



United States Department of Agriculture



# Interseeding alfalfa or red clover into corn silage as dual-purpose cover and forage crops



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**Corn silage and alfalfa are often grown in rotation to provide forage for livestock, but low yields of spring-seeded alfalfa reduce profitability**

**Rotation: Corn – corn – spring seeded alfalfa – alfalfa – alfalfa**

**Forage dry matter yields**

**Corn silage: 9 t per acre**

**Established alfalfa: 5 t per acre**

**Spring seeded alfalfa: 3 t per acre**





## Excessive corn silage production also causes problems...

- **High risk of soil and nutrient loss**
- **Without crop rotation, corn silage yields decline and input costs for fertilizer and pesticides increase**





## Possible solution: Interseed alfalfa into corn to protect soil and jumpstart full alfalfa production the following year

- Alfalfa planted into corn interrows
- Corn silage harvested, alfalfa remains as a cover crop
- Following year(s) alfalfa harvested as a forage crop





## **Problem: Interseeded alfalfa is prone to stand failure**

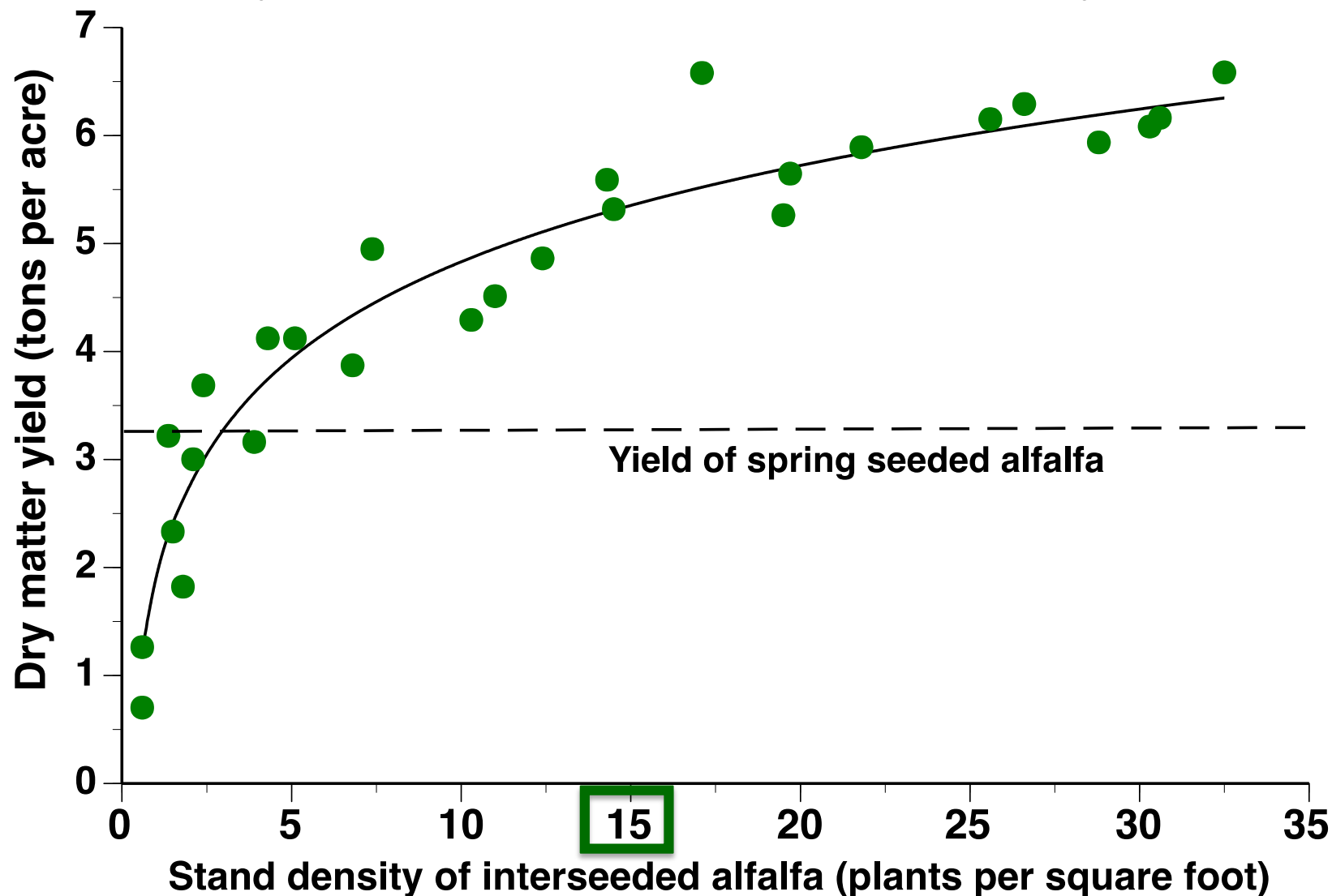


**Objective: Develop reliable, productive, and profitable interseeded alfalfa-corn silage production systems**



**Goal: Want >15 alfalfa plants per square foot after corn silage harvest to maximize 1<sup>st</sup> year yields of alfalfa**

(2018 and 2019 data from Prairie du Sac, Wisconsin)



