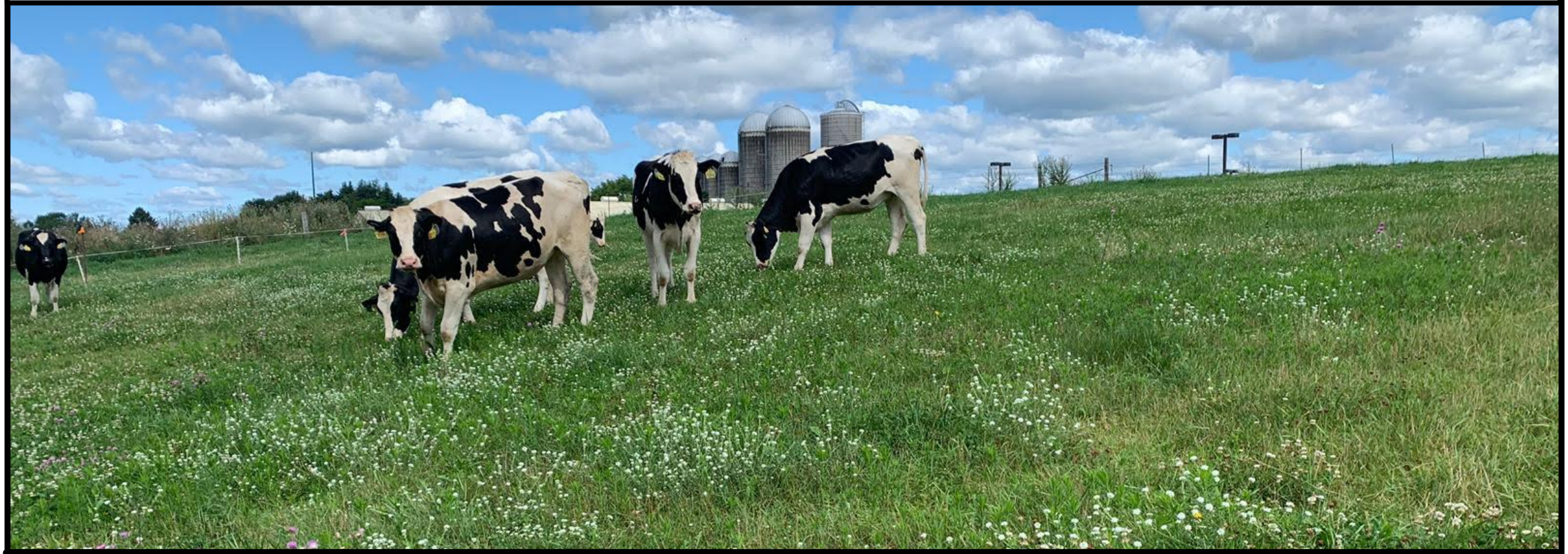
# A clover-safe broadleaf herbicide?

## Evaluation of a potential new tool



Renz Weed Science
COLLEGE OF AGRICULTURAL & LIFE SCIENCES
UNIVERSITY OF WISCONSIN-MADISON

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CORTEVA™ agriscience

# WI's Dairy Cattle Industry

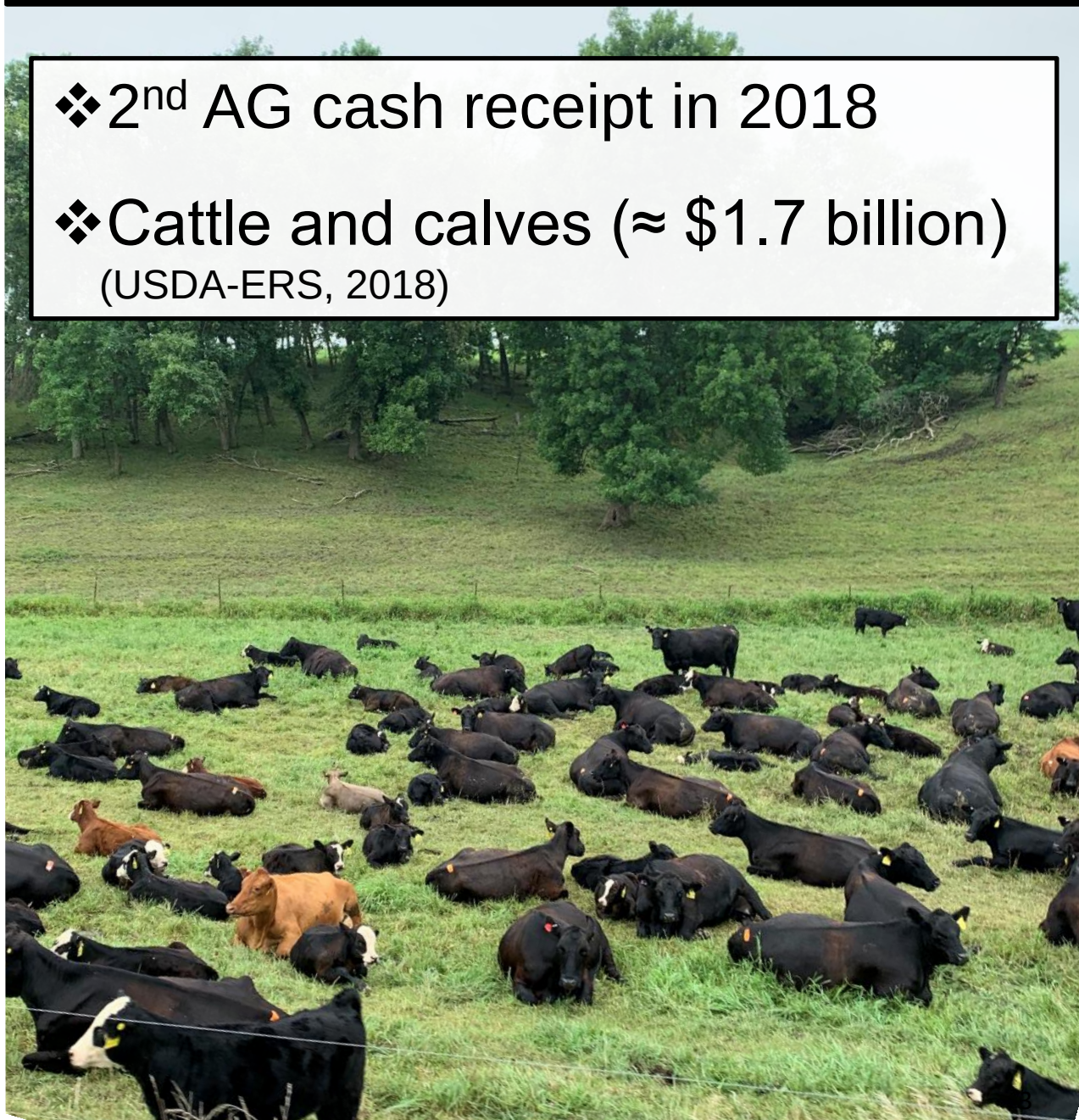
# WI's Beef Cattle Industry

# WI's Dairy Cattle Industry

- 1st AG cash receipt in 2018
- Dairy products (≈ $5.0 billion)
  (USDA-ERS, 2018)

# WI's Beef Cattle Industry

- 2nd AG cash receipt in 2018
- Cattle and calves (≈ $1.7 billion)
  (USDA-ERS, 2018)



# WI's Dairy Cattle Industry

- 22% of Wisconsin's dairy farmers use managed grazing (Paine 2012)

# WI's Beef Cattle Industry

- Most beef cattle operations rely on pastures to provide a significant amount of feed

# WI's Dairy Cattle Industry

# WI's Beef Cattle Industry

It is important to investigate ways to optimize and enhance forage yield and quality from grazed pastures!

# Grass-legume mixtures

- **Benefits of adding legumes:**

1. Increased grass yield due to N fixation (Sanderson et al. 2005)
2. Increased forage nutritive value (Sleugh et al. 2000)
3. Extended grazing season (Sleugh et al. 2000)
4. Ecosystem services

**Red clover (*Trifolium pretense* L)**

**White clover (*Trifolium repens* L)**

# Grass-clover mixtures

- Clovers are popular legumes planted into pastures
- White and red clover are widely adopted in WI
- White clover is the most abundant (Brink and Casler, 2004)
- Red clover is the second (Riday, 2007)

**Red clover (*Trifolium pretense* L)**

**White clover (*Trifolium repens* L)**

# What about pasture weed management?

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- 1st pest for livestock producers in the US
- $ 2.0 billion in losses each year

(DiTomaso, 2000)

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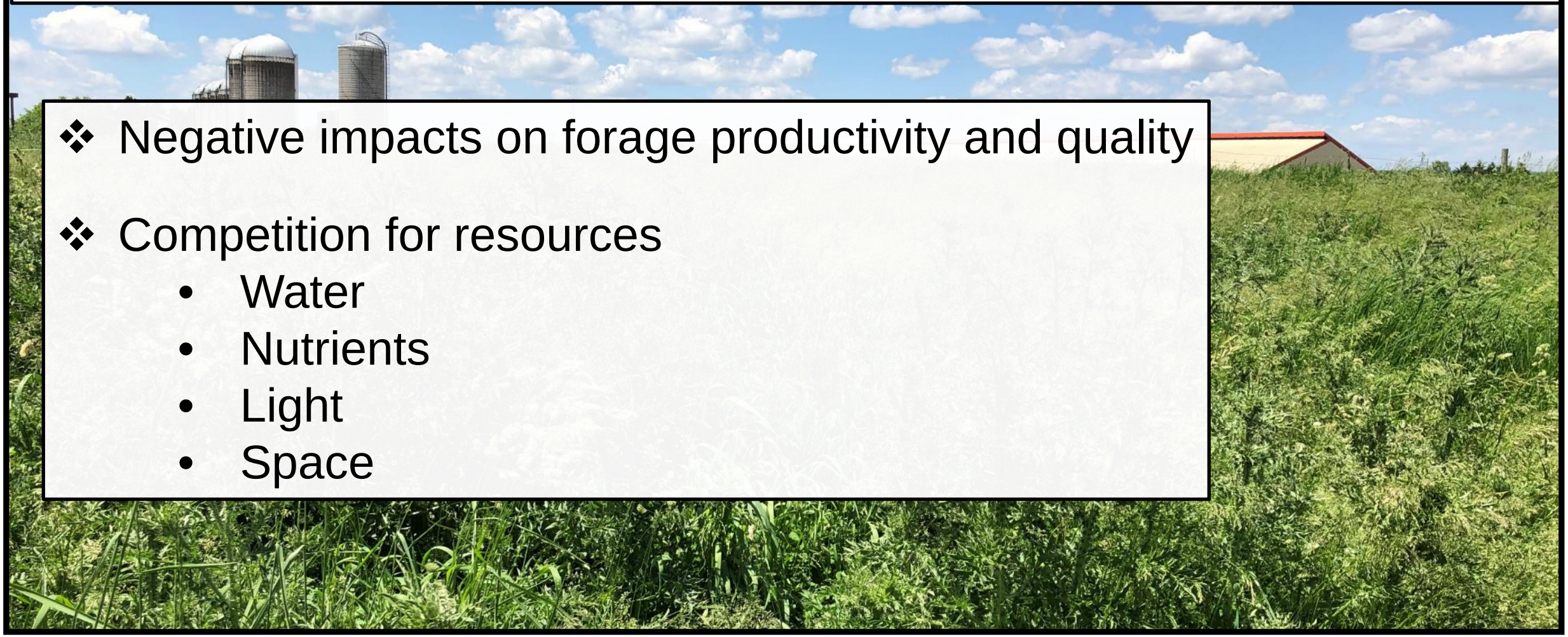


- Negative impacts on forage productivity and quality
- Competition for resources
  - Water
  - Nutrients
  - Light
  - Space

