actual concentration (ml/L)	0.381057
log of Concentration in chamber (C)	-0.41901
Volume of Flow (V) in ml	217.2291
Enter ft to calculate Rate @ ft	25
Rate (X) @ ft given above	0.038106



GA concentrations throughout plots

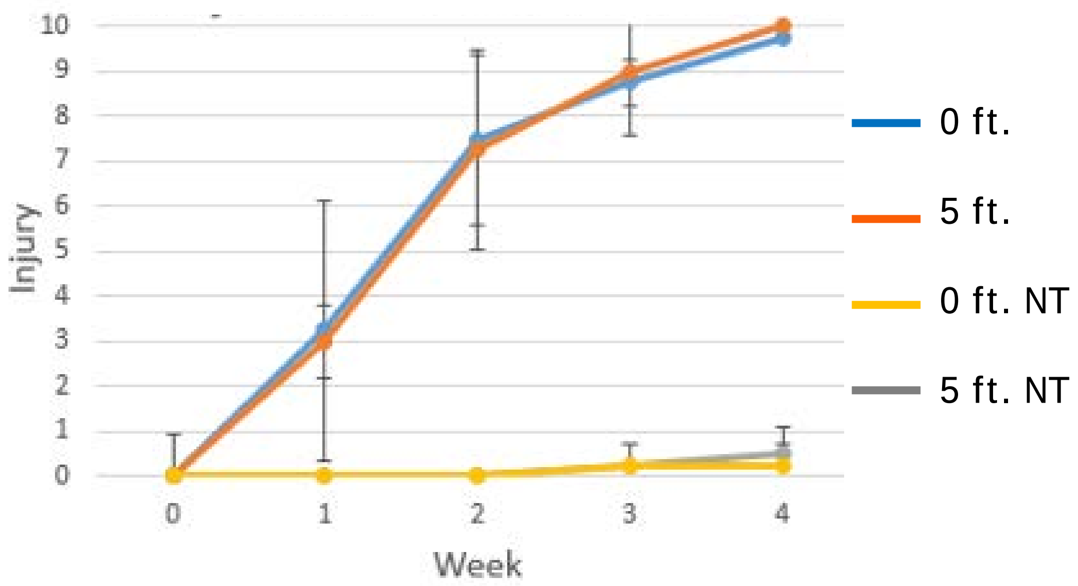
18 ft.: concentration ex: 4.97 mM of Gibberellin

10 ft.: concentration ex: 5.46 mM of Gibberellin

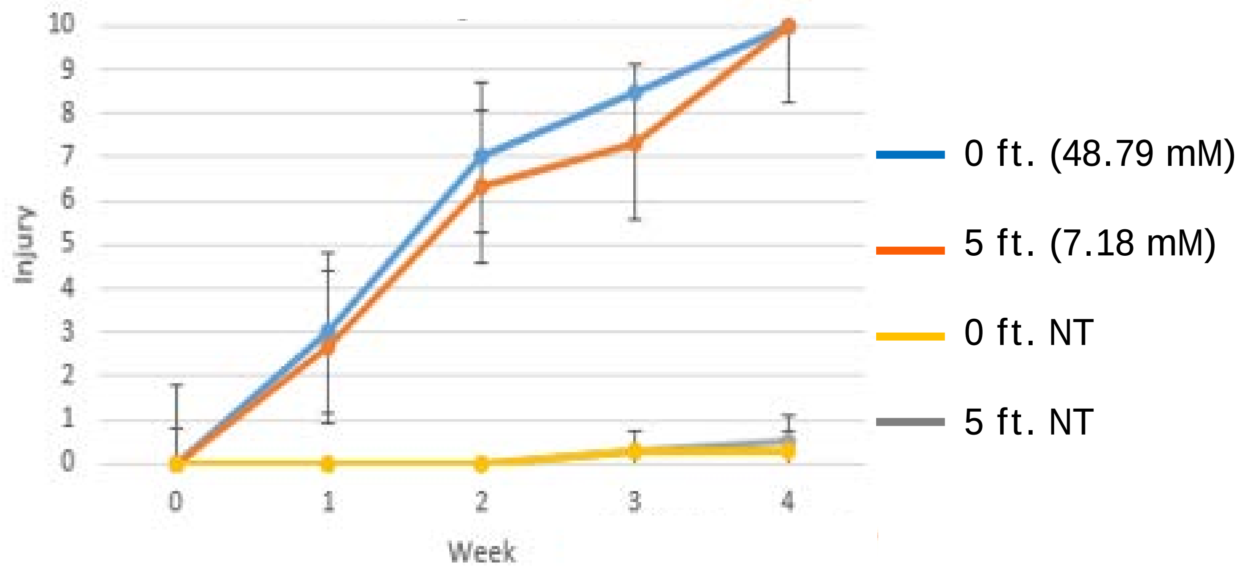
5 ft.: concentration ex: 7.18 mM of Gibberellin

