The Potential for Pyraflufen-ethyl to Selectively Control ALS-Resistant Kochia (*Kochia scoparia*) in Lentil (*Lens culinaris* Medik)

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PLSC 494.6

Background

- Herbicide resistant weeds are increasing
  - 252 weed species documented globally
  - 478 unique cases (species x site of action)

(Heap 2017)

- Herbicide resistant weeds are a challenge in lentil (*Lens culinaris* Medik) production

Lentils in Saskatchewan

- 84% of Canada's lentil production in 2016 (Statistics Canada 2016)
- Lentil is a poor competitor (Fedoruk and Shirtliffe 2011)
- Few in-crop herbicide options
  - Clearfield® varieties released in 2006
- ALS- and glyphosate-resistant kochia (*Kochia scoparia*) (Beckie et al. 2013)

PPO Inhibitors

- Group 14 Herbicides
- Few resistant weeds (Li et al. 2003)
- Light requirement (Zimdahl 2007)
- Rapid Activity
- Fluthiacet-methyl (Cadet® in US)
  - Not registered in Canada due to issues that need resolving with the US EPA (Johnson 2016, Pers. Comm.
- Pyraflufen-ethyl (Blackhawk®, Goldwing®) (SMA 2016; PMRA 2016)

Objectives

- Determine if lentil and ALS-resistant kochia response to pyraflufen-ethyl is similar to fluthiacet-methyl

- Determine the ability of lentil to regrow from below-ground nodes when sprayed with pyraflufen-ethyl

Materials and Methods

Lentil Varieties: CDC Improve and CDC Maxim

Weed: ALS-resistant kochia

Herbicides: Pyraflufen-ethyl (EC), Fluthiacet-methyl (SC)