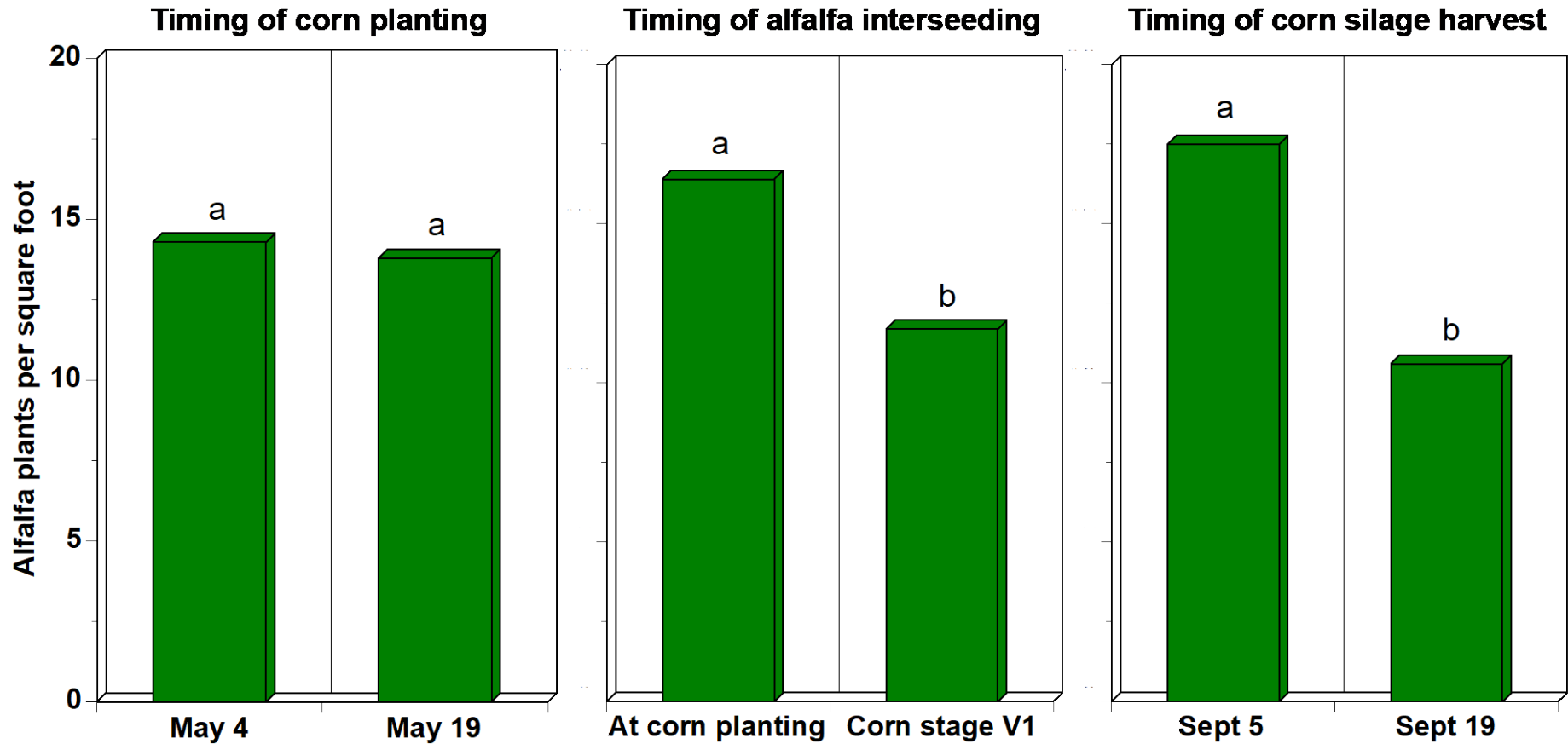


# **Impact of management practices on establishment of interseeded alfalfa**



# Establishment of alfalfa favored by early interseeding and early corn harvest, but not influenced by timing of corn planting

Requires further study



Alfalfa stand counts taken after corn silage harvest at Prairie du Sac, Wisconsin in 2017.

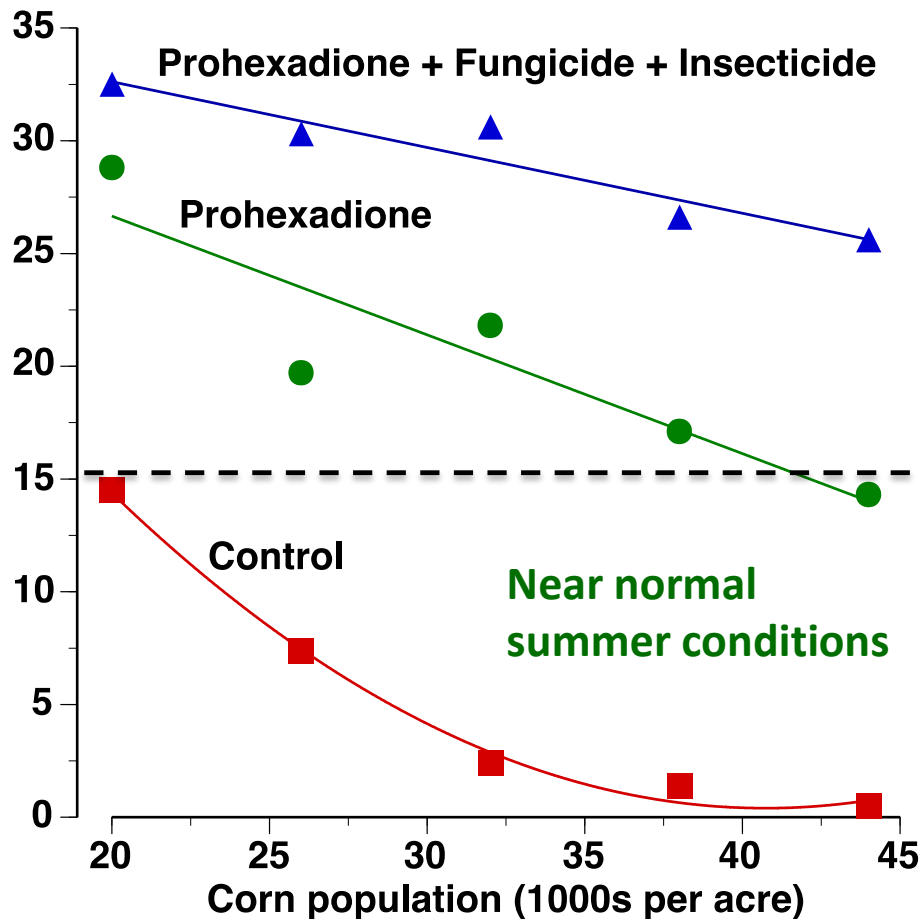
Treatments with unlike letters differ at  $P = 0.05$