# What about pasture weed management?

- **Weedy issues in WI's pastures:**

1. Poisonous weeds.

Poison hemlock

Whorled Milkweed

# What about pasture weed management?

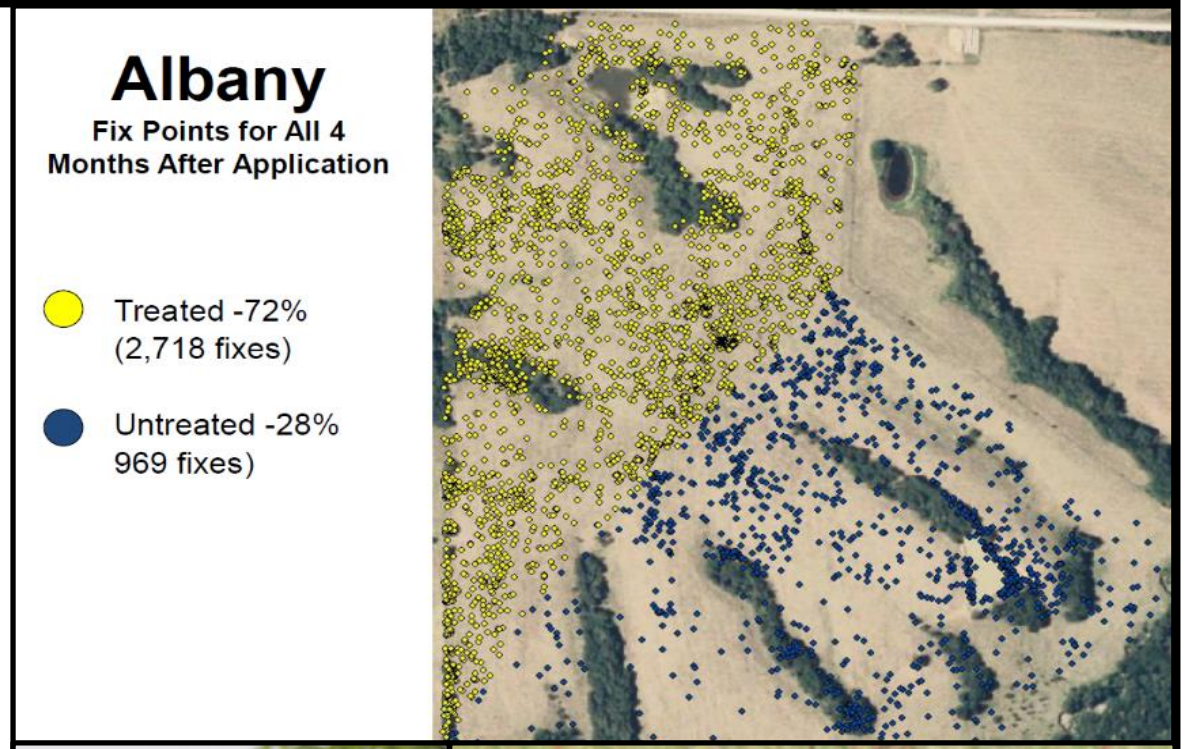
## ❖ Weedy issues in WI's pastures:

1. Poisonous weeds.

Poison hemlock

Whorled Milkweed

2. Impacts on forage utilization
(Shater et al. 2013)




Courtesy of Dr. Bradley, University of Missouri


How can we control broadleaf weeds while at the same time preserving our clover?
Red clover

# How can we control broadleaf weeds while at the same time preserving our clover?

- **Long-lasting weed management challenge:**

1. Clovers sensitivity to current pasture broadleaf herbicides

# How can we control broadleaf weeds while at the same time preserving our clover?

- **Long-lasting weed management challenge:**

1. Clovers sensitivity to current pasture broadleaf herbicides
2. Lack of effective / affordable alternative management strategies

# Current management options used to control broadleaf weeds in grass-legumes mixed swards

- Lack of effective / affordable alternative management strategies

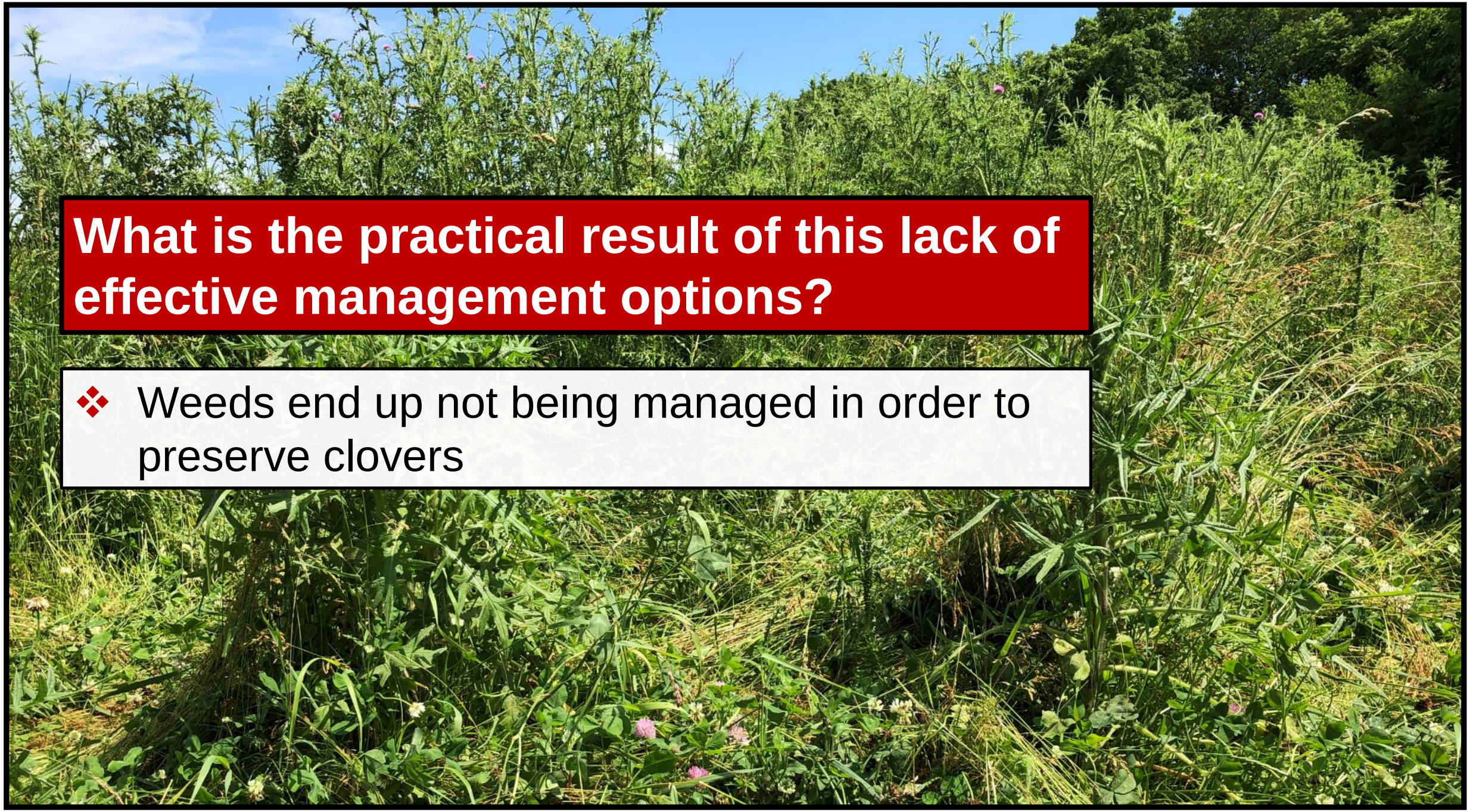
## Mowing?

## Spot treatment?


## Kill and reseed?

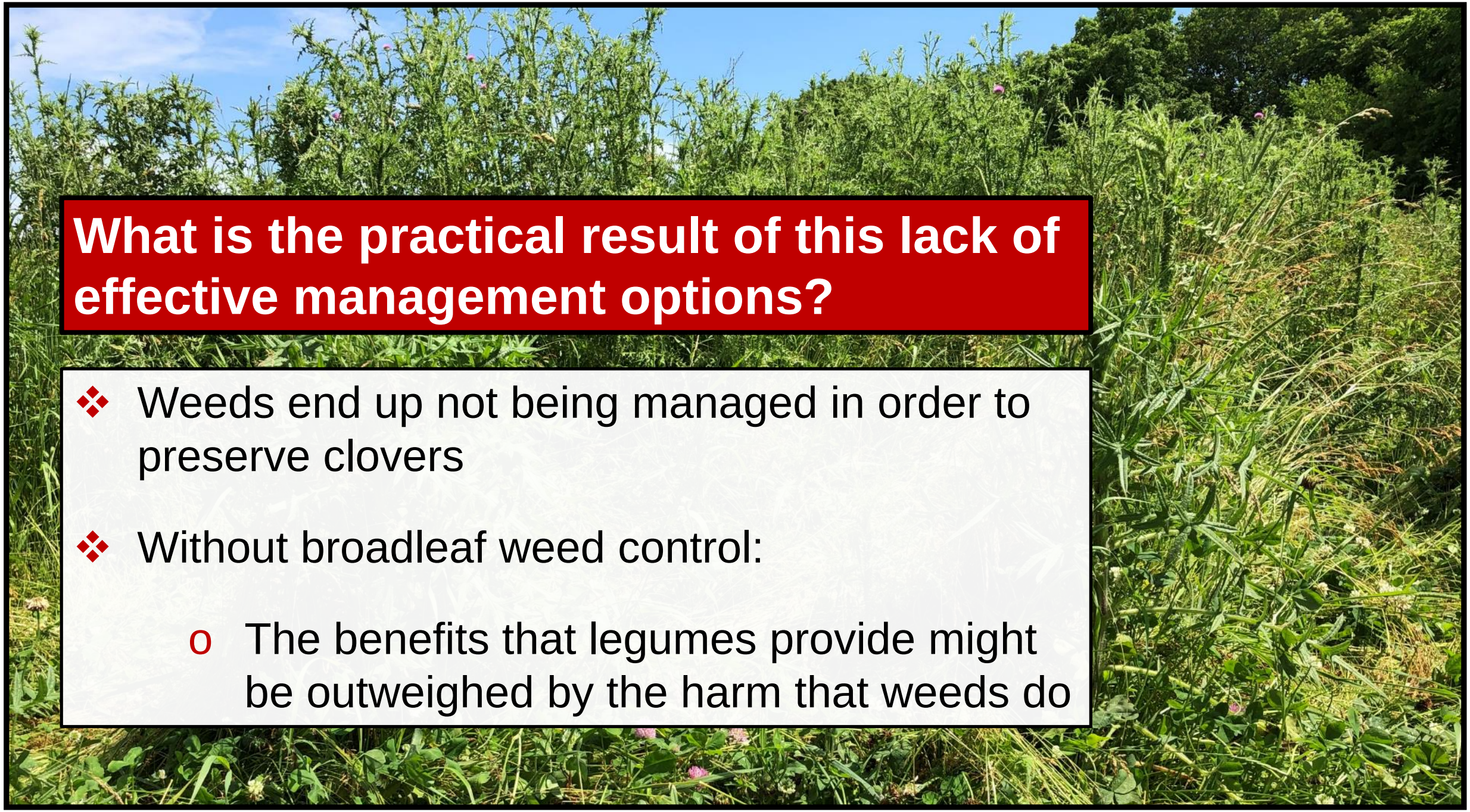
# What about the use of the weed-wipers?


What is the practical result of this lack of effective management options?