0 ft.: concentration ex: 48.79 mM of Gibberellin

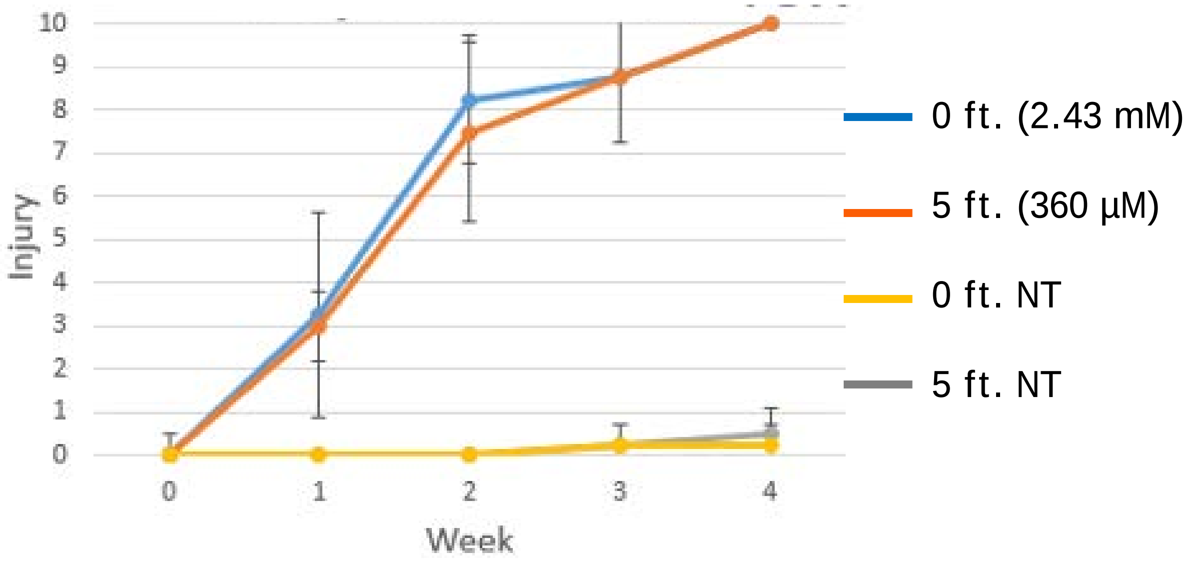
Effects of Beyond



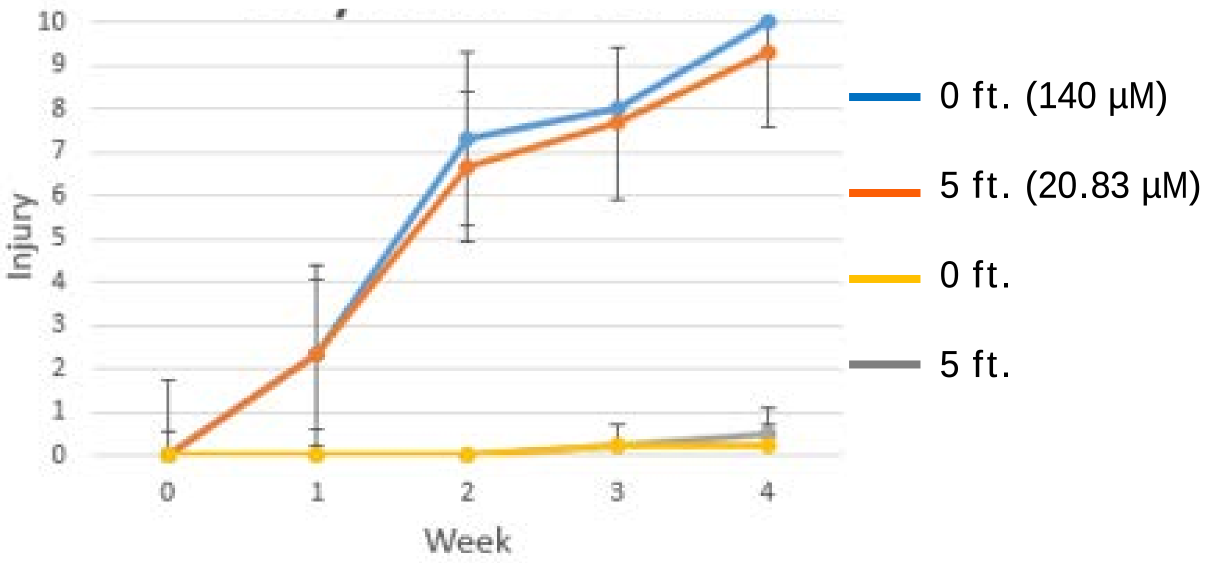
Effects of Beyond + GA



Effects of Beyond + GA



Effects of Beyond + GA



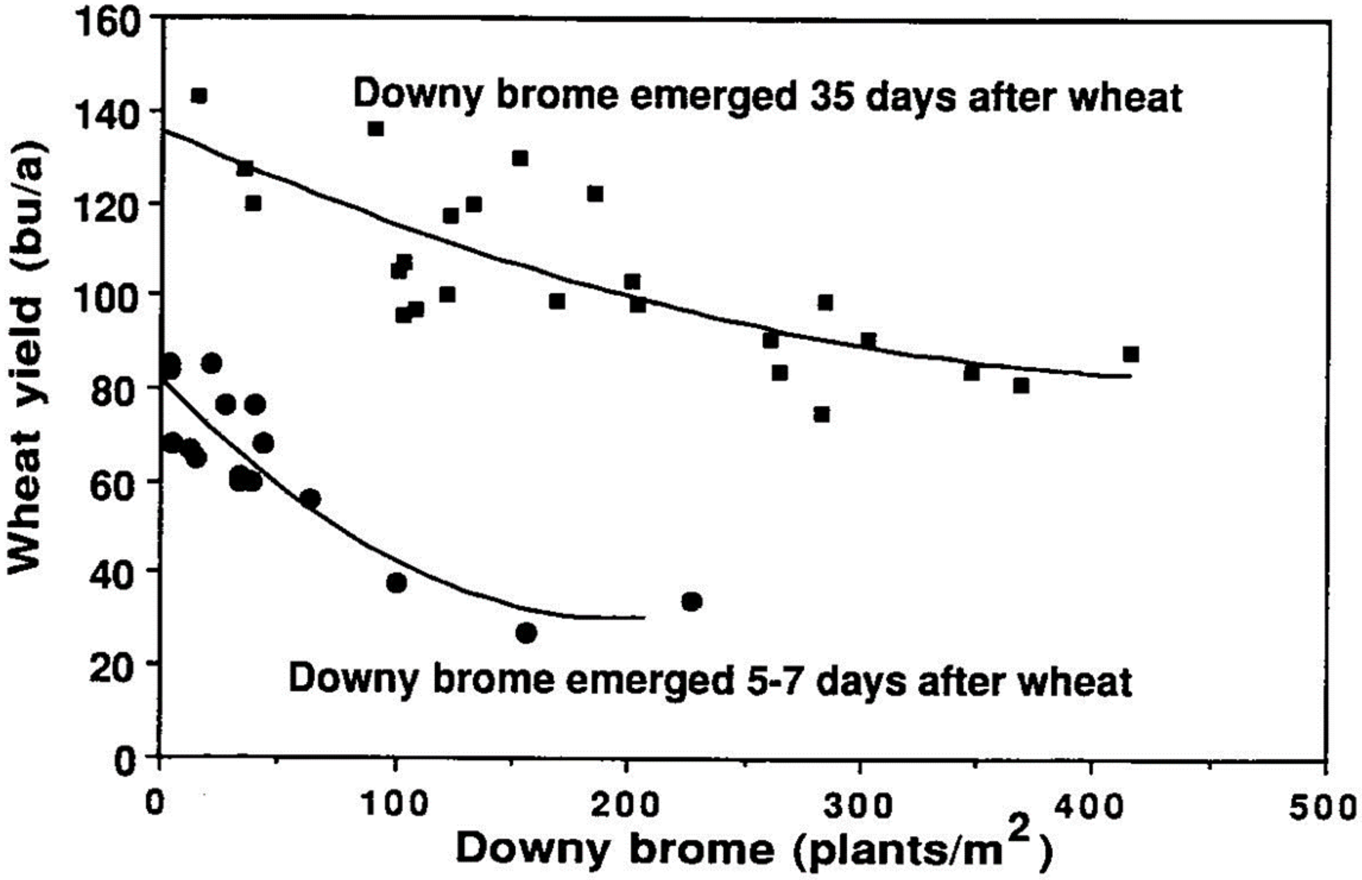
Conclusion

There might be some effect of adding GA from comparing weeks 1 and 2