# Prohexadione sprayed on alfalfa in June followed by fungicide and insecticide in July improves alfalfa establishment

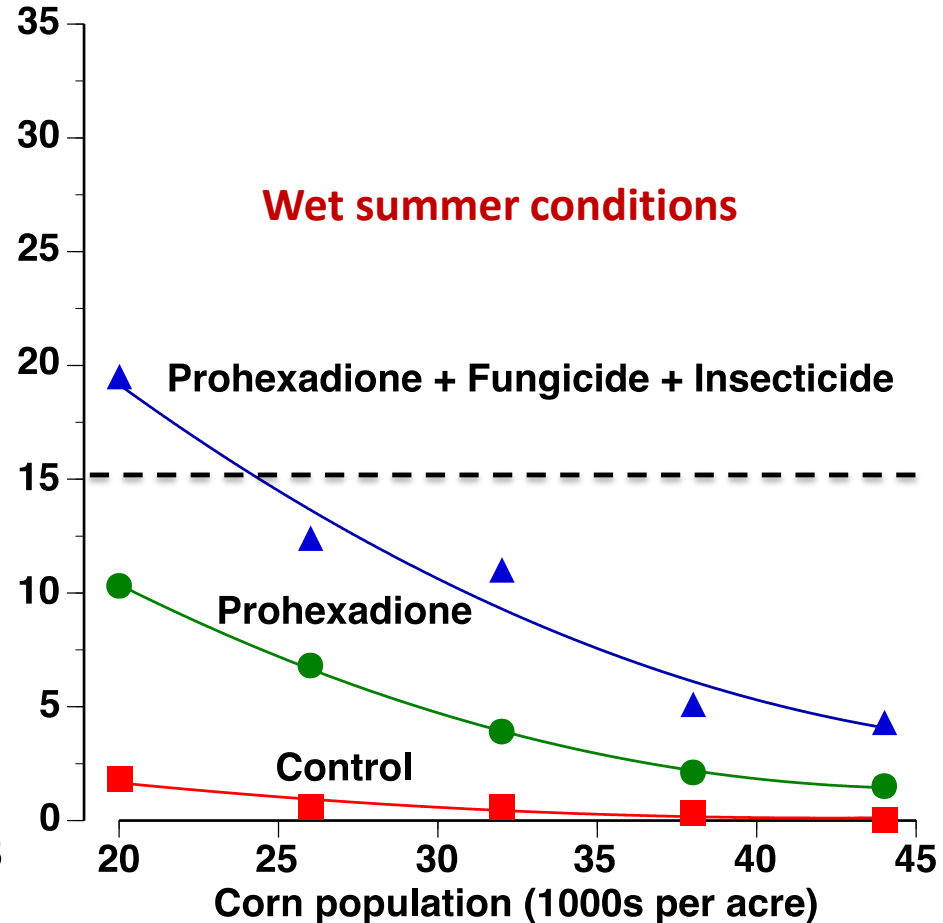
Data from Prairie du Sac, Wisconsin

Confirmed in other Wisconsin locations, but not always observed in other states

Alfalfa plants per sq ft after corn harvest in 2017



Alfalfa plants per sq ft after corn harvest in 2018





**July**

**August**

**October**

**Control**



**Prohexadione**



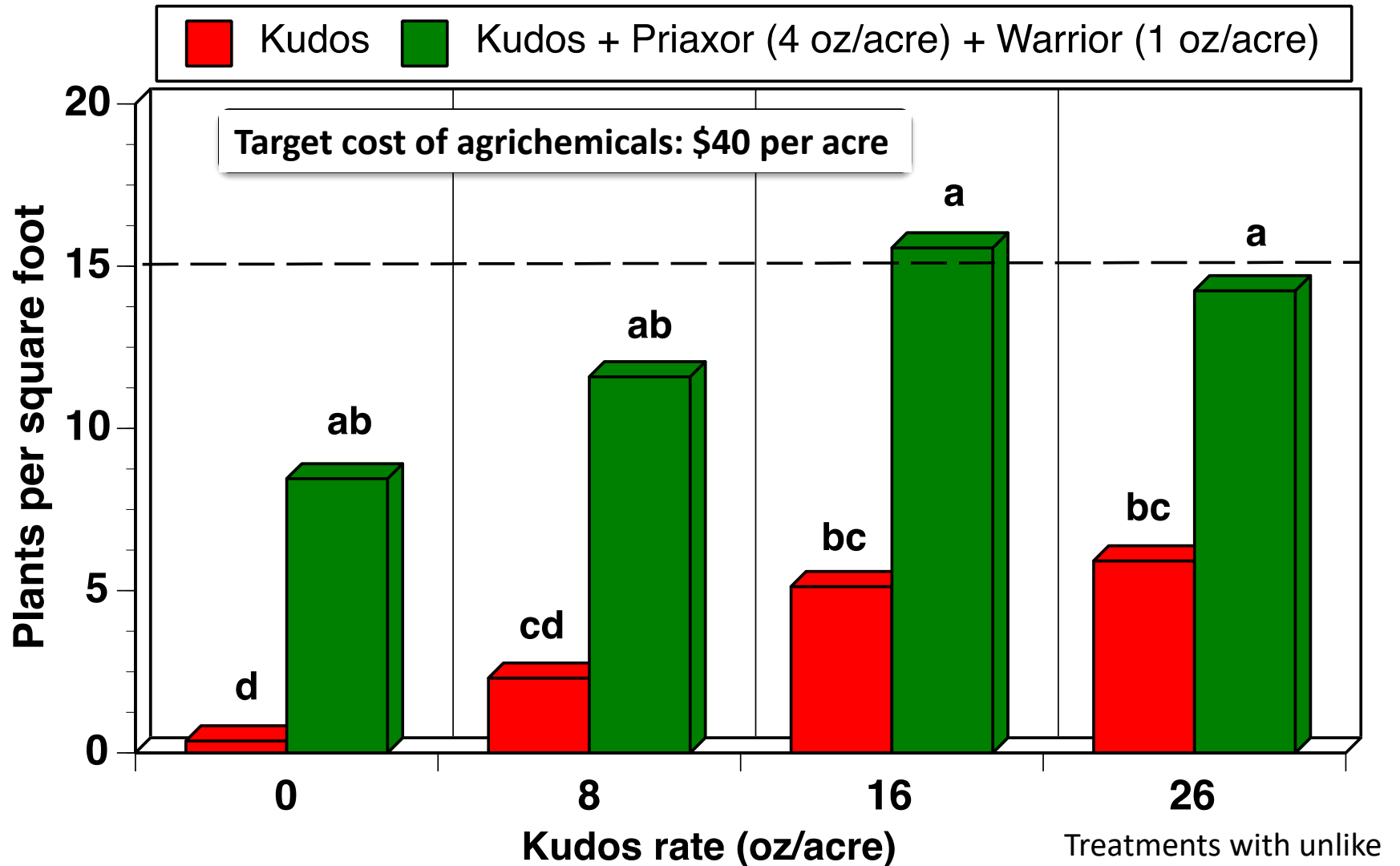
**Prohexadione  
+ Fungicide +  
Insecticide**