# What is the practical result of this lack of effective management options?

- Weeds end up not being managed in order to preserve clovers

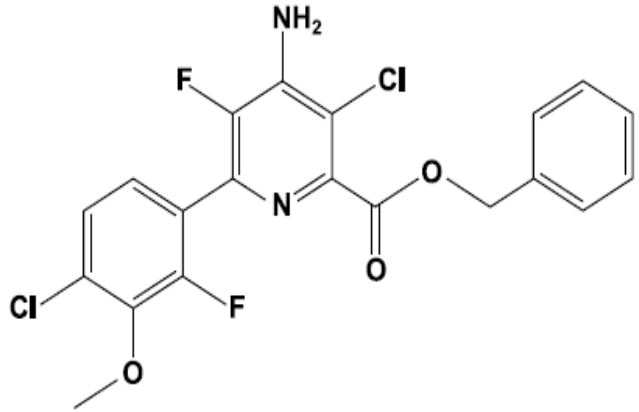


# What is the practical result of this lack of effective management options?

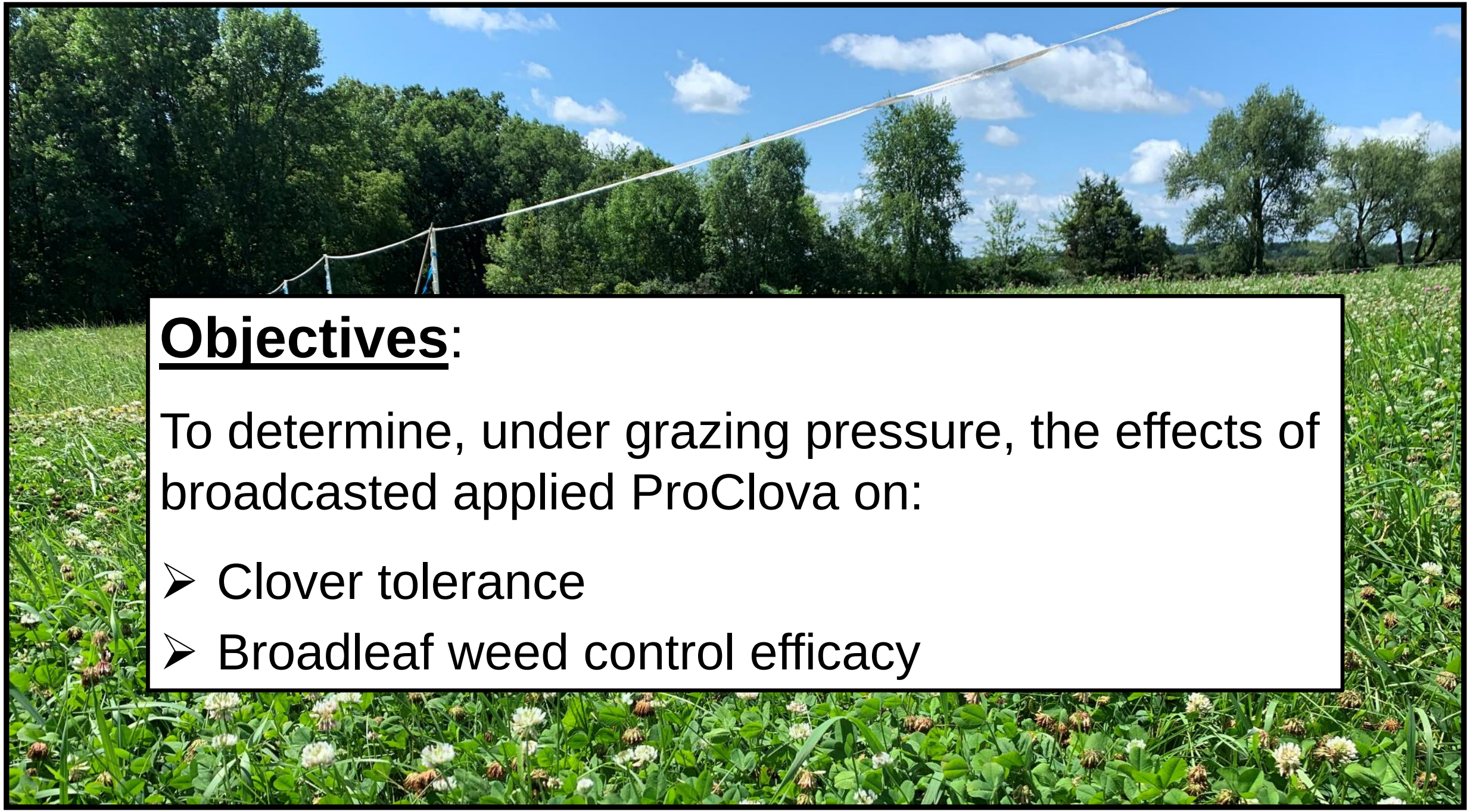
- Weeds end up not being managed in order to preserve clovers
- Without broadleaf weed control:
  - The benefits that legumes provide might be outweighed by the harm that weeds do

# New management tool:
# **ProClova** (florpyrauxifen-benzyl and 2,4-D)

- First new active introduced in the Range & Pasture market in nearly 15 years
- Post emergence broad spectrum broadleaf weed control
- White clover and annual lespedeza tolerance
- Low-use rates and rapid degradation




Florpyrauxifen molecular structure

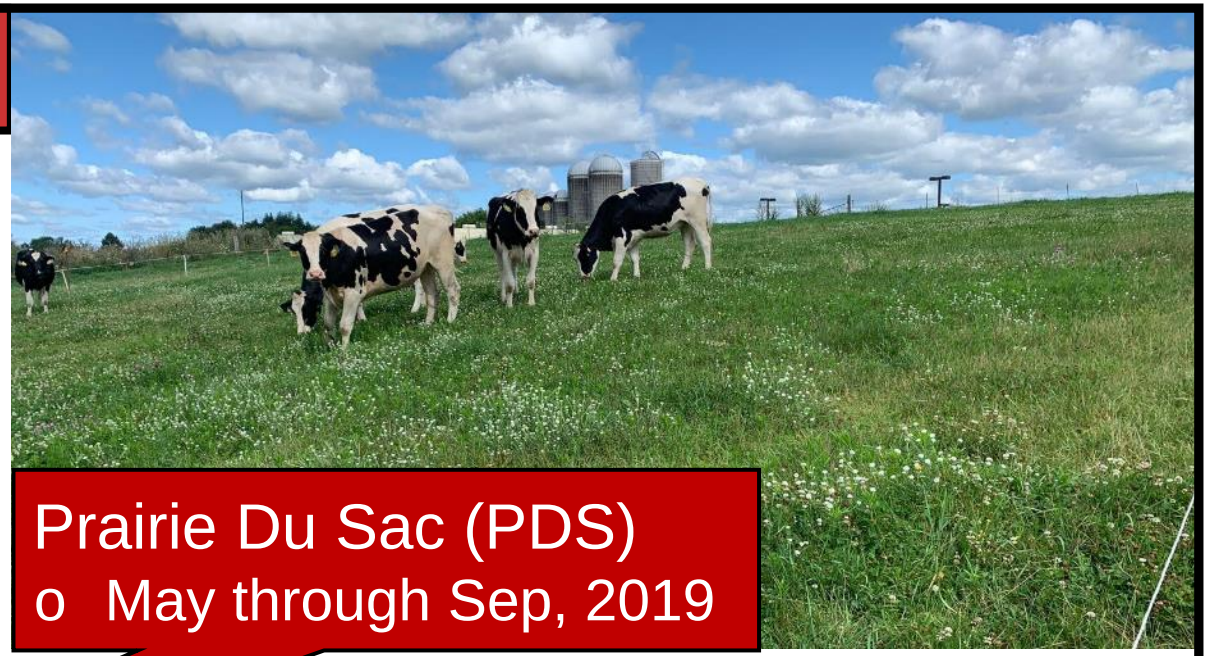


## **Objectives**:

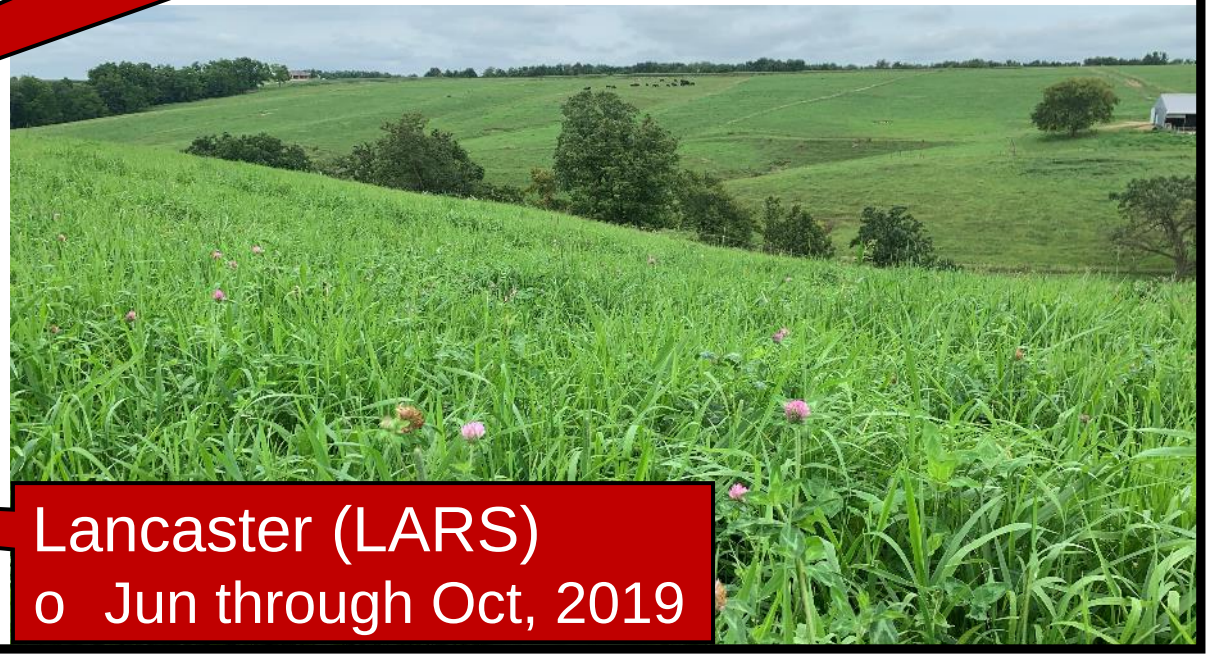
To determine, under grazing pressure, the effects of broadcasted applied ProClova on:

- Clover tolerance
- Broadleaf weed control efficacy

# Research locations

Prairie Du Sac (PDS)
- May through Sep, 2019



Lancaster (LARS)
- Jun through Oct, 2019

# Pastures Botanical Composition

Plant species > 5 % cover at each location

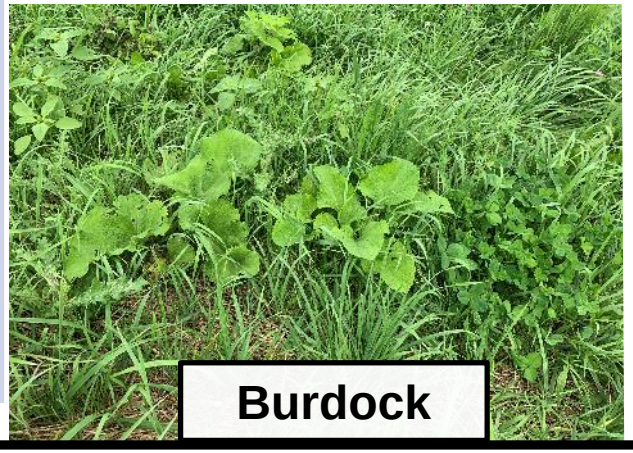
| Classes | Lancaster | Prairie Du Sac |
|---|---|---|
| Clover | White clover<br>Red clover | |
| Perennial grasses | Tall fescue<br>Orchard grass<br>Smooth brome | |
| Broadleaf weeds | Dandelion<br>Canada thistle<br>Burdock | Dandelion<br>Plumeless thistle |


White clover


Red clover


Canada thistle


Plumeless thistle


Burdock


Dandelion

# Treatments and Experimental Design

- Treatments included:
  - ProClova (24.0 fl oz acre$^{-1}$)
  - Control

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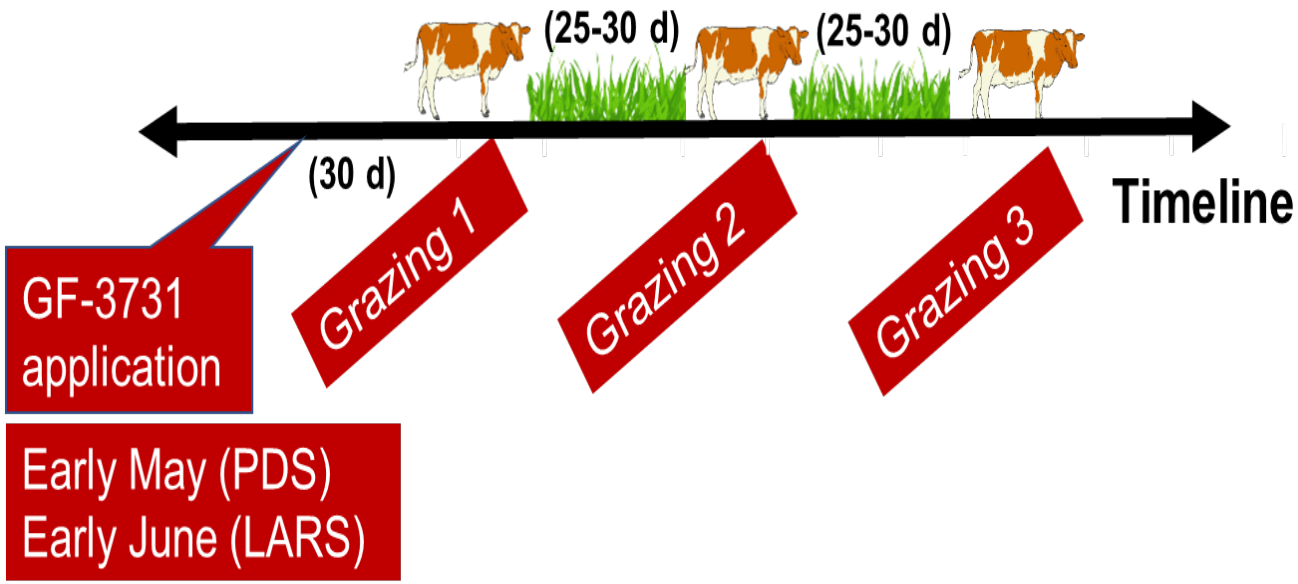
- Treatments included:
  - ProClova (24.0 fl oz acre$^{-1}$)
  - Control
- RCBD with 4 replicates
- Plot size was 100 by 100 ft (0.23 A)

# Herbicide application and grazing procedures

- ProClova was broadcasted applied with a tractor-mounted sprayer (20 gal/acre)