GA acted as an antagonist with Beyond

Future work will to be to look at field studies with high brome infestations

Another Way to Alter Germination Timing



- Emerging at 5-7 days after wheat, brome causes a considerable amount of % drop in crop yield
- Emergence after 35 days, crop yield still dropped

Accidental Discovery of Novel Application

- Observation from Amber Hauvermale that Cruiser Maxx inhibits seed germination
- Cruiser Maxx used on brome seed for preparation in common garden
- Fungicide produced by Syngenta

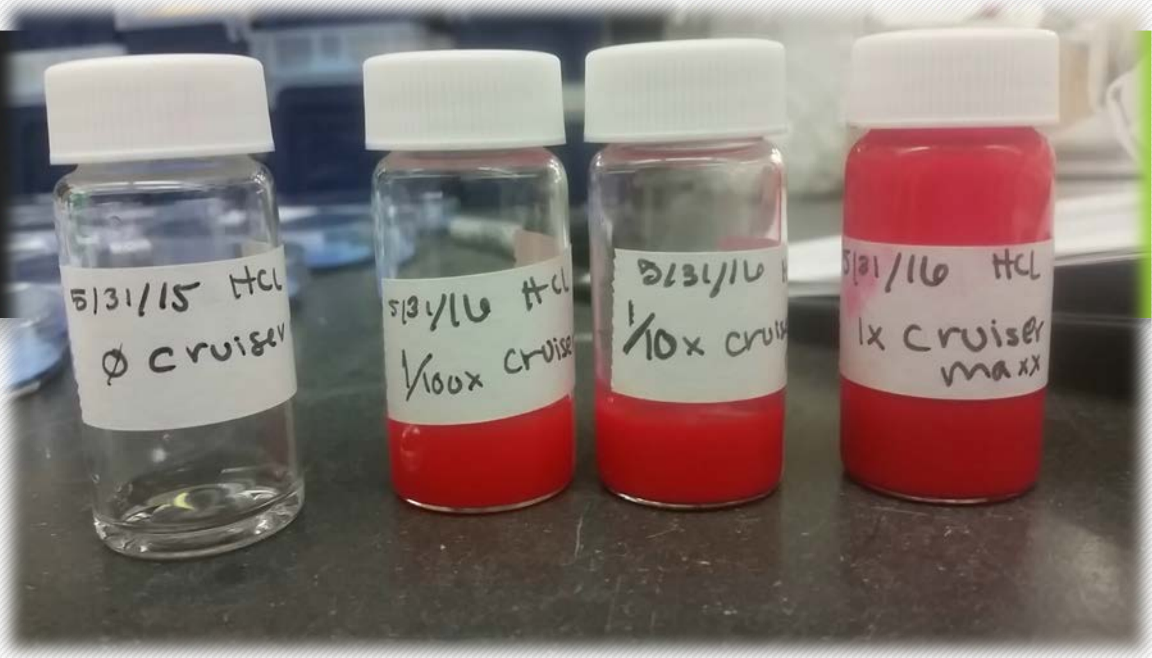
Cruiser Maxx protects seeds against:

- Certain early season insects
- Seed-borne diseases
- Soil-borne diseases

Active ingredients:

- Thiamethoxam
- Fludioxonil
- Mefenoxam

Bin Application

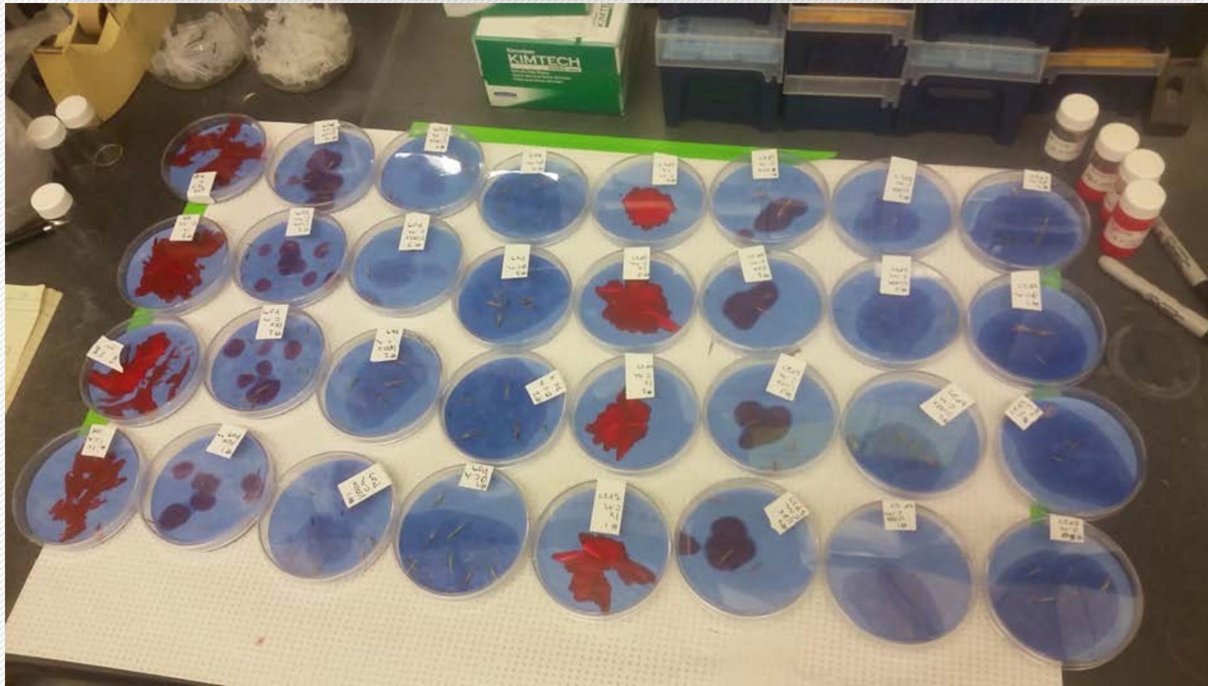


Three different dilutions and one control

- 1-2 ml added to the seeds
- 10 seeds from Pomeroy
- 5 seeds from Sprague
- 16 bags total