- **Lentil:** 3-above ground nodes
- **Kochia:** 3.5cm in diameter

Rate: 0, .56, 1.13, 2.25, 4.5, 9, 18, 36, 72, 144 g a.i./ha

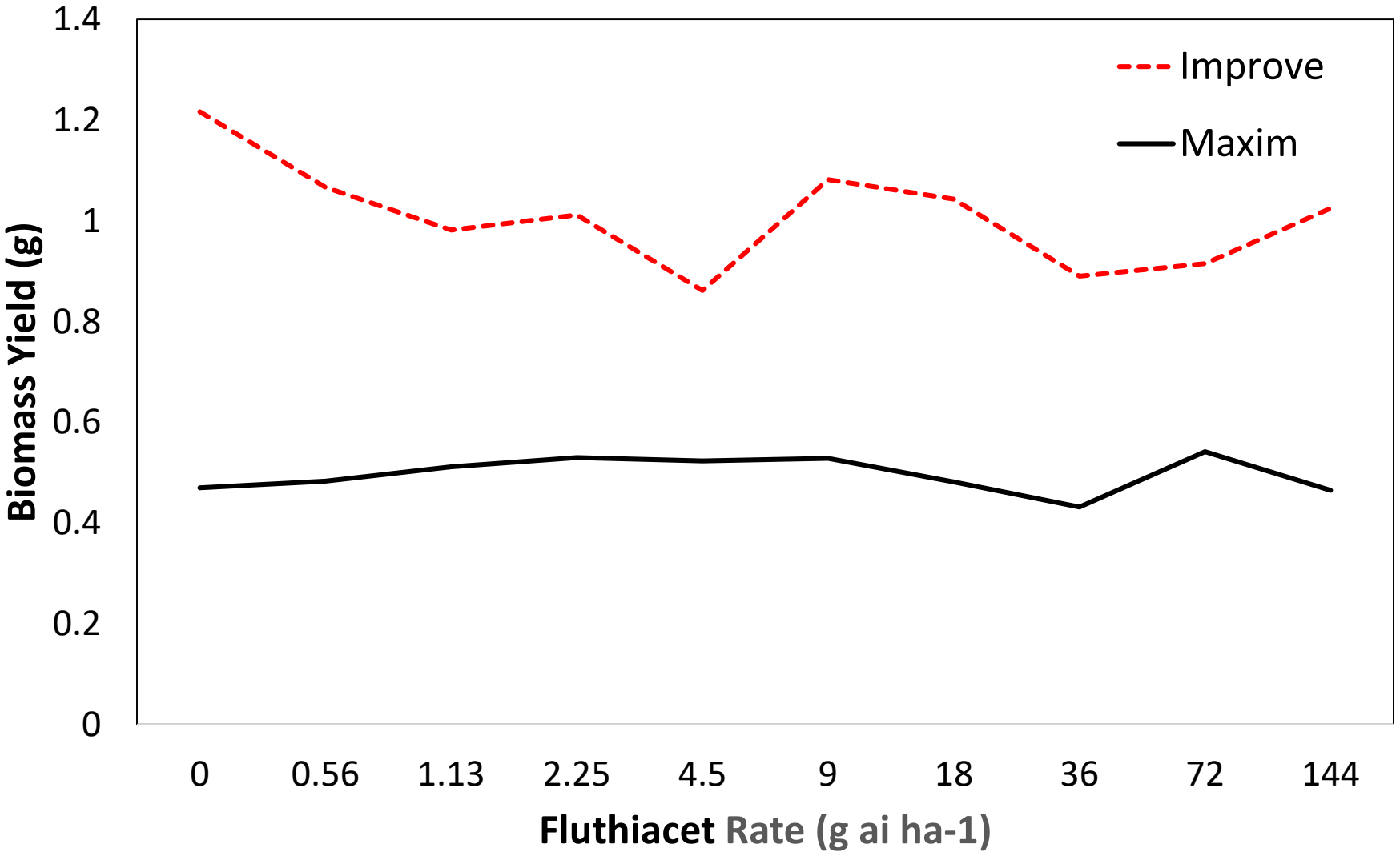
Design: 3 way factorial RCBD

- **60 Treatments:** 3 plants x 2 herbicides x 10 rates

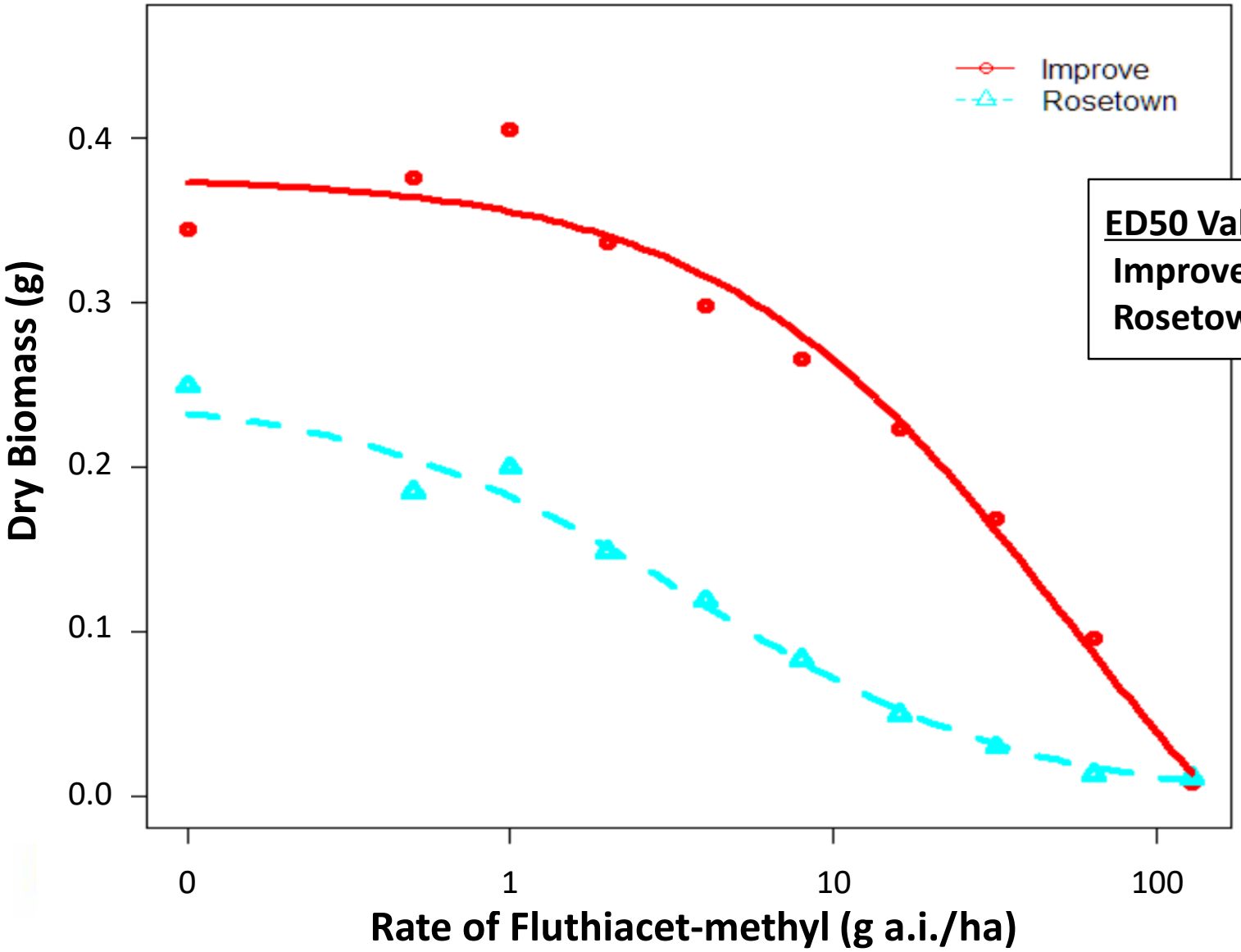
Measurements:

- Height, chlorosis/efficacy ratings 4, 7, 14, 20DAT
- Biomass yield 20DAT

Results- Fluthiacet-methyl applied to lentil



Fluthiacet Dose Response



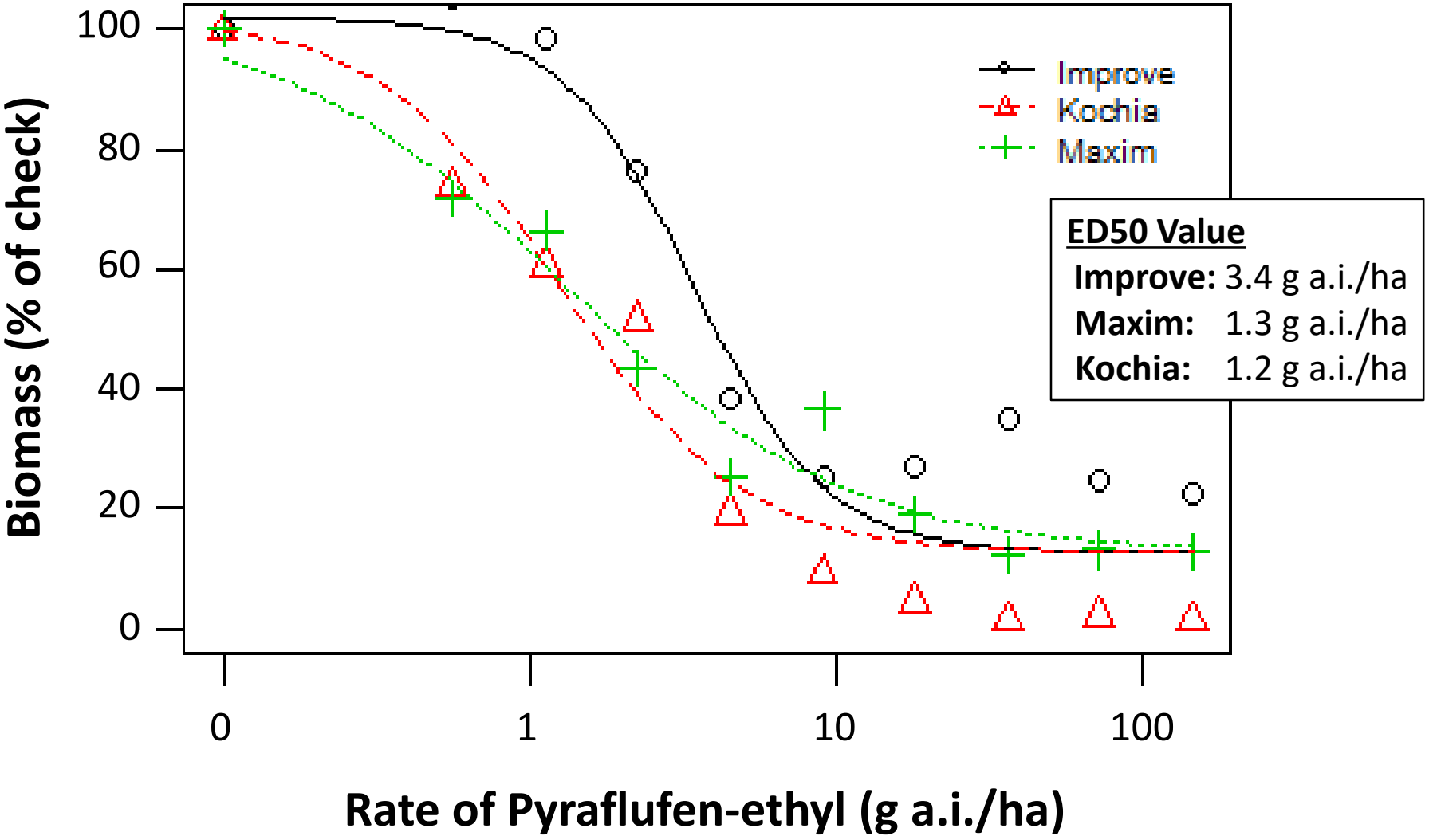
ED50 Value

Improve: 32 g a.i./ha

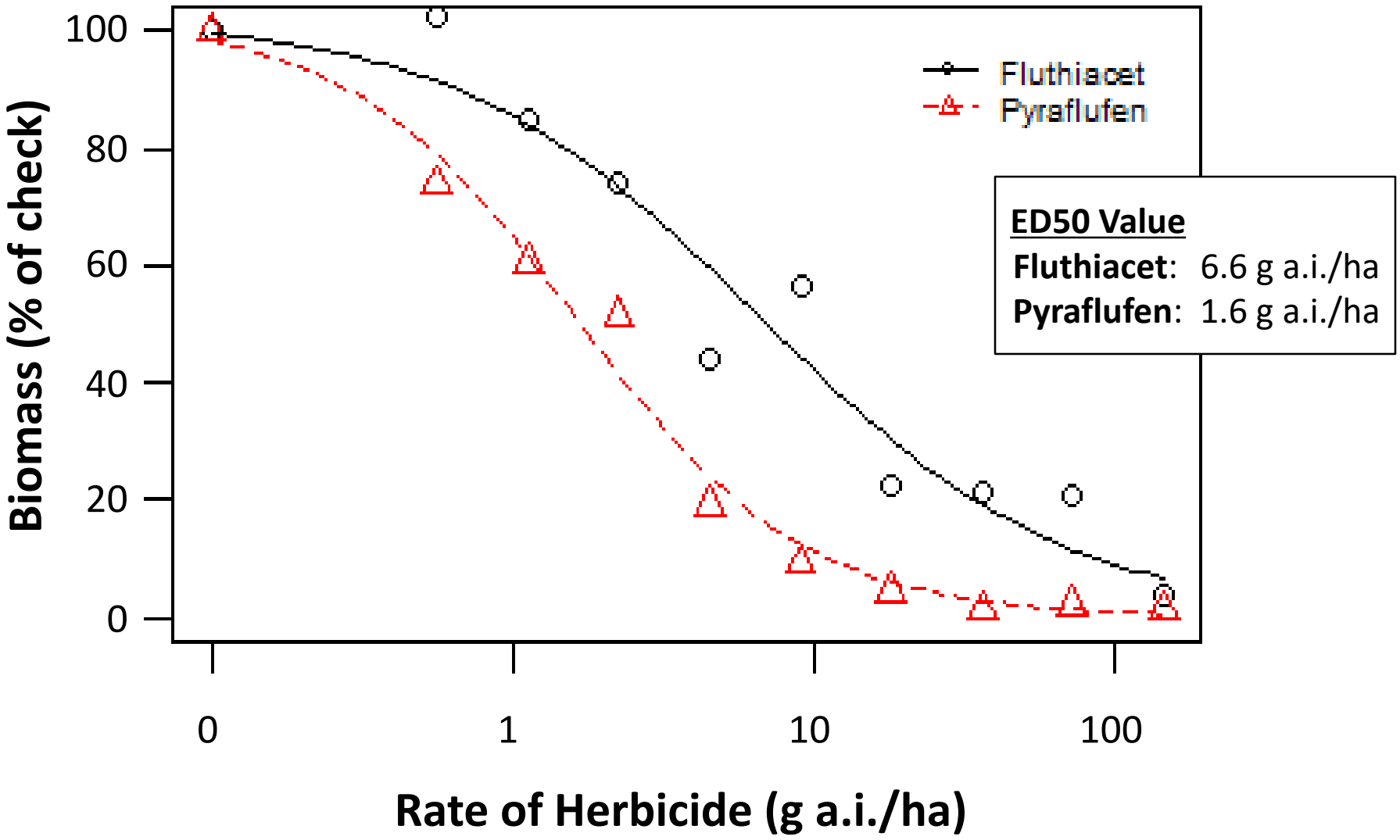
Rosetown: 1.7 g a.i./ha

(Pajic 2015)