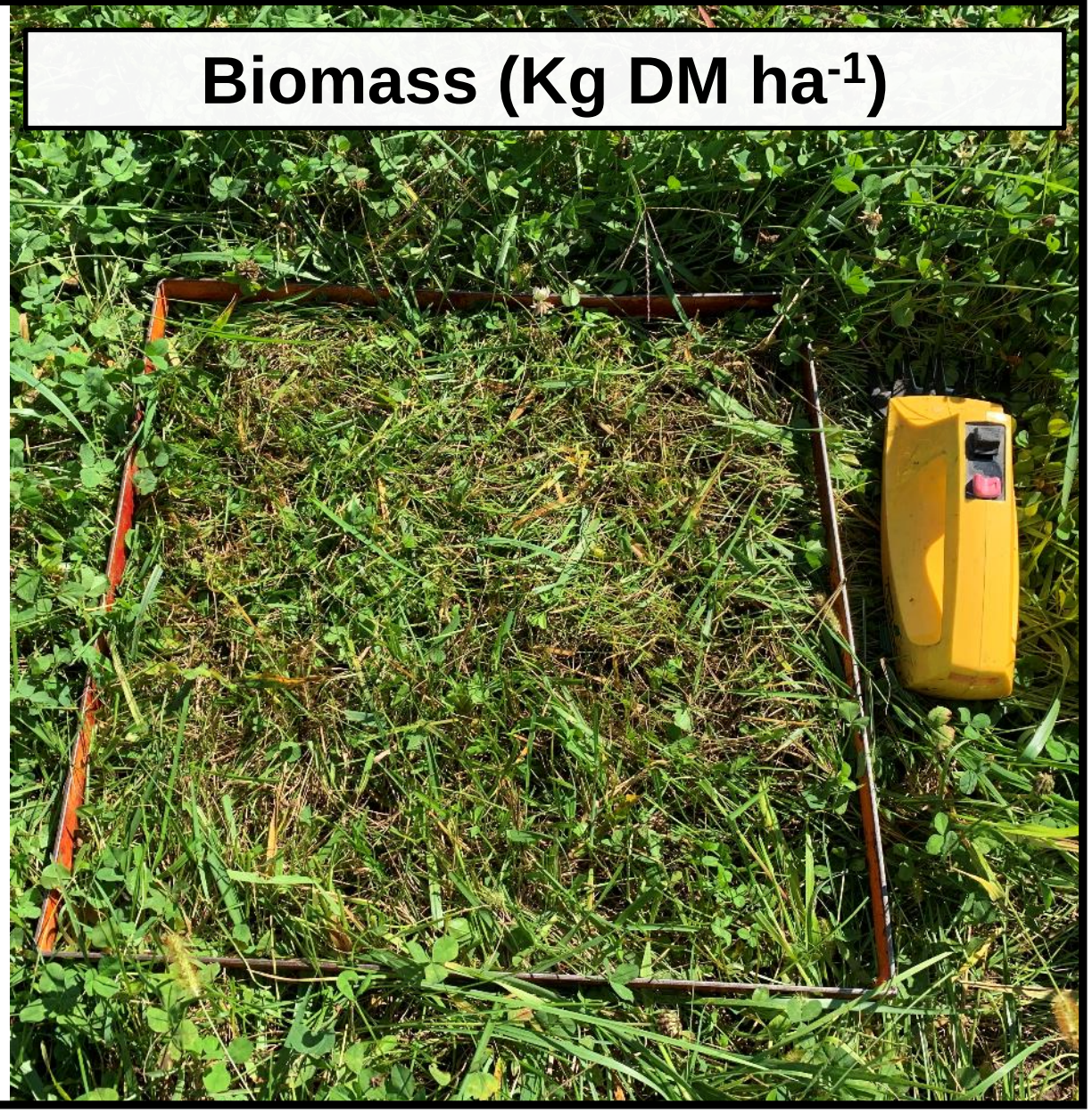
## Rotational grazing scheme




# Response Variables (Measurements)

## Vegetative Plant Cover (%)

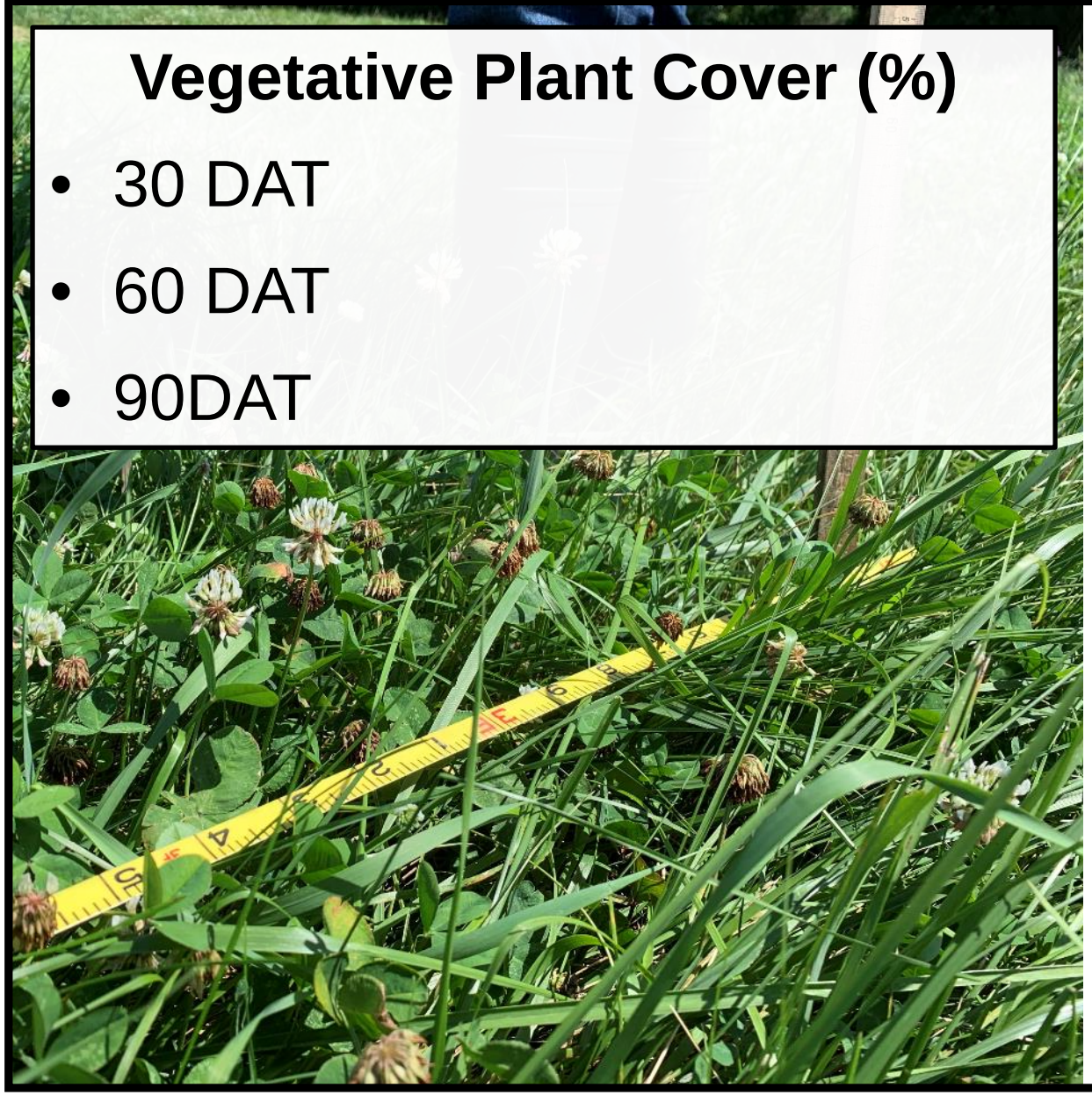
## Biomass (Kg DM $ha^{-1}$)



# Response Variables (Measurements)

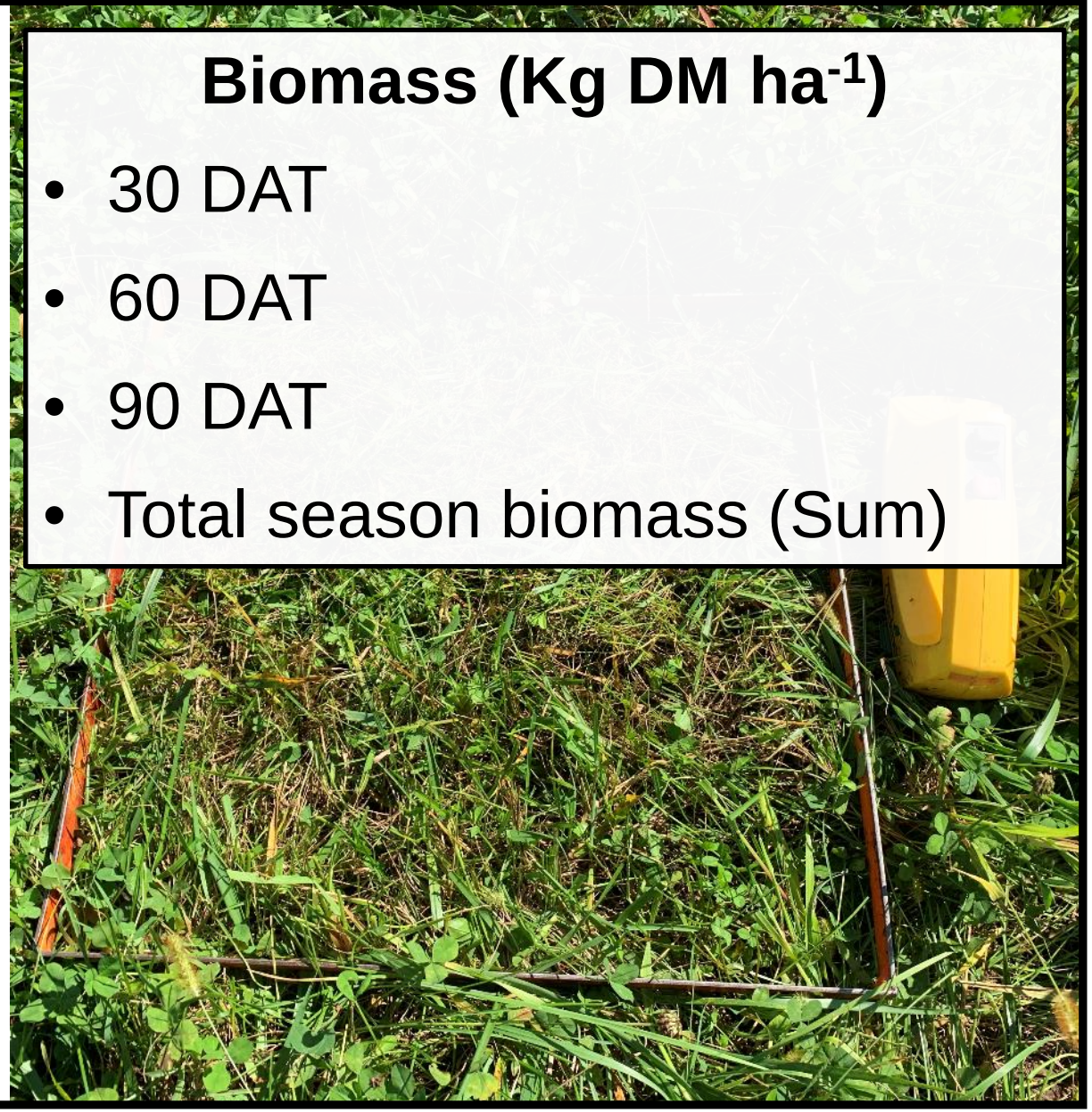
## Vegetative Plant Cover (%)

- 30 DAT
- 60 DAT
- 90DAT



## Biomass (Kg DM $ha^{-1}$)

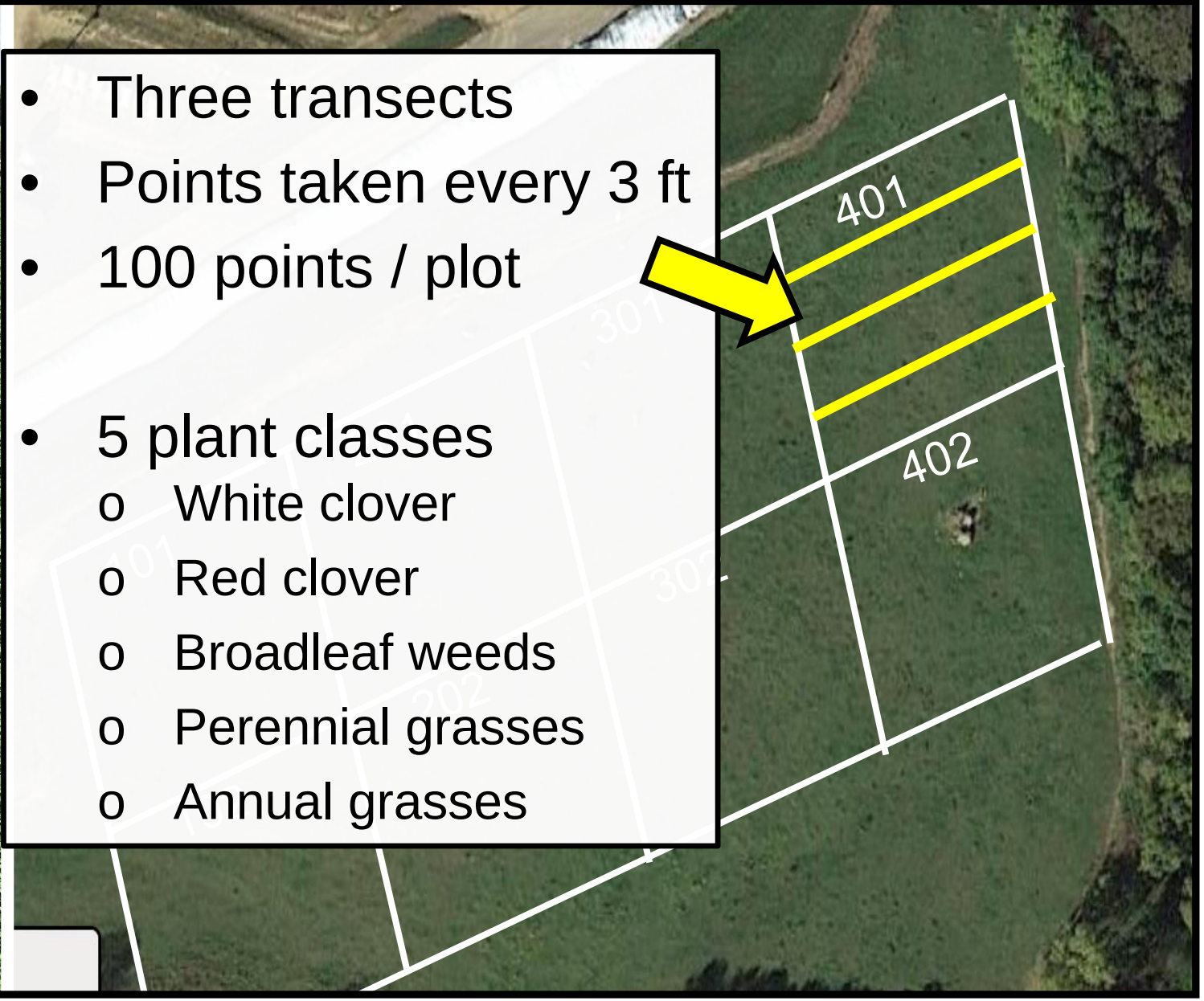
- 30 DAT
- 60 DAT
- 90 DAT
- Total season biomass (Sum)