Adding 20 ml of water to each bag every other day to assure a consistent “rain fall”

Scoring seed germination daily for 2 weeks



Field Application

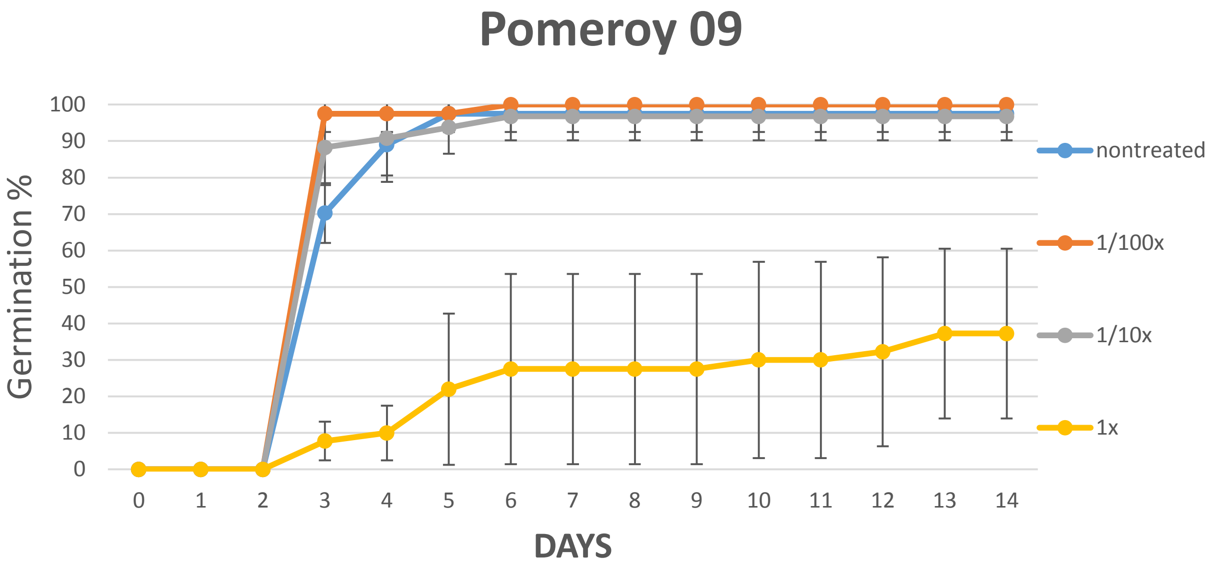
Based on farm practices and applications