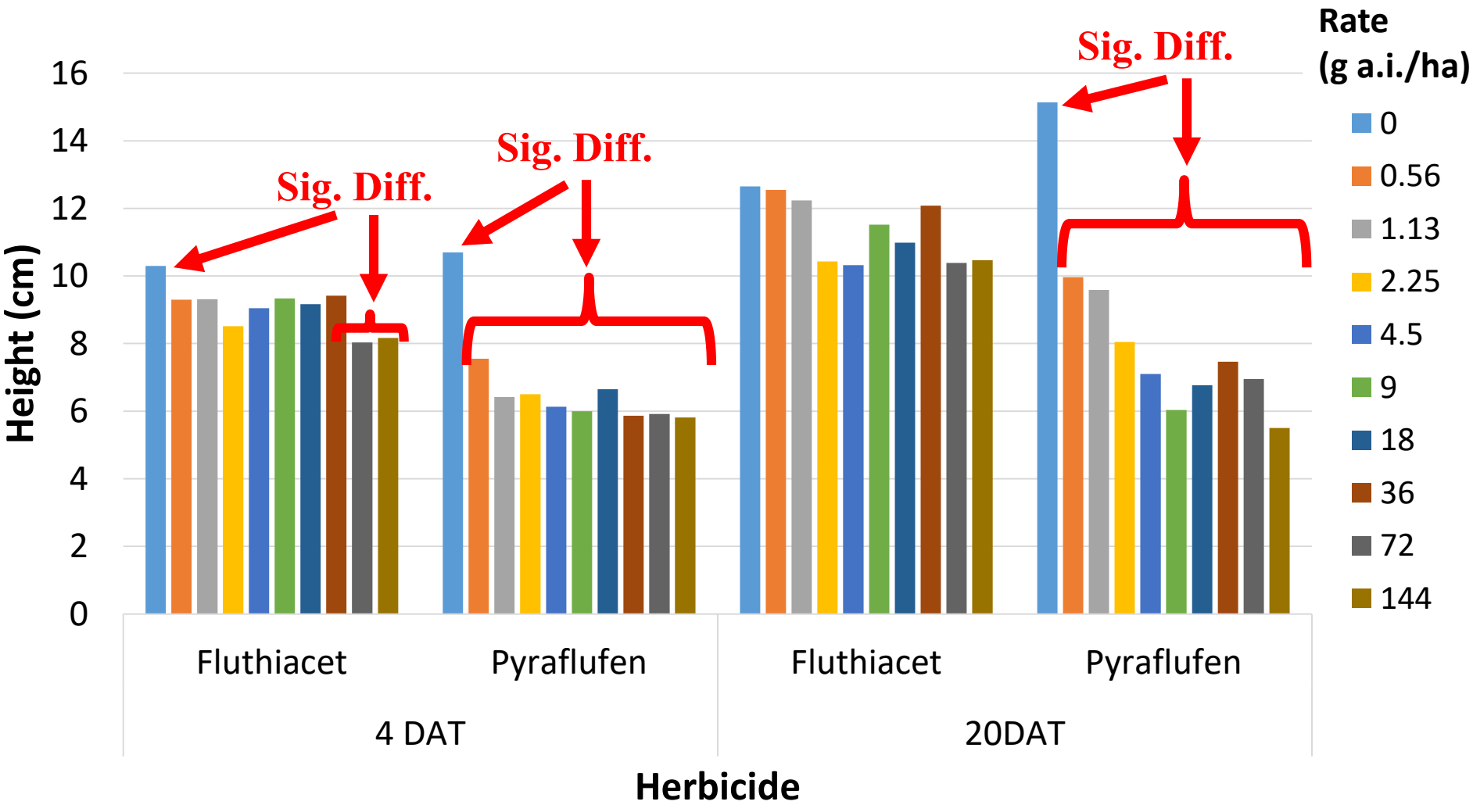
Pyraflufen-ethyl Dose Response



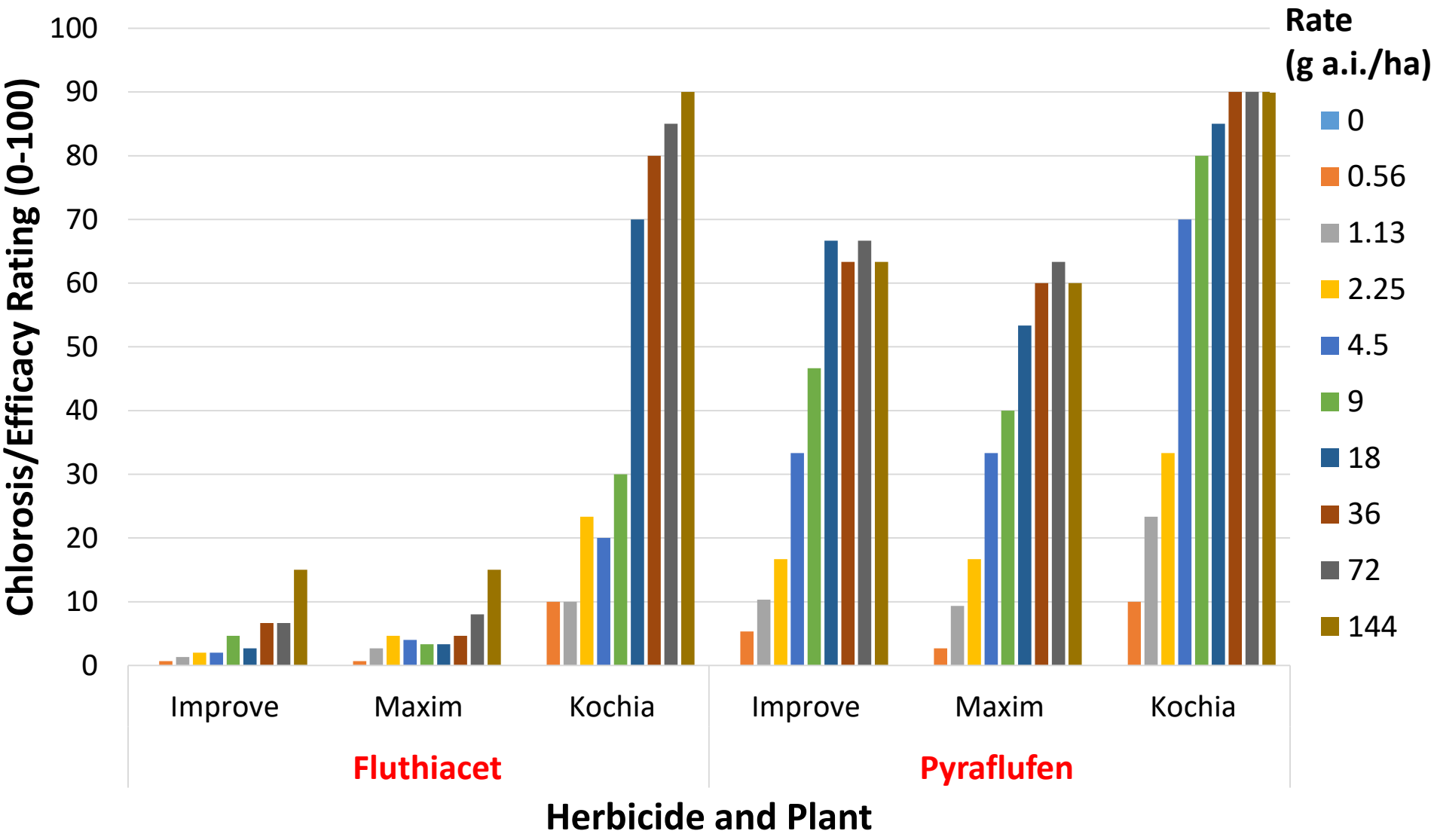
Kochia Dose Response Curve



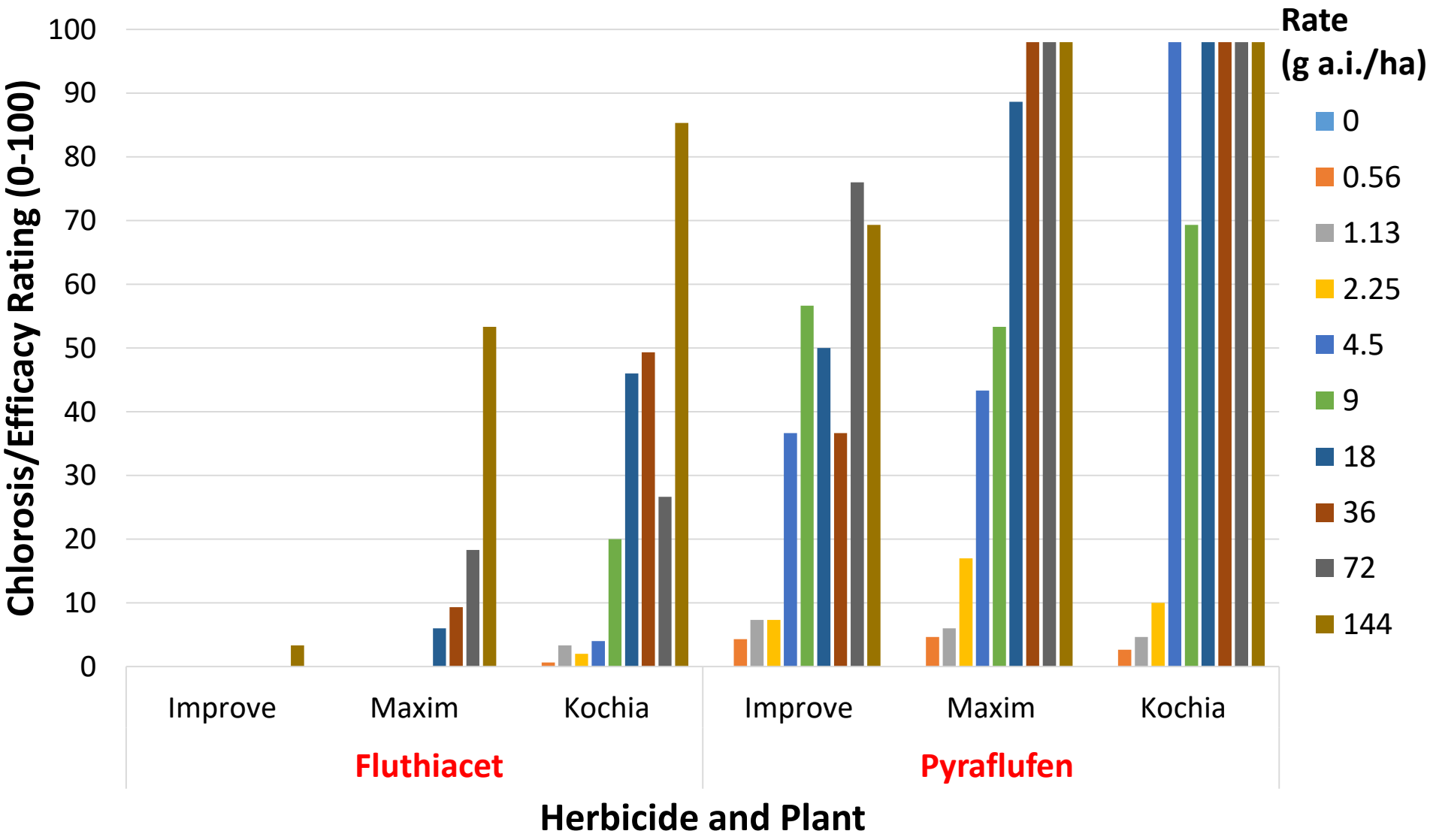
Lentil Height Response



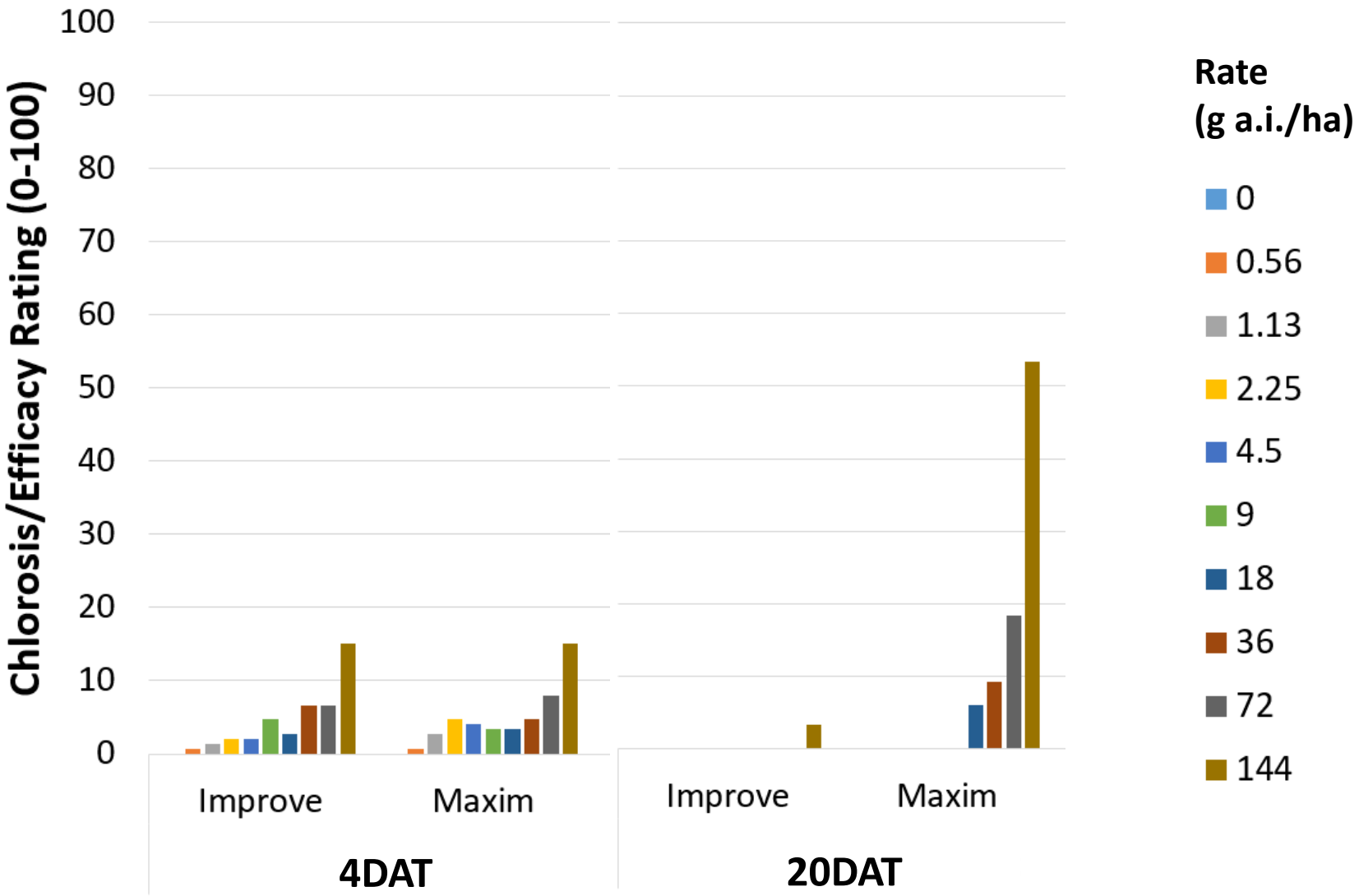
Chlorosis/Efficacy Response 4DAT



Chlorosis/Efficacy Response 20DAT



Chlorosis Following Fluthiacet



Rate

-144-

-72-

-36-

-18-

-9-

-4.5-

-2.25-

-1.13-