# Vegetative plant cover (%) at 30, 60 and 90 DAT

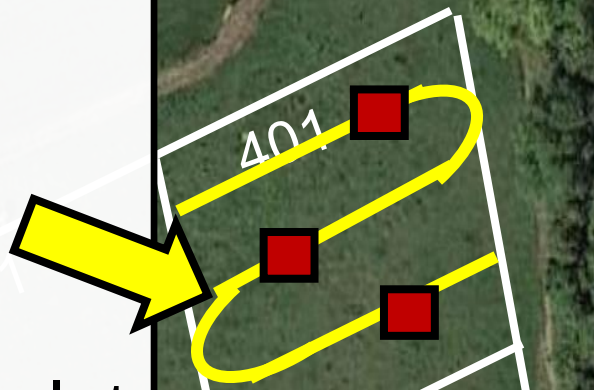
- Three transects
- Points taken every 3 ft
- 100 points / plot

- 5 plant classes
  - White clover
  - Red clover
  - Broadleaf weeds
  - Perennial grasses
  - Annual grasses



# Biomass (kg DM $ha^{-1}$) at 30 DAT, 60 DAT, 90 DAT and Total Season


- Pasture height
  (30 points / plot)
- Biomass collection
  (at points 10, 20 and 30)
- Three 0.25 $m^2$ quadrats / plot
- 4 plant classes
  - Clovers
  - Broadleaf weeds
  - Perennial grasses
  - Annual grasses



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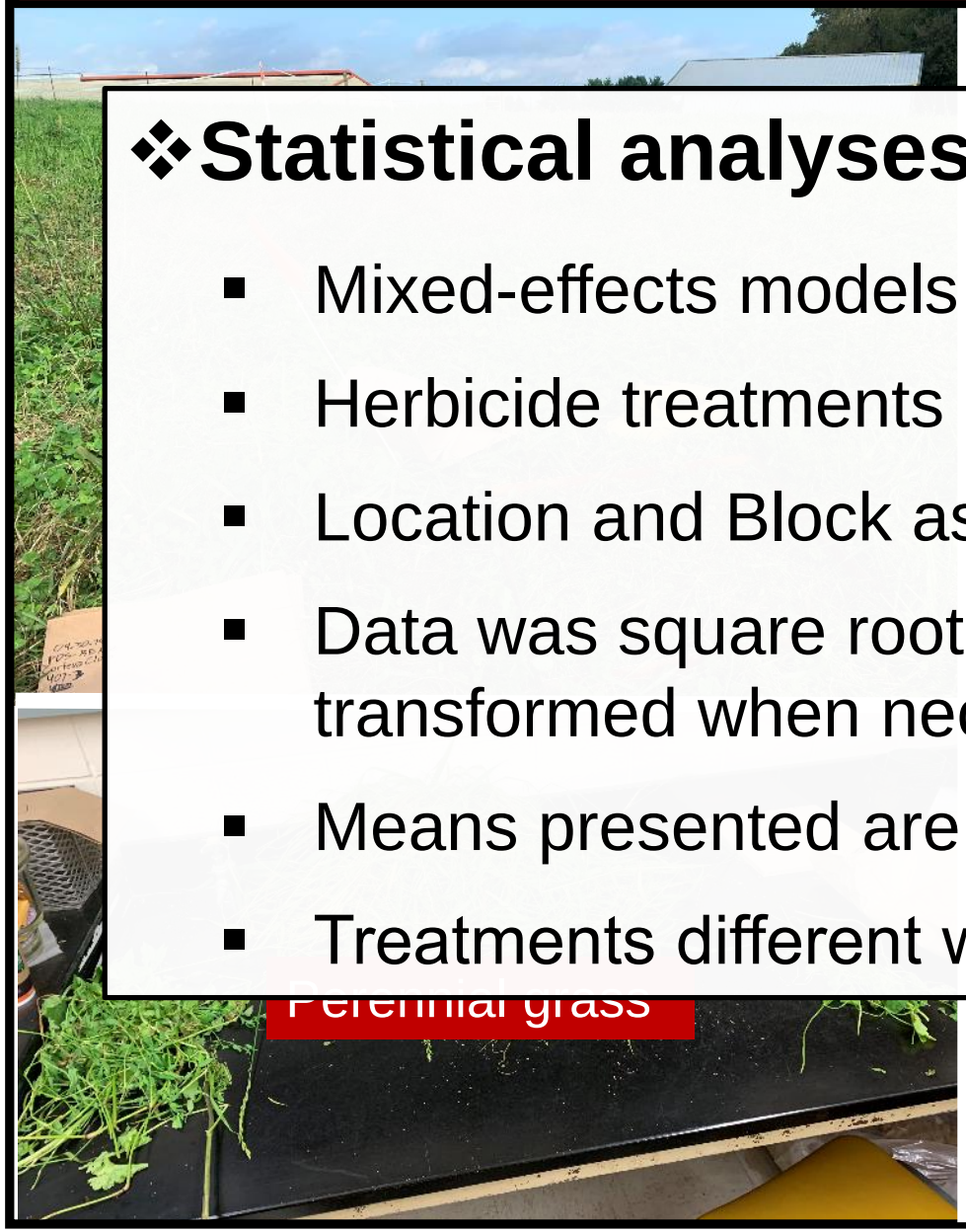
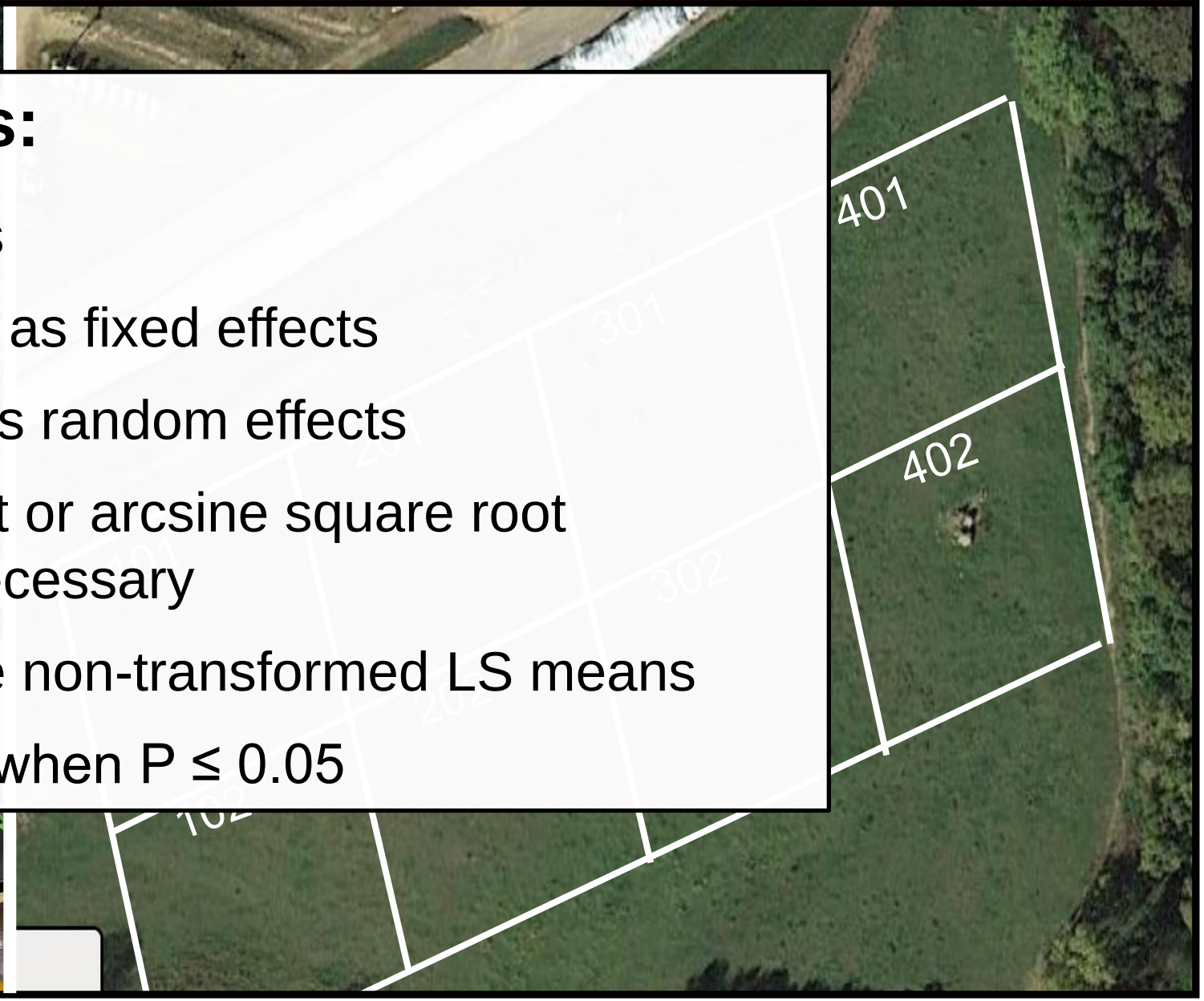


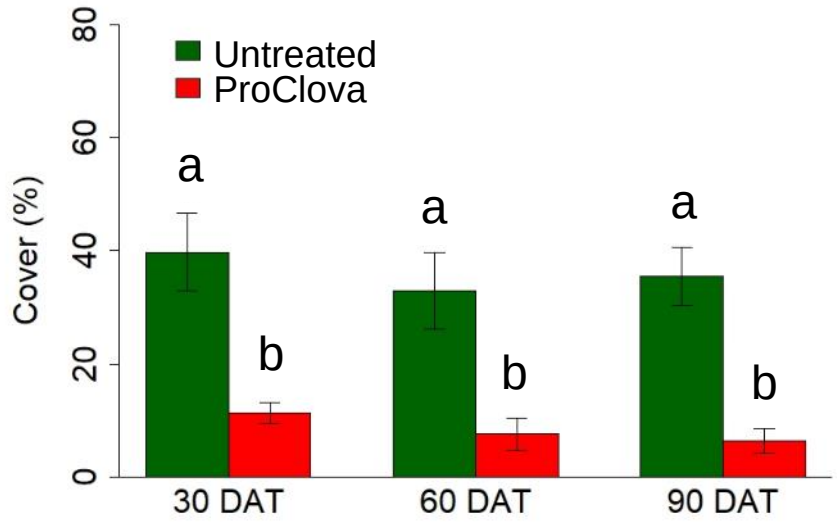




## ❖Statistical analyses:

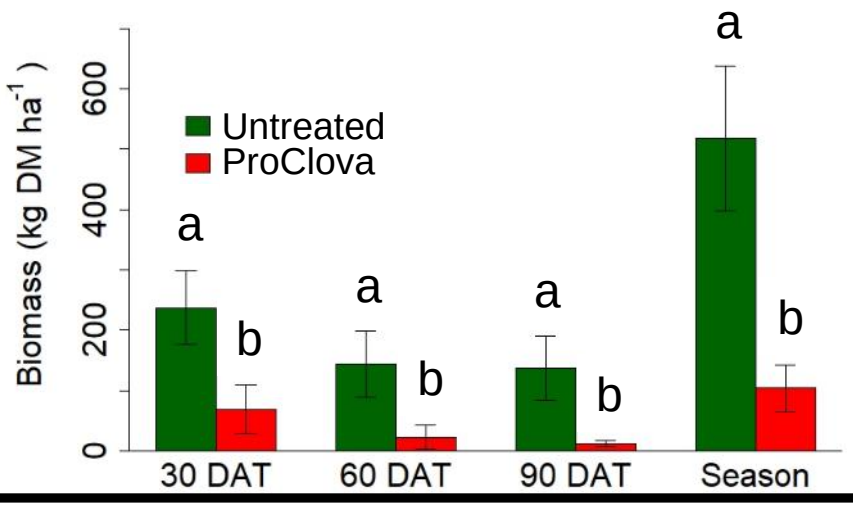
- Mixed-effects models
- Herbicide treatments as fixed effects
- Location and Block as random effects
- Data was square root or arcsine square root transformed when necessary
- Means presented are non-transformed LS means
- Treatments different when $P \leq 0.05$