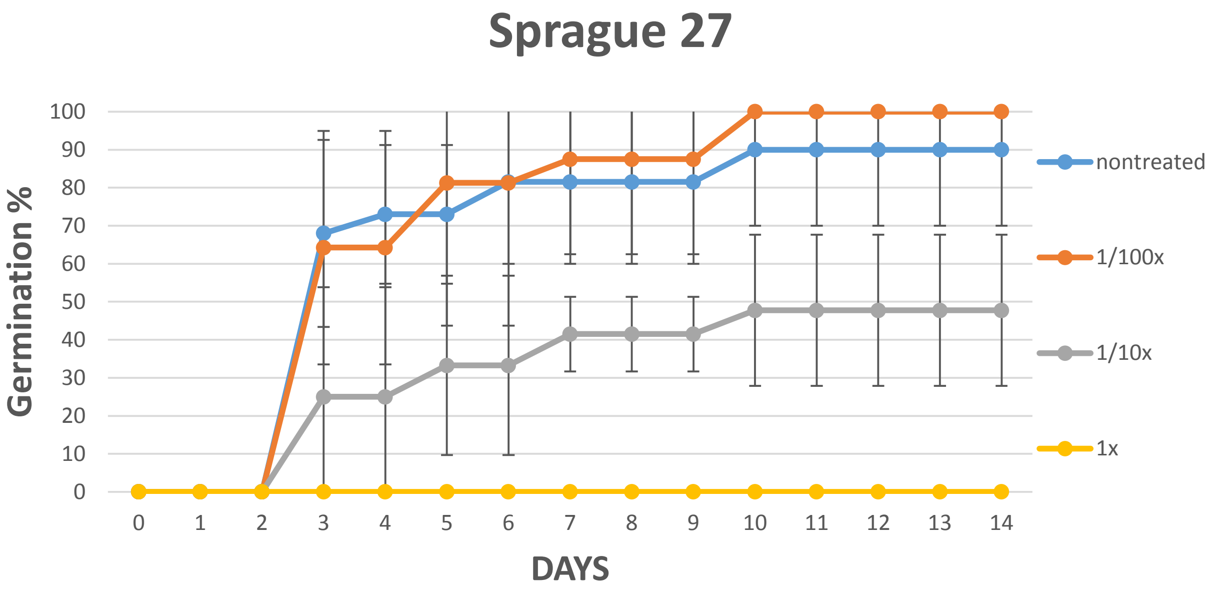
- 1 ml of dilutions to strip of germination bag
- Seeds from various brome locations
- Other grass seeds
- 16 bags total

Adding 20 ml of water to each bag every other day to assure a consistent “rain fall”

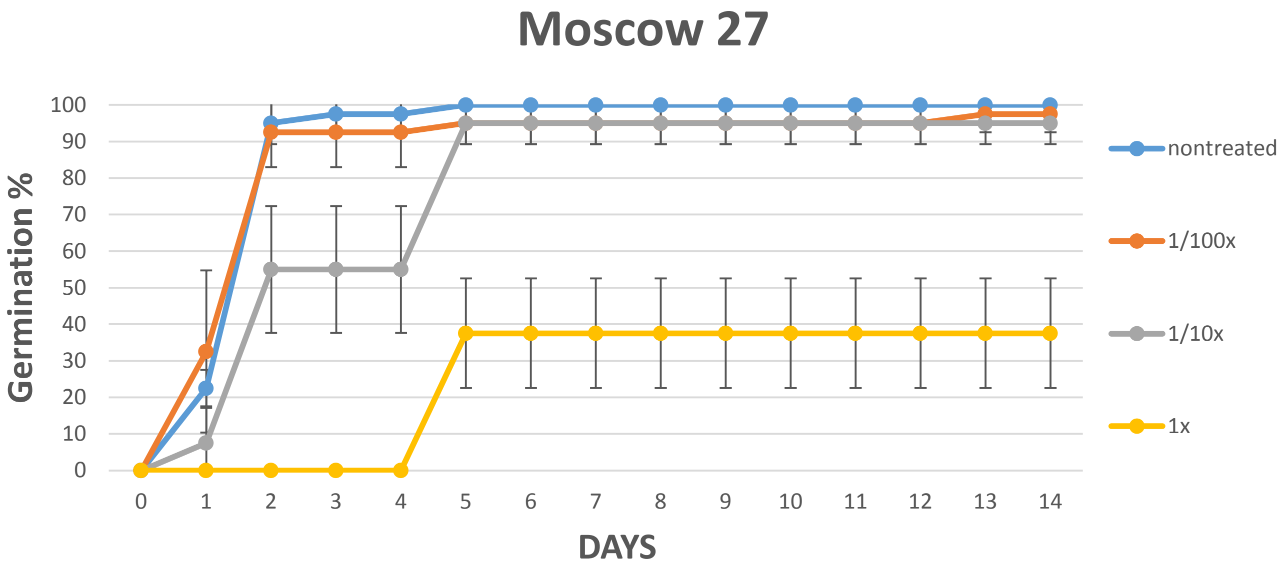
Scoring seed germination daily for 2 weeks