# How much (Kudos) with fungicide (Priaxor) and insecticide (Warrior) are needed for alfalfa establishment?

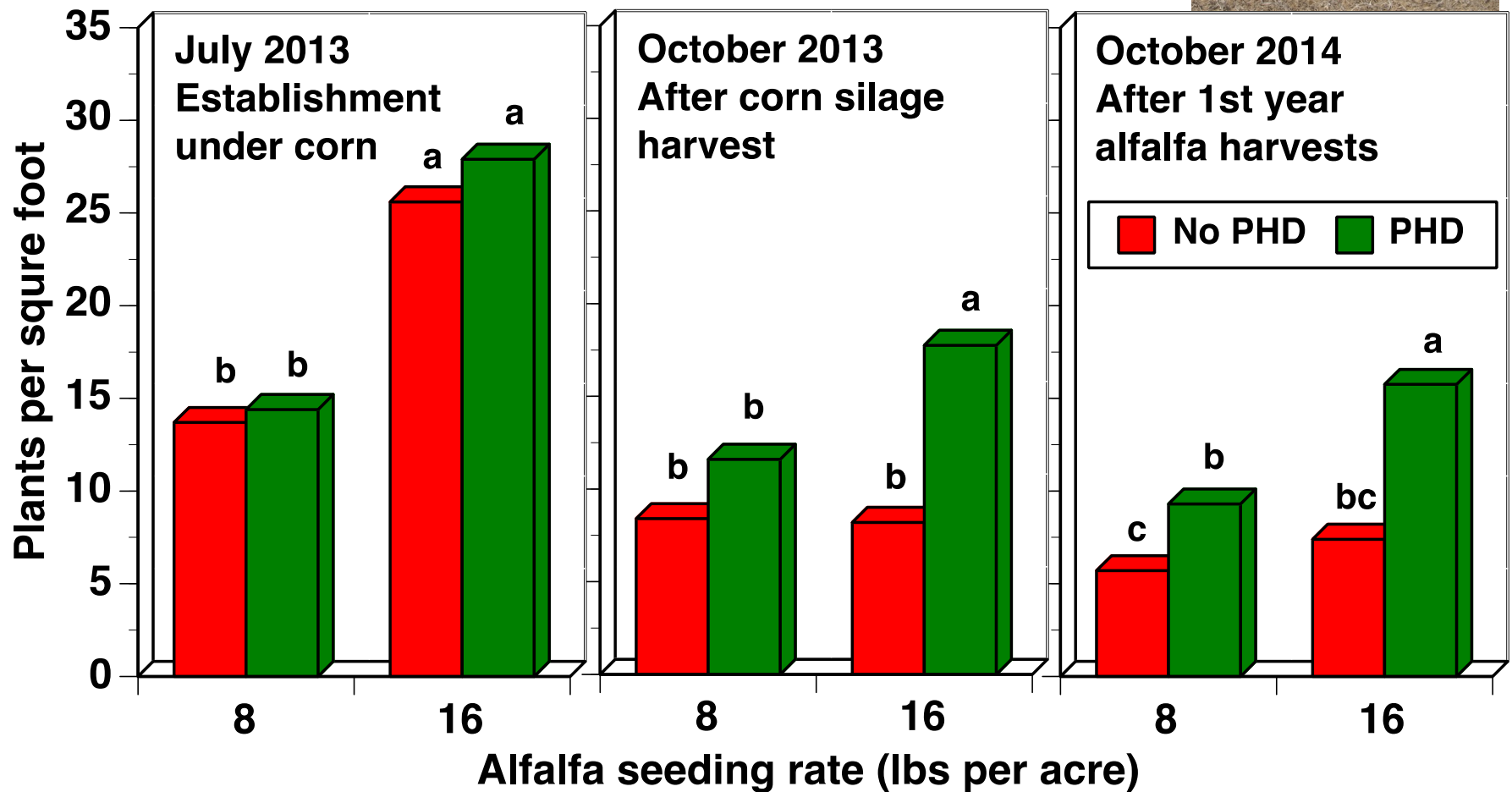
Arlington, Wisconsin 2019. Requires further study



Treatments with unlike letters differ at  $P = 0.05$



Drill alfalfa into properly prepared seedbed,  
use normal seeding rates, and treat seedlings  
with agrichemicals such as prohexadione (PHD)