# Results: Broadleaf Weed Control Efficacy

## Broadleaf weeds cover

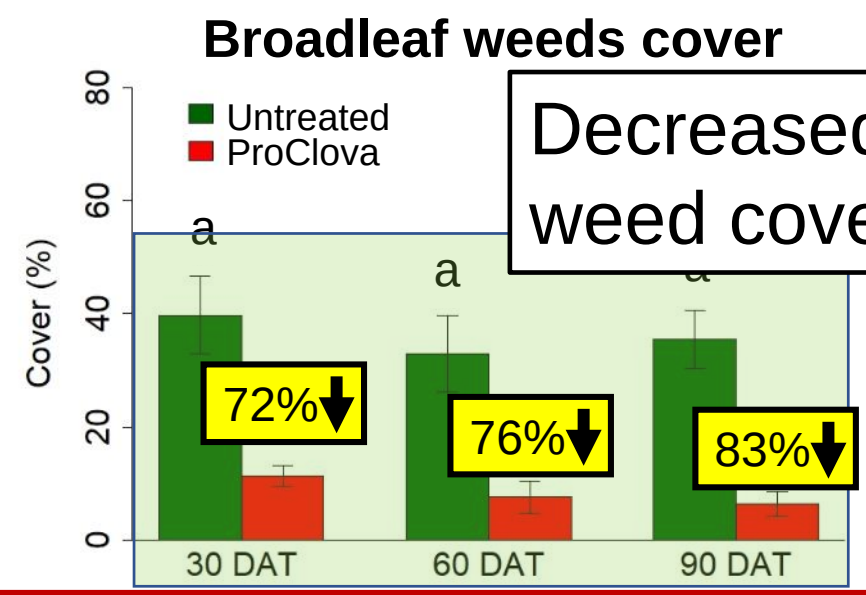



## Broadleaf weeds biomass

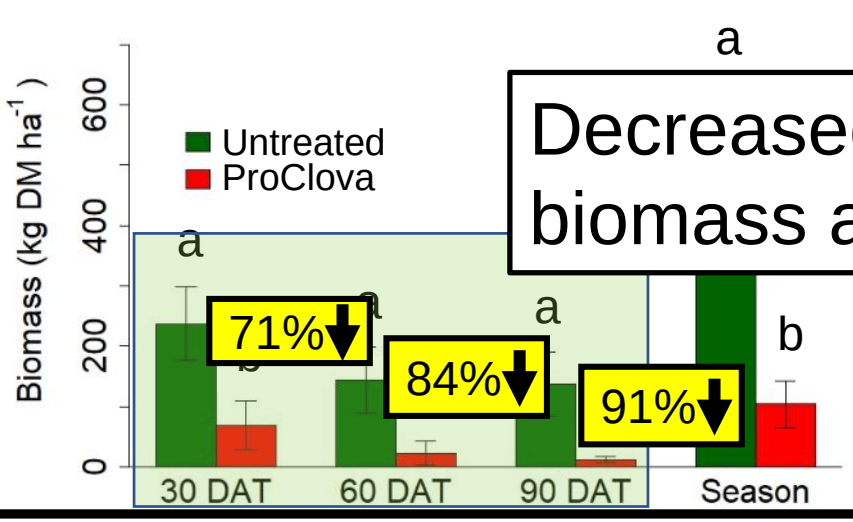



**White clover lack of symptoms at 20 DAT while bull thistle showing chlorosis and necrosis**

# Results: Broadleaf Weed Control Efficacy




Decreased broadleaf weed cover at all timings

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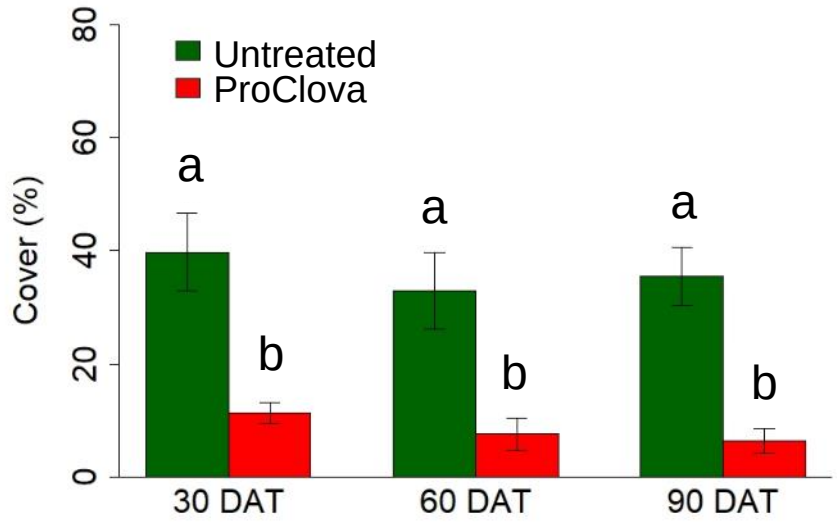
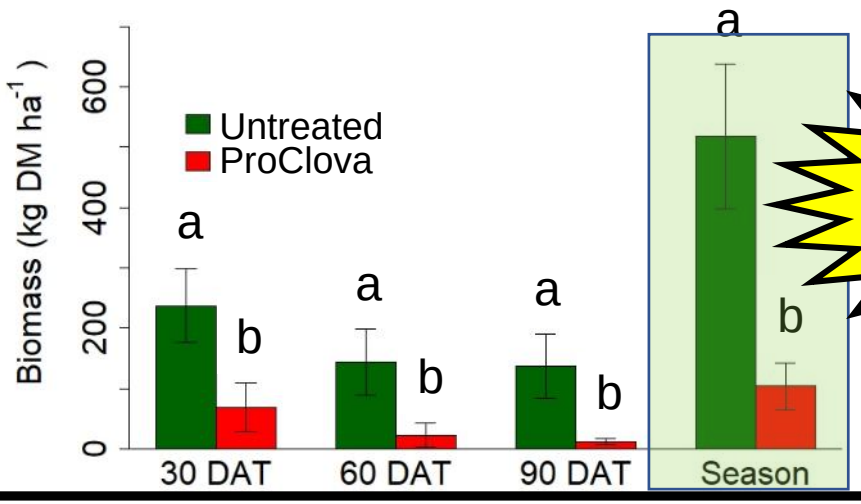


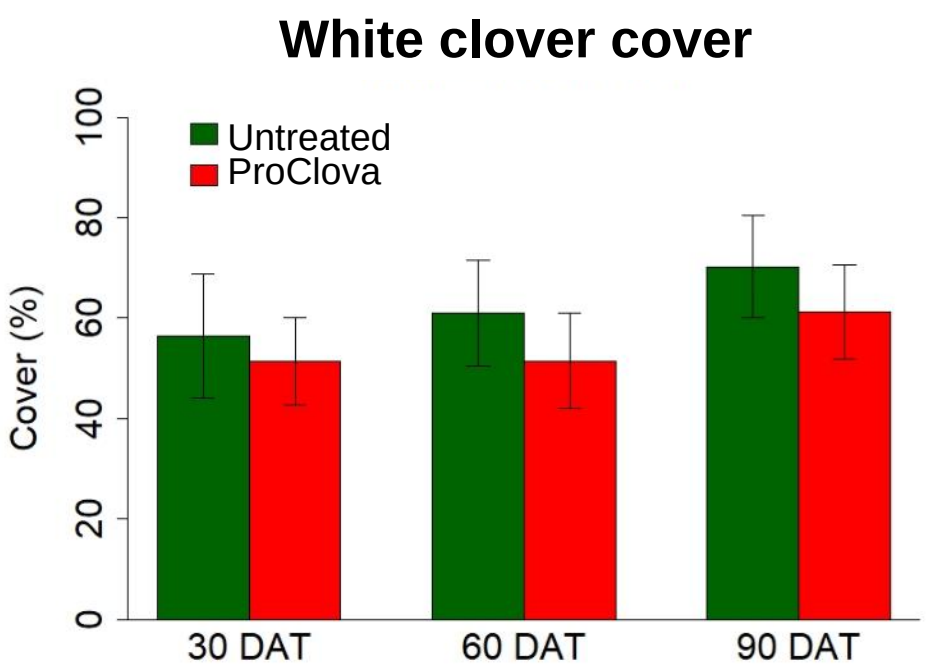

## Broadleaf weeds biomass




5 times lower

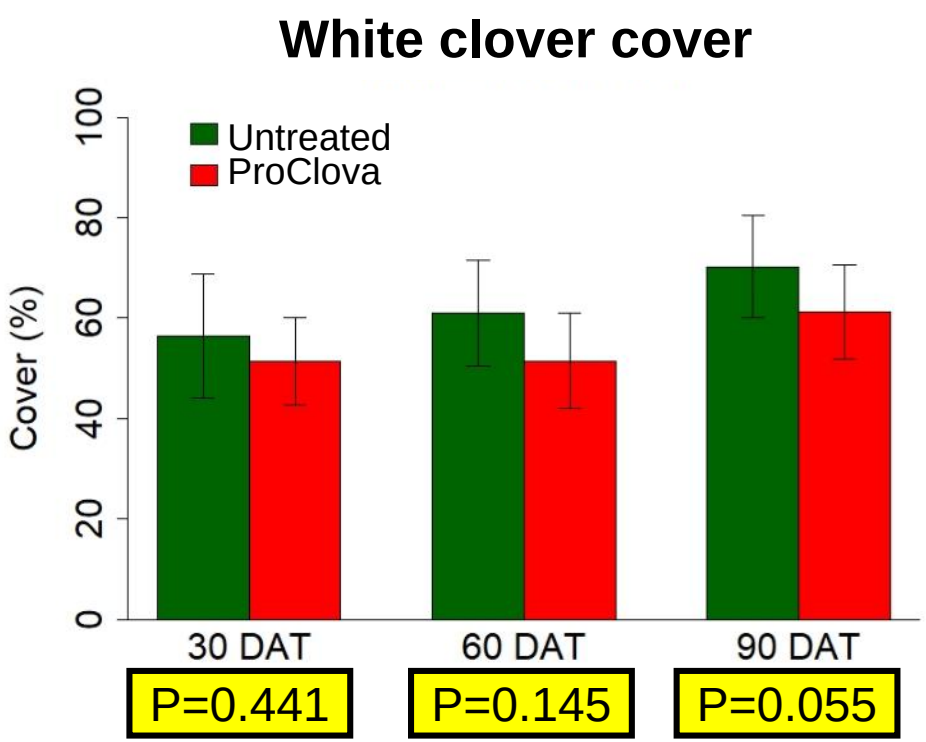
**White clover lack of symptoms at 20 DAT while bull thistle showing chlorosis and necrosis**