-0.56-

-0.0-

Fluthiacet-methyl applied to CDC Improve 4DAT

Pyraflufen-ethyl applied to CDC Improve 4DAT

Rate

-144-

-72-

-36-

-18-

-9-

-4.5-

-2.25-

-1.13-

-0.56-

-0.0-

Pyraflufen-ethyl applied to CDC Improve 4DAT

Pyraflufen-ethyl applied to CDC Improve 20DAT

Rate

-144-

-72-

-36-

-18-

-9-

-4.5-

-2.25-

-1.13-

-0.56-

-0.0-

Fluthiacet-methyl applied to kochia 4DAT

Pyraflufen-ethyl applied to kochia 4DAT

Rate

-144-

-72-

-36-

-18-

-9-

-4.5-

-2.25-

-1.13-

-0.56-

-0.0-

Fluthiacet-methyl applied to kochia 20DAT

Pyraflufen-ethyl applied to kochia 20DAT

Experiment 2: Staging

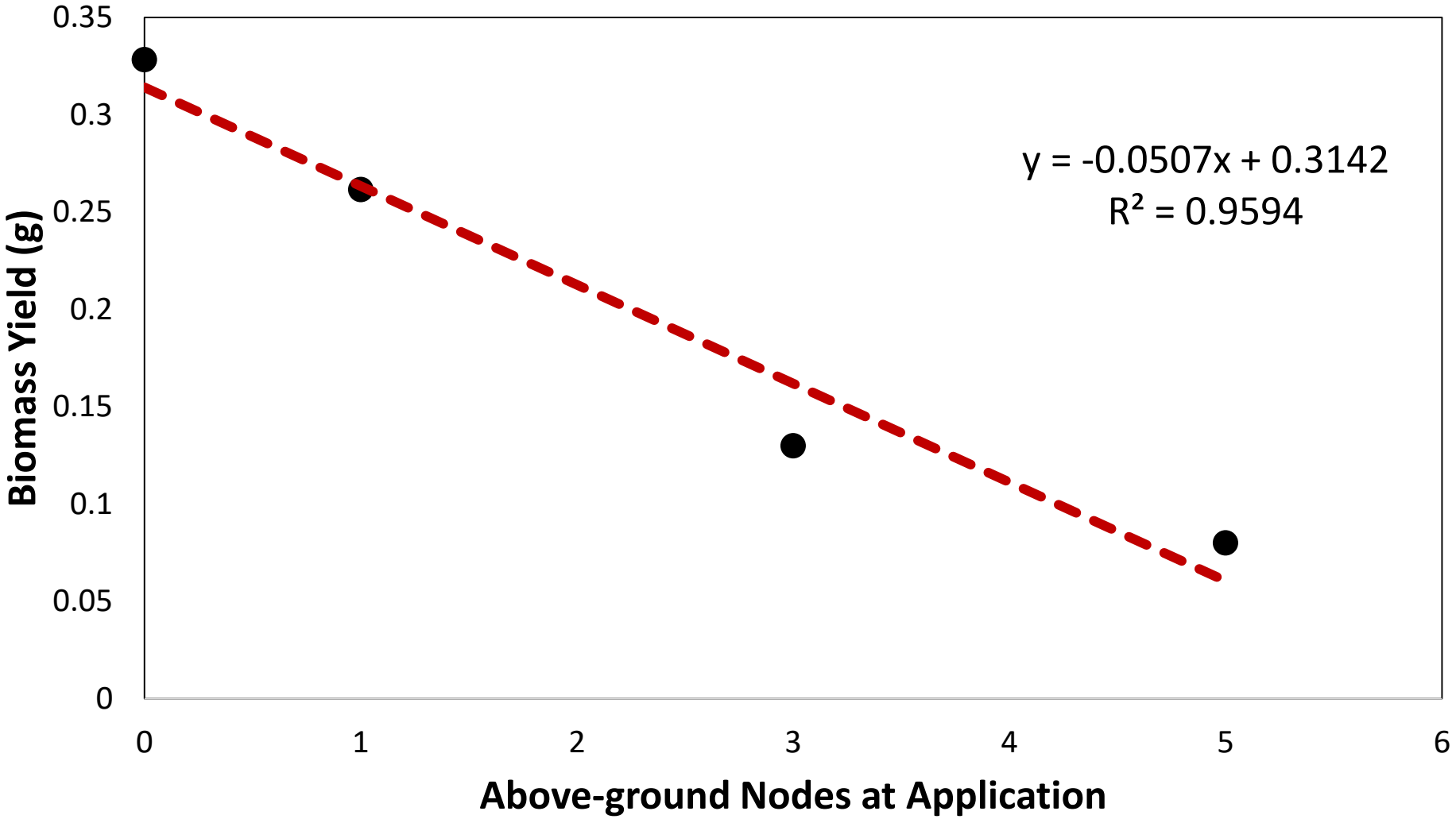
Lentil: CDC Maxim

Herbicide: pyraflufen-ethyl

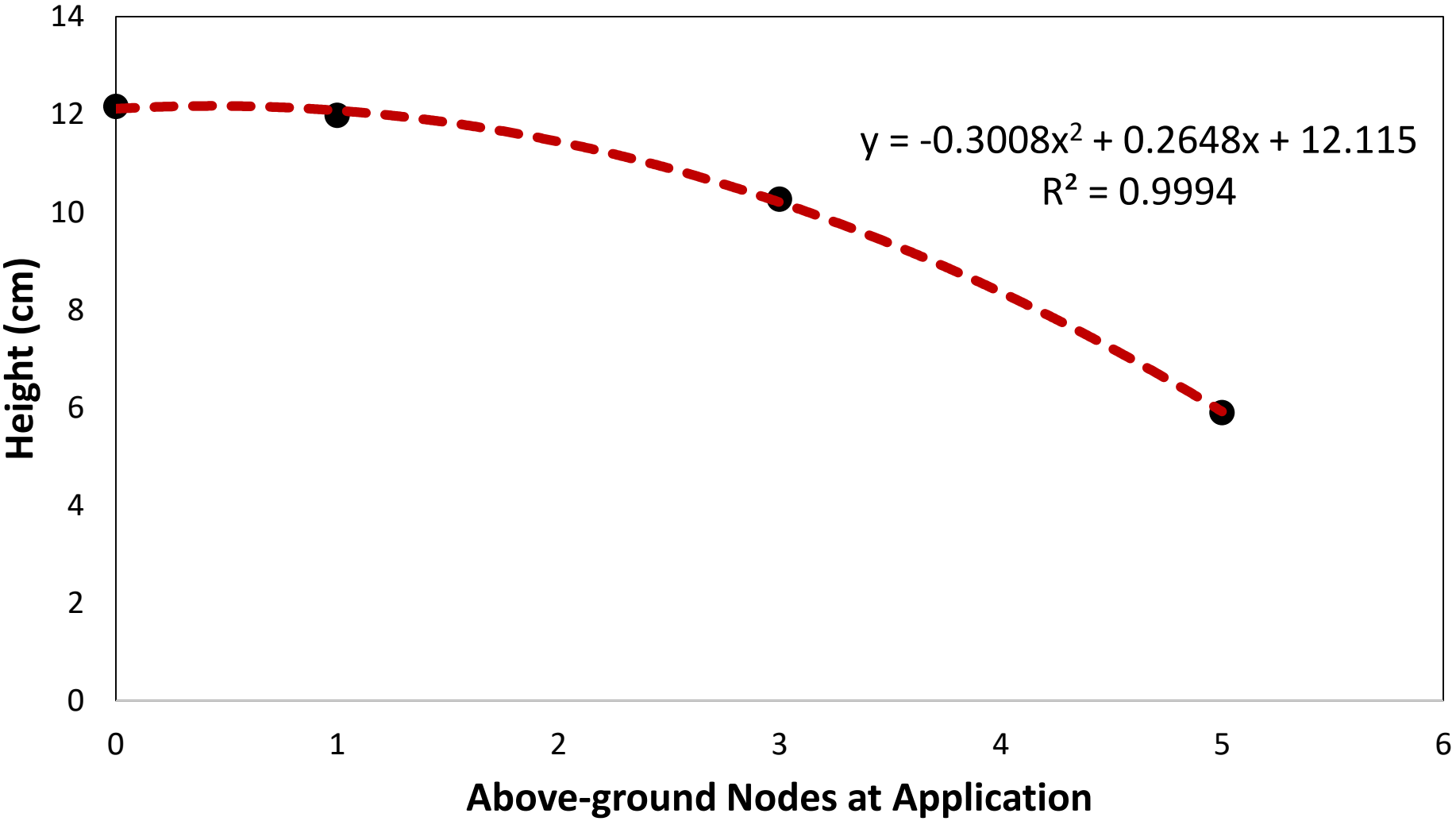
Rate: 9 g a.i./ha

Stages: 1-, 3-, 5-above ground nodes

Results- Biomass Yield



Height Response



Control

Applied at 1-node stage

Major Conclusion and Relevance

- Pyraflufen-ethyl activity > fluthiacet-methyl on lentil and kochia
- Improve lentil tolerance > Maxim = kochia

- The reason for higher activity may be formulation
  - Pyraflufen-ethyl EC and Fluthiacet SC
  - Fluthiacet formulation was changed from EC to SC

- Applications earlier in the season lead to less biomass yield loss and height reduction

Major Conclusion and Relevance

- PPO inhibitors have the potential to manage ALS- and glyphosate-resistant kochia in lentil production
- Further research with pyraflufen-ethyl and fluthiacet-methyl in both EC and SC formulations
  - Field studies need to follow

References

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Questions?

Thank-you to Eric Johnson for his assistance and expertise