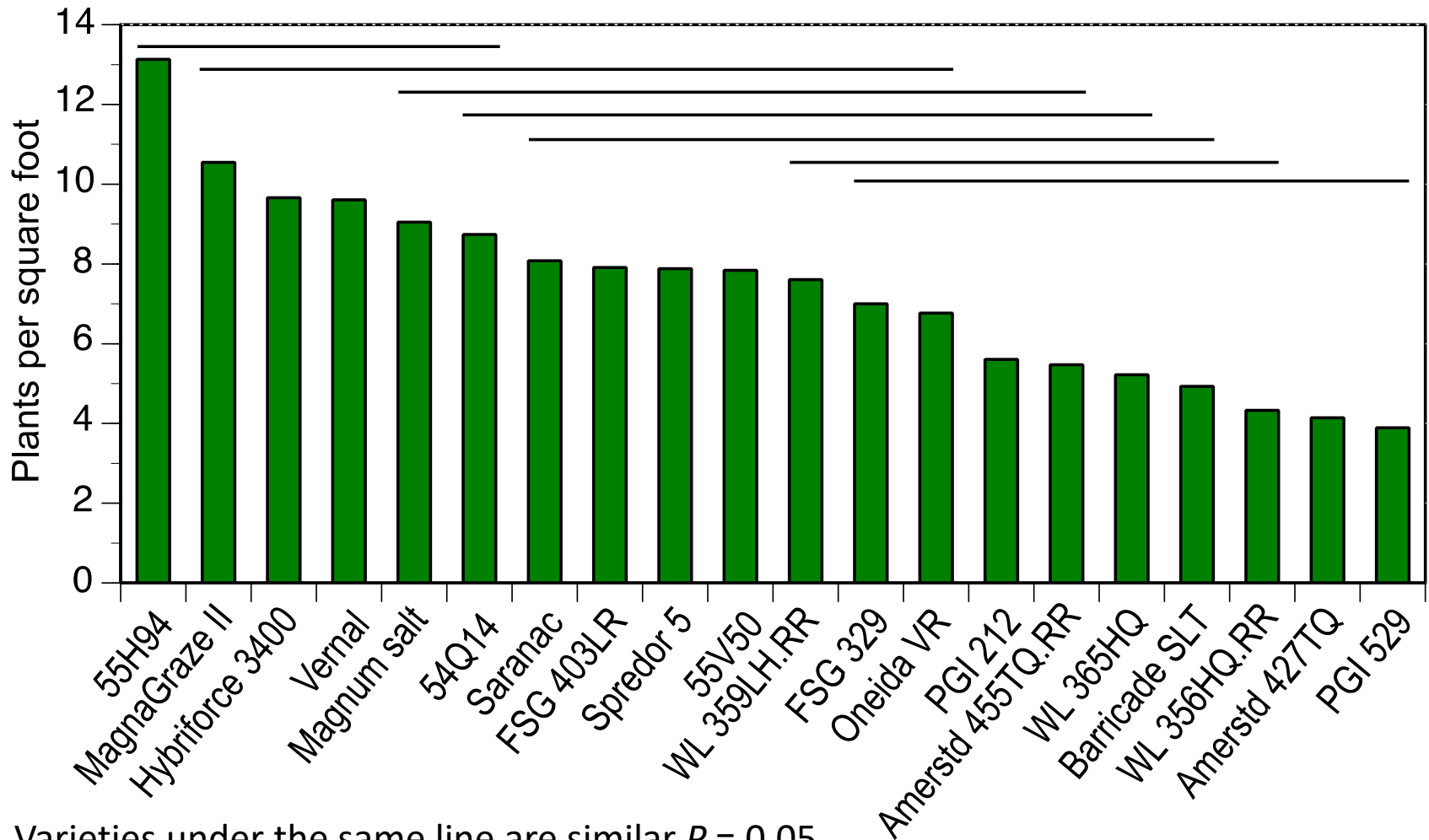


Treatments with unlike letters differ at  $P = 0.05$

Grabber, J.H. Agronomy J. 108:726-735 (2016)

# Use alfalfa varieties that are well-adapted for establishment under corn

Stand density after corn in 2016, averaged across two sites in Wisconsin  
Confirmed in other Wisconsin studies, but not always observed in other states





# Use appropriate herbicides for controlling weeds in corn with interseeded alfalfa

## Conventional alfalfa (Arlington, Wisconsin 2016)

Crop(s)	Herbicide treatment	Timing	Weed cover (%) 2 weeks after POST	Alfalfa cover (%) 2 weeks after POST
Corn + alfalfa	Warrant 3 pt/A + Buctril 2EC 1 pt/A	PRE + POST	2 c	89 a
Corn + alfalfa	Non-treated control	-	23 b	77 b
Corn	Non-treated control	-	67 a	-
			$P < 0.05$	$P < 0.05$

Herbicides often reduce weed cover to < 10% but avoid seeding in fields infested with summer annual grasses

Alfalfa interseeding partially suppresses weeds

## Roundup-Ready alfalfa

Glyphosate reliably provides excellent weed control

# Don't interseed...



...during a spring drought  
(remember 2012!)



...into weedy, poorly drained,  
acidic or infertile fields, or  
poorly prepared seedbeds