# Results: White Clover Tolerance




**ProClova (24 fl oz acre$^{-1}$) @ 90 DAT**

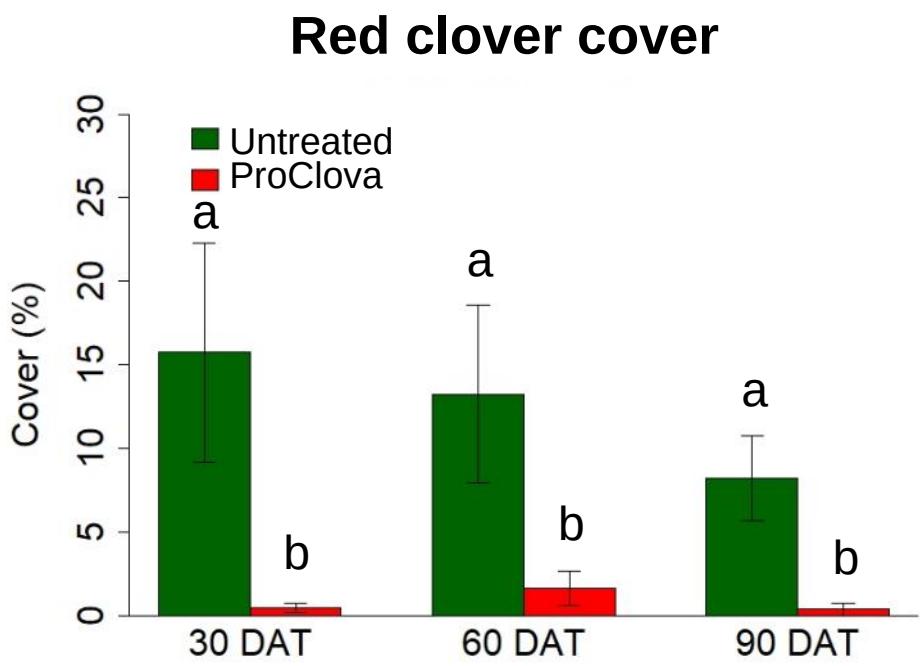
# Results: White Clover Tolerance

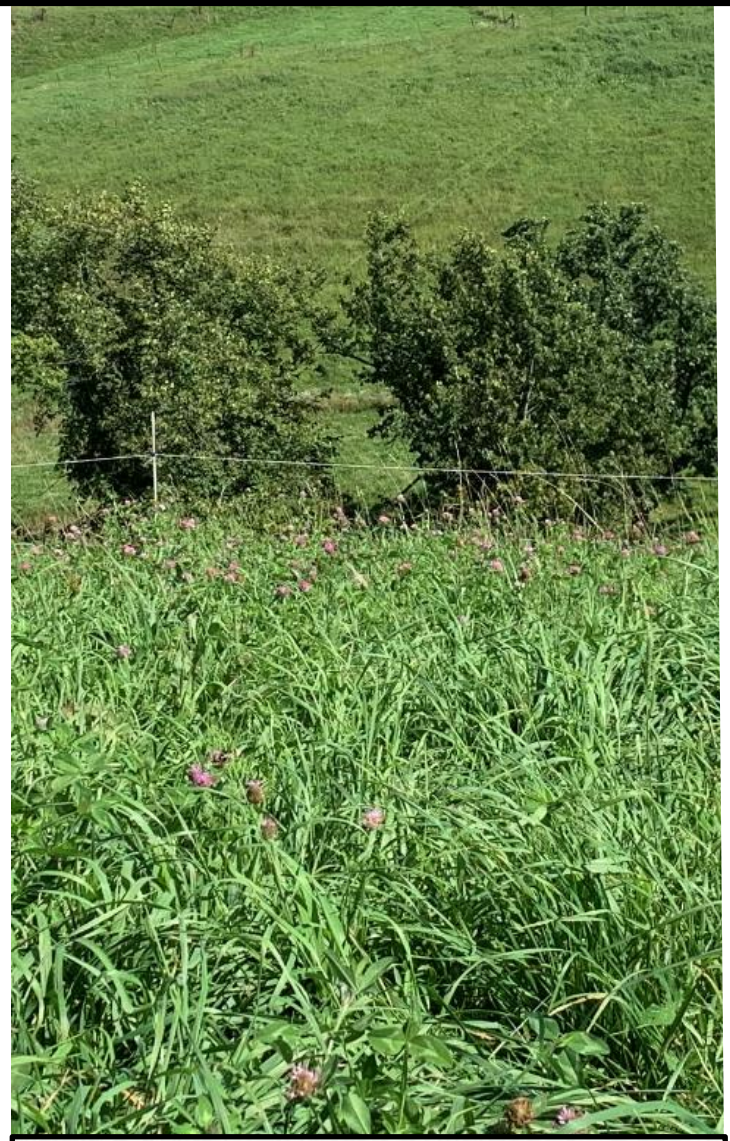



No differences were detected at all timings

**ProClova (24 fl oz acre$^{-1}$) @ 90 DAT**

# Results: Red Clover Tolerance

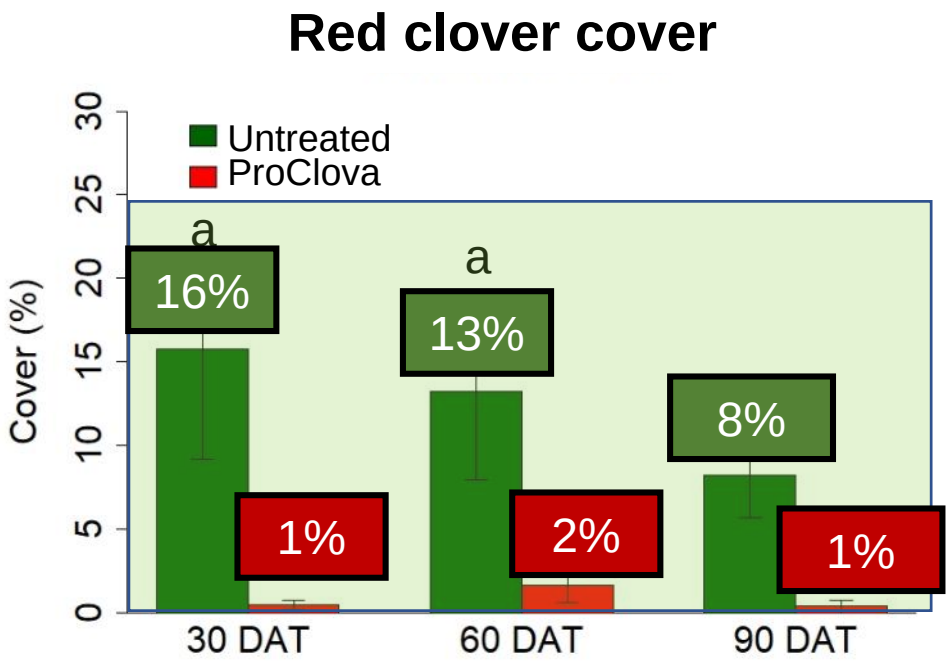


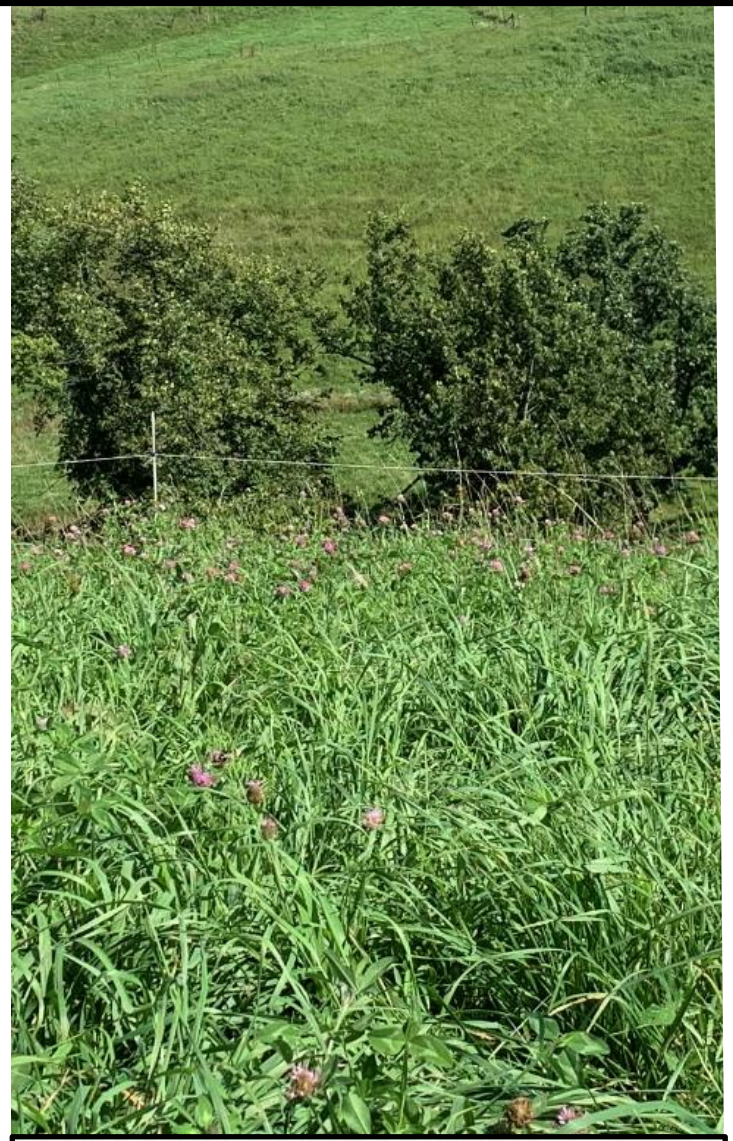
Control @ 60 DAT

ProClova @ 60 DAT

# Results: Red Clover Tolerance



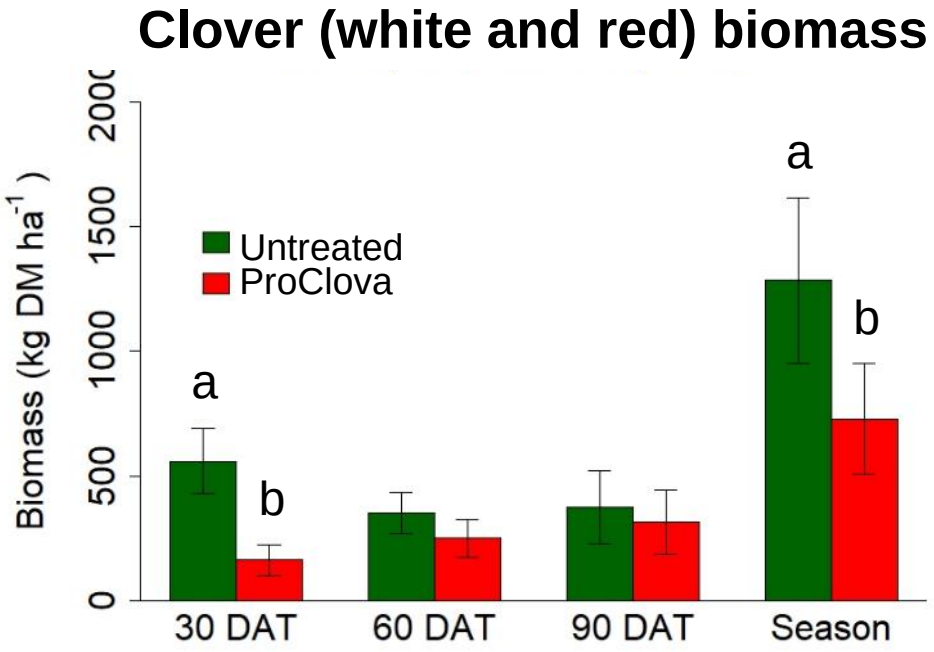

Decreased red clover cover at all timings



Control @ 60 DAT

ProClova @ 60 DAT

# Results: Clover (white and red) Biomass

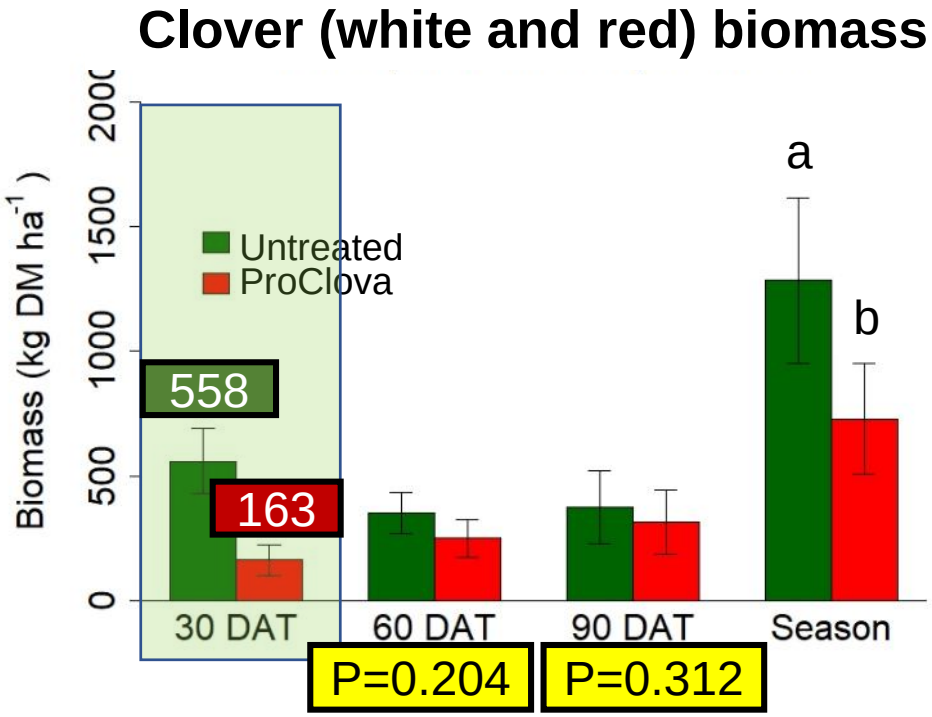



Control @ 60 DAT

ProClova @ 60 DAT

ProClova (24 fl oz acre$^{-1}$) @ 90 DAT

# Results: Clover (white and red) Biomass



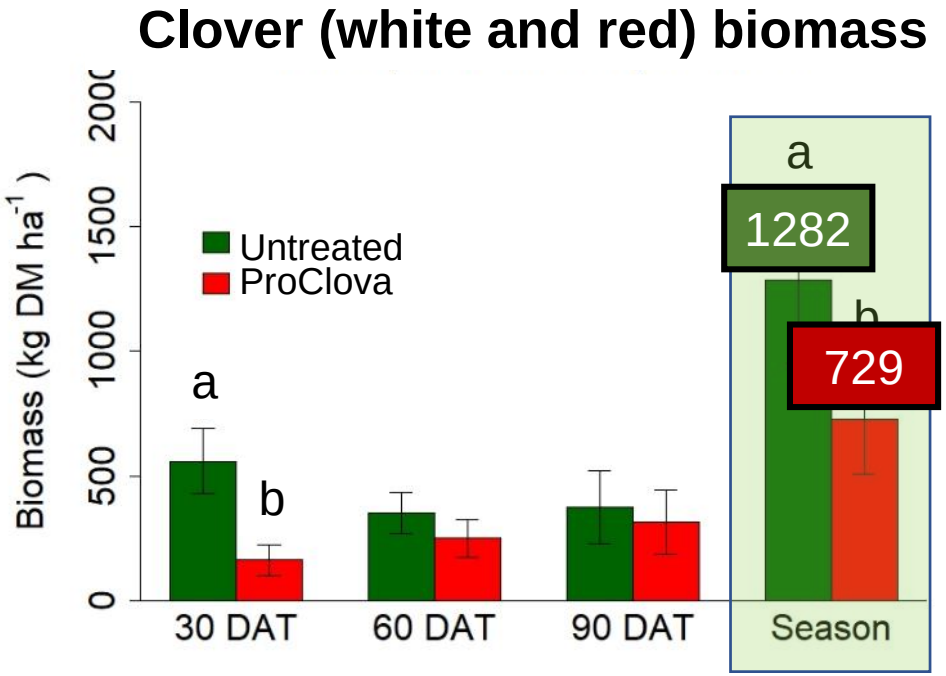

Control @ 60 DAT

ProClova @ 60 DAT

ProClova (24 fl oz acre$^{-1}$) @ 90 DAT

- Lower clover (white and red) biomass at 30 DAT
- No differences at 60 and 90 DAT

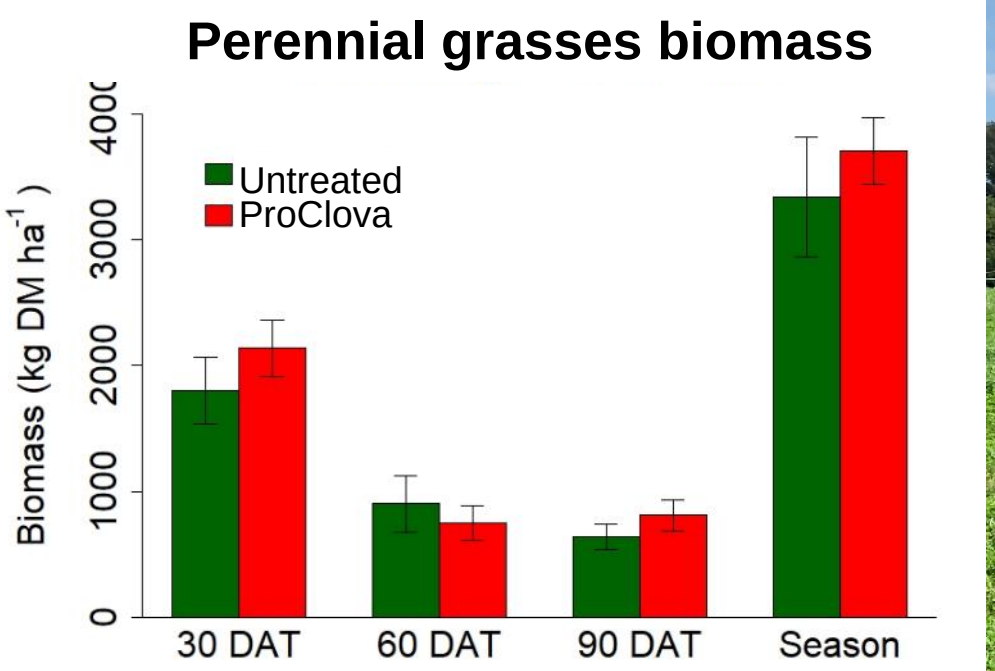
# Results: Clover (white and red) Biomass




Lower total season clover (white and red) biomass