Bin Application

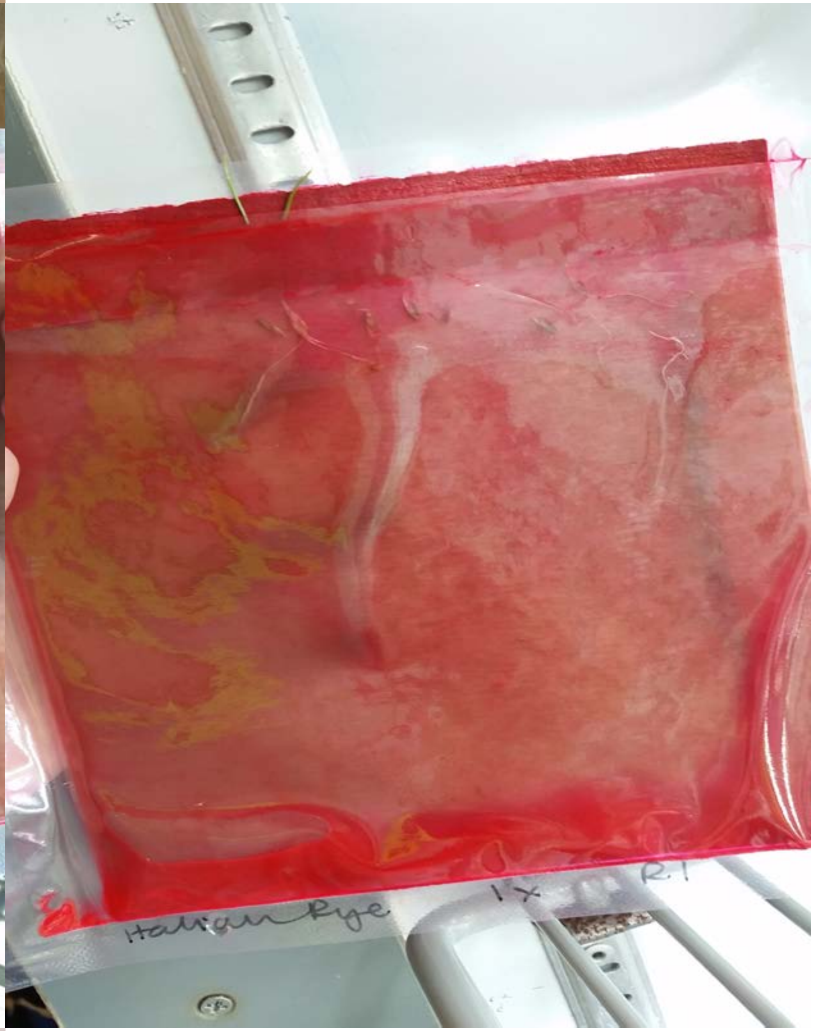


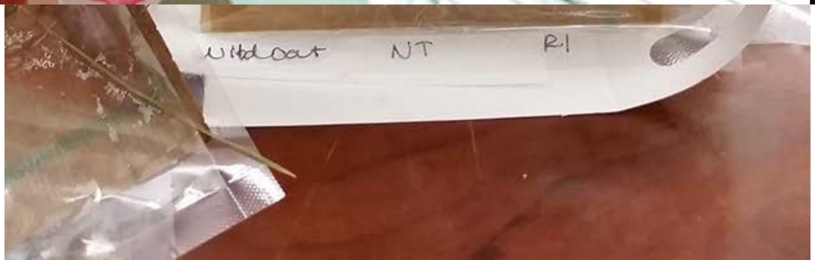


Field Application




R4


Italian Rye
1x
R1


Wildoat
NT
R1

Conclusion

Cruiser Maxx acts as inhibiter for seed germination in brome and select grasses tested

Seeds germination is delayed

Roots and leaves are stunted

Severity of inhibition depends on application method

Future work will address feasibility in the field

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