**Wet soil conditions at corn silage harvest in early September**



**Stand recovery by mid October**

Photos by Brad Holtz

**Minimize wheel traffic of alfalfa when chopping corn, especially on wet soil**

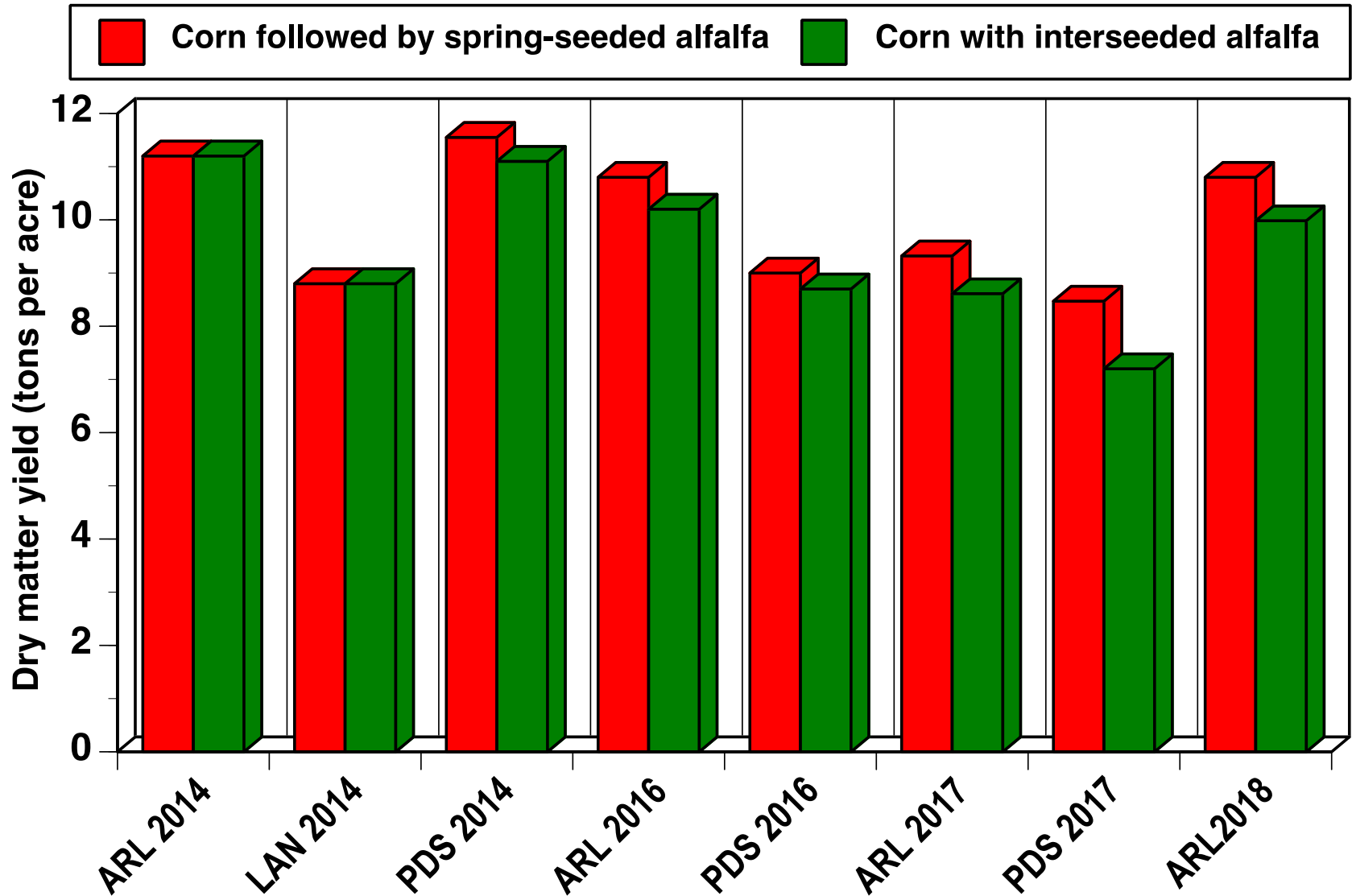


**On wet soils, severe compaction from truck tires kills alfalfa**

**What's the yearly variation  
in yields for corn silage  
and interseeded alfalfa?**

# Alfalfa interseeding reduces corn silage yields in some environments, but not others. . . why?

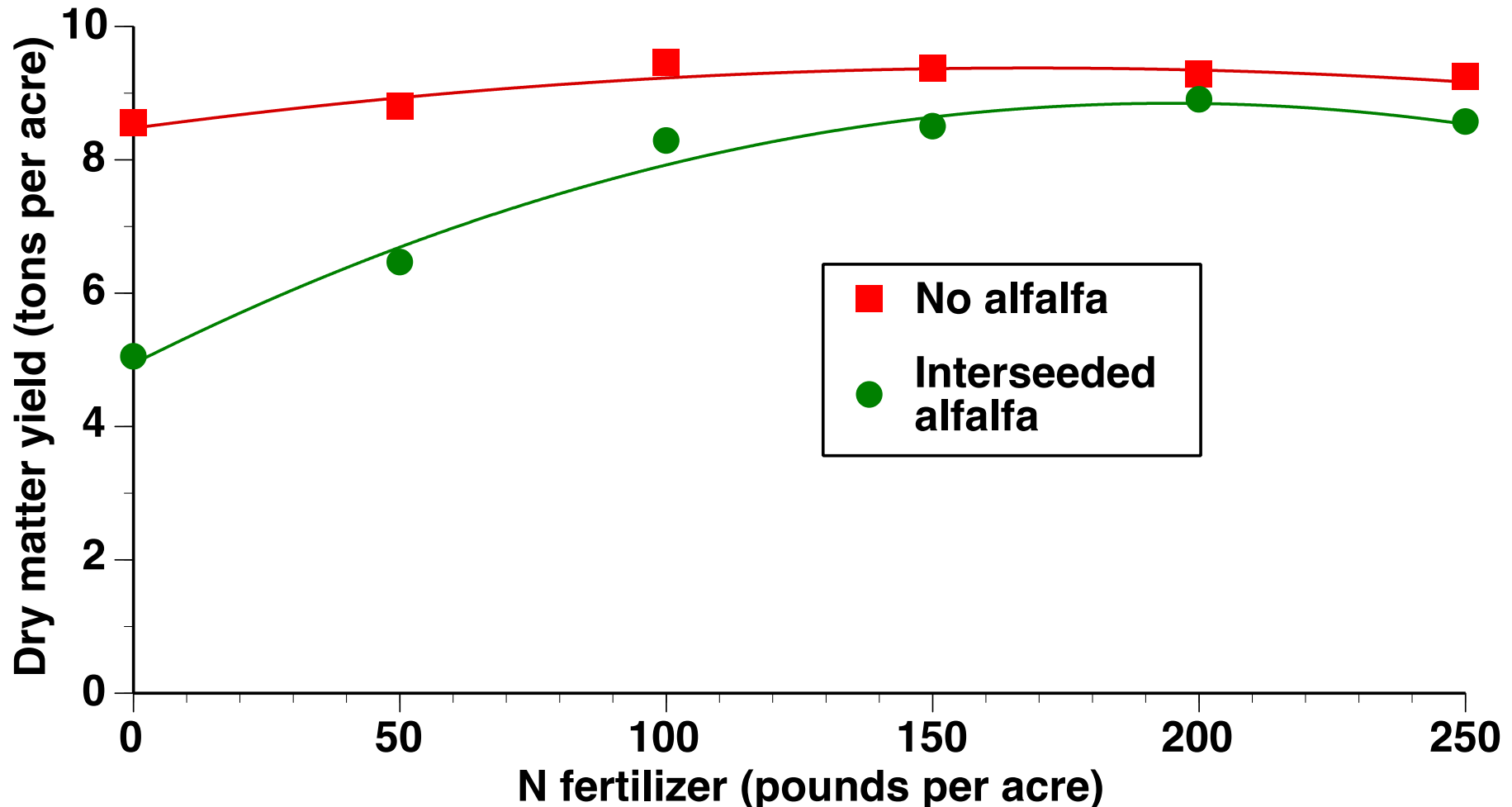
Applied 200 lbs per acre nitrogen fertilizer