**ProClova (24 fl oz acre$^{-1}$) @ 90 DAT**

# Results: Perennial Grasses Biomass




| P=0.143 | P=0.352 | P=0.233 | P=0.334 |
|---|---|---|---|

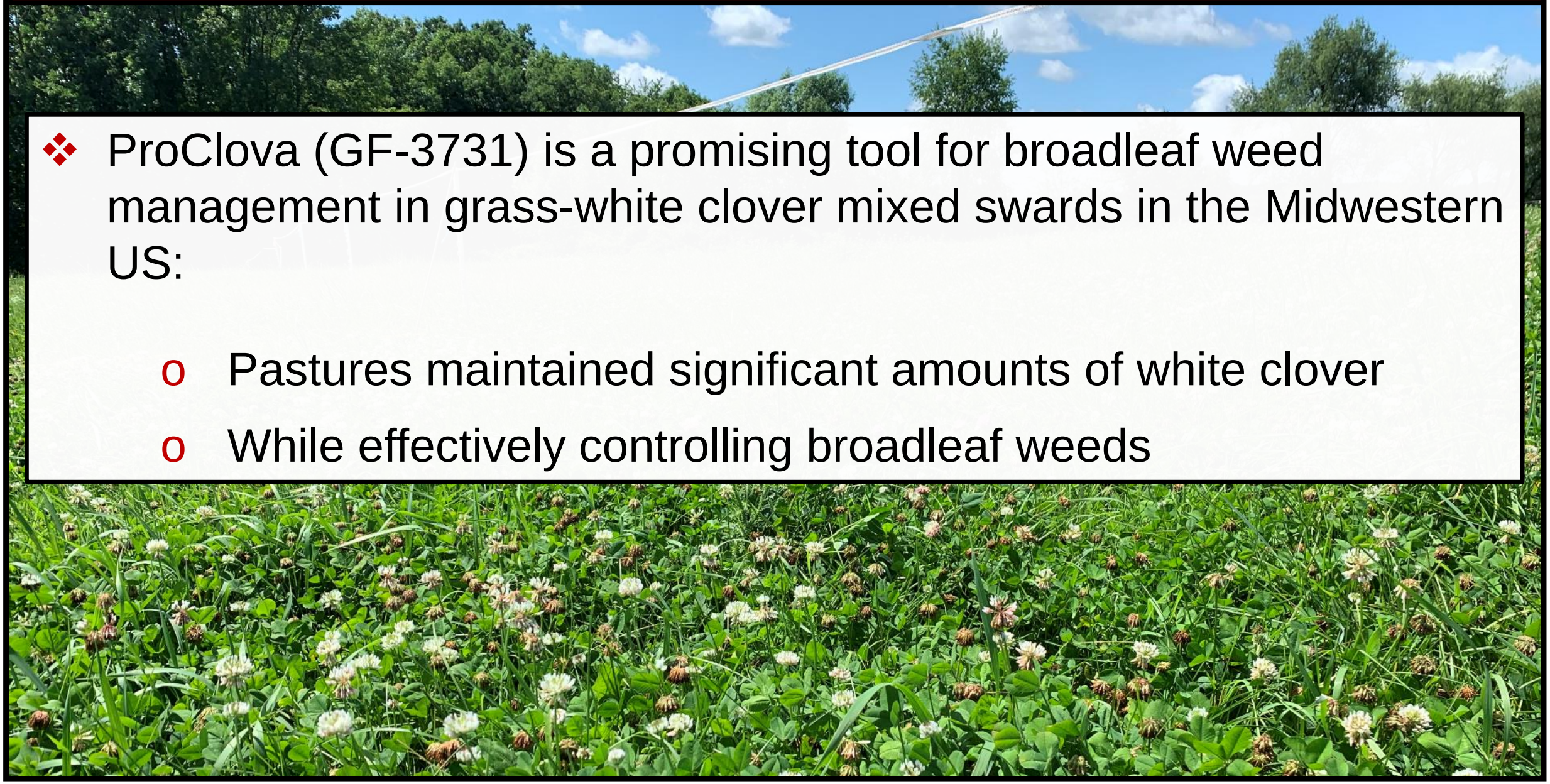
There were no significant differences

**ProClova @ 90 DAT**

**Control @ 90 DAT**


# What about forage utilization?

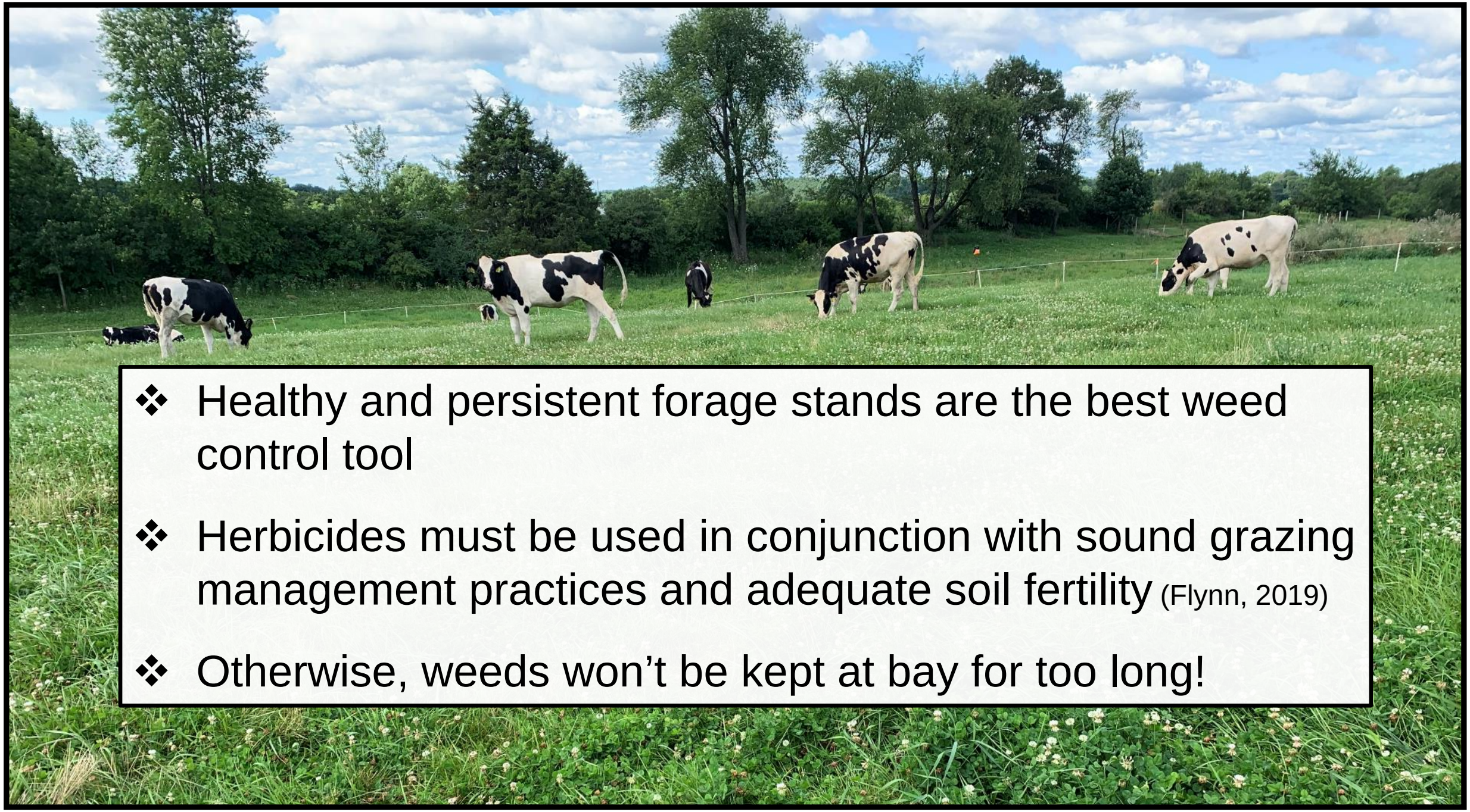
# Take Home Message



- ProClova (GF-3731) is a promising tool for broadleaf weed management in grass-white clover mixed swards in the Midwestern US:
  - Pastures maintained significant amounts of white clover
  - While effectively controlling broadleaf weeds

# Future Research

- Continue to evaluate effectiveness on additional pasture weeds (how effective on perennials)
- Evaluate the effectiveness when applied in fall (and clover tolerance)
- Can grazing within days after application reduce impact to red clover?
- Does its use increase profitability of beef/dairy grazing operations?



- Healthy and persistent forage stands are the best weed control tool
- Herbicides must be used in conjunction with sound grazing management practices and adequate soil fertility (Flynn, 2019)
- Otherwise, weeds won't be kept at bay for too long!

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