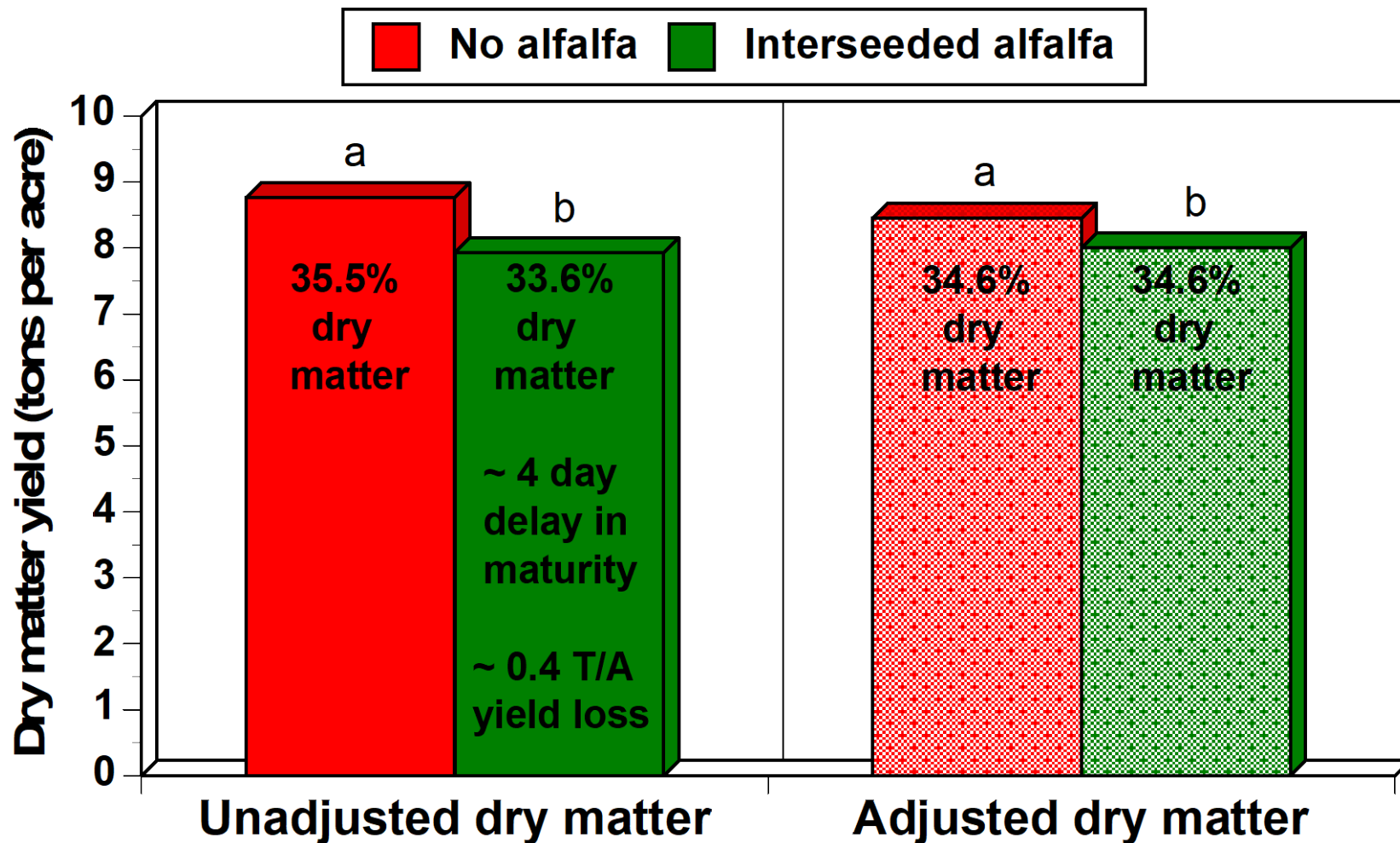
# Need to fertilize corn with adequate nitrogen to maximize silage yield

Arlington, Wisconsin 2017. Fertilizer management requires further study



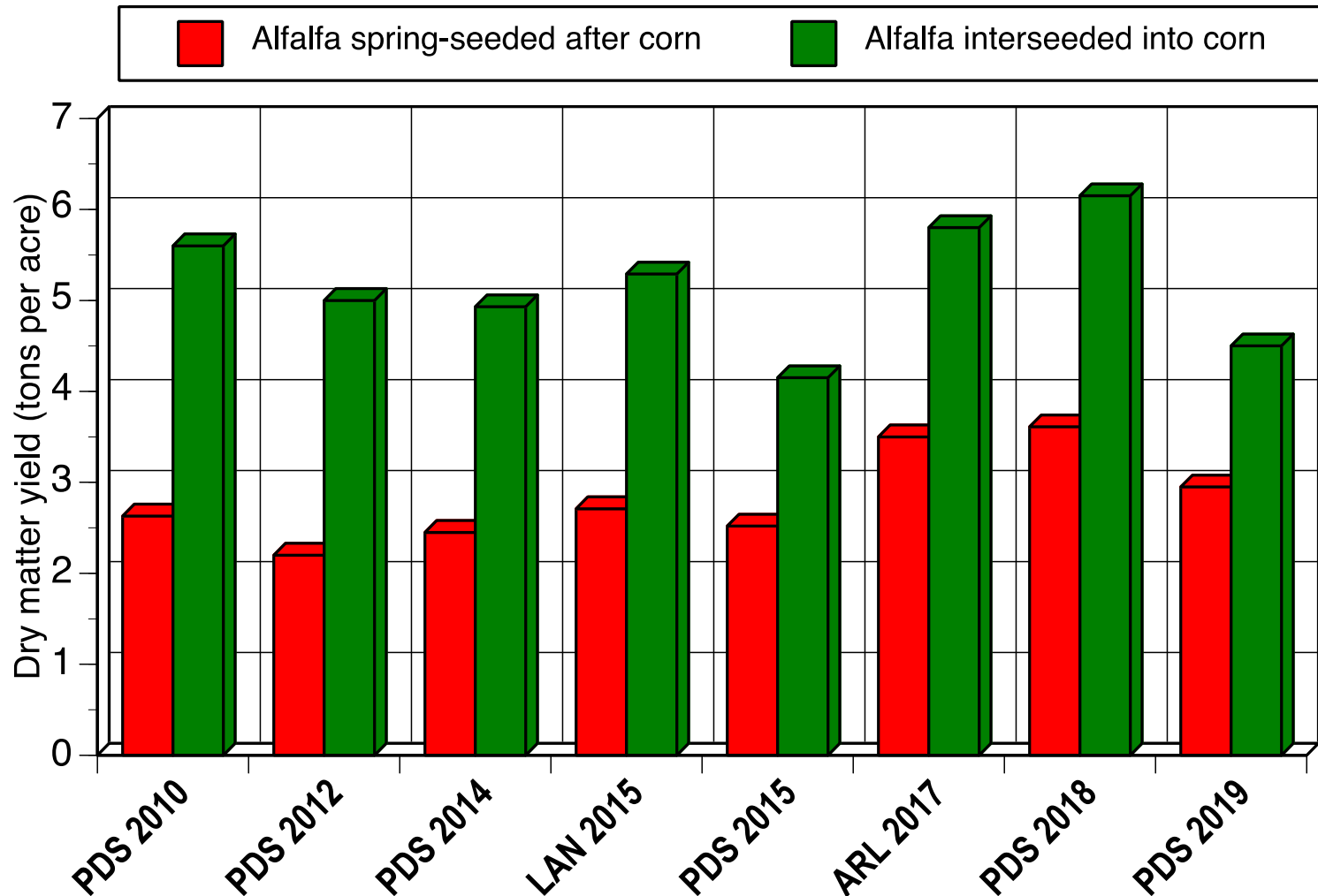
# Interseeding slightly delays corn development so monitor dry matter prior to silage harvest

Prairie du Sac, Wisconsin 2017



Treatments with unlike letters differ at  $P = 0.05$

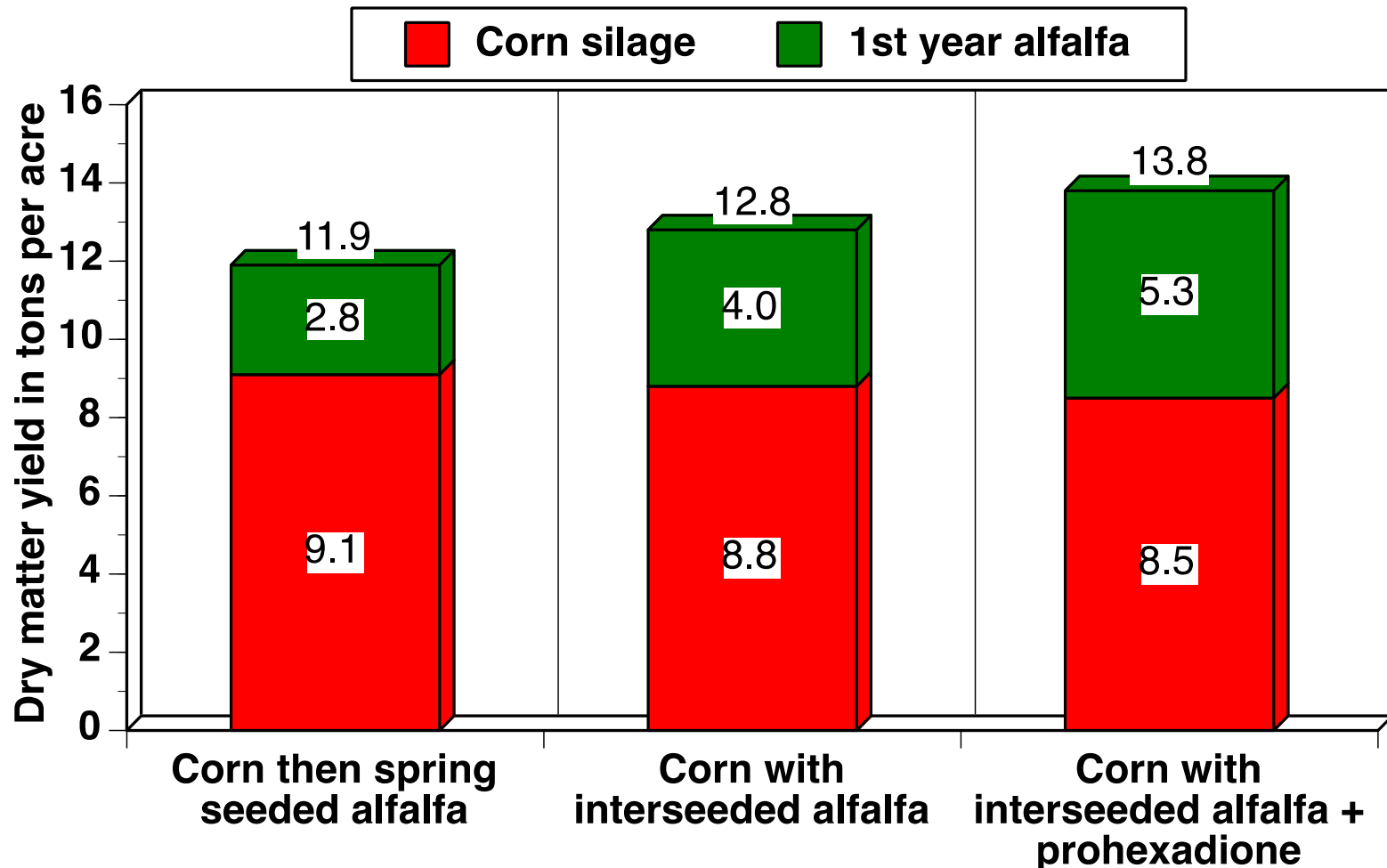
# First year alfalfa yields are increased by 1.6 to 2.3-fold by successful interseeding into corn



Treatments differ at  $P = 0.05$



**Overall, successful alfalfa interseeding increases total dry matter yields of corn silage followed by 1<sup>st</sup> year alfalfa compared to conventional spring seeding of alfalfa**



Alfalfa interseeded at corn planting on May 4th with corn harvest on Sept 19<sup>th</sup> in 2017.  
Alfalfa was harvested 3-4X during 2018 at Prairie du Sac, Wisconsin.

**But will interseeding of  
alfalfa be profitable?**



# Switching from spring seeding to interseeding of alfalfa could increase average net returns of corn silage (CS)-alfalfa (A) rotations by about 12%

**Most profitable rotation with spring seeding (8 years):**

**CS1-CS2-CS3-CS4-A1-A2-A3-A4**  
**Net return averaged across**  
**rotation **\$129 per acre per year****

**Most profitable rotation with interseeding (6 years):**

**CS1-CS2-CS3/A1-A2-A3-A4**  
**Net return averaged across**  
**rotation **\$144 per acre per year****

**Key assumptions:**

- Interseeded alfalfa increases corn N requirements from 160 to 200 lbs per acre
- Interseeded alfalfa reduces corn silage yield by 5%, but doubles 1<sup>st</sup> year alfalfa yield
- \$48 per acre cost for applying agrichemicals to interseeded alfalfa
- 80% success rate for alfalfa establishment by interseeding

**Is interseeded alfalfa an  
effective cover crop?**



# Interseeding alfalfa in corn substantially reduces soil and nutrient loss from cropland compared to corn grown without a cover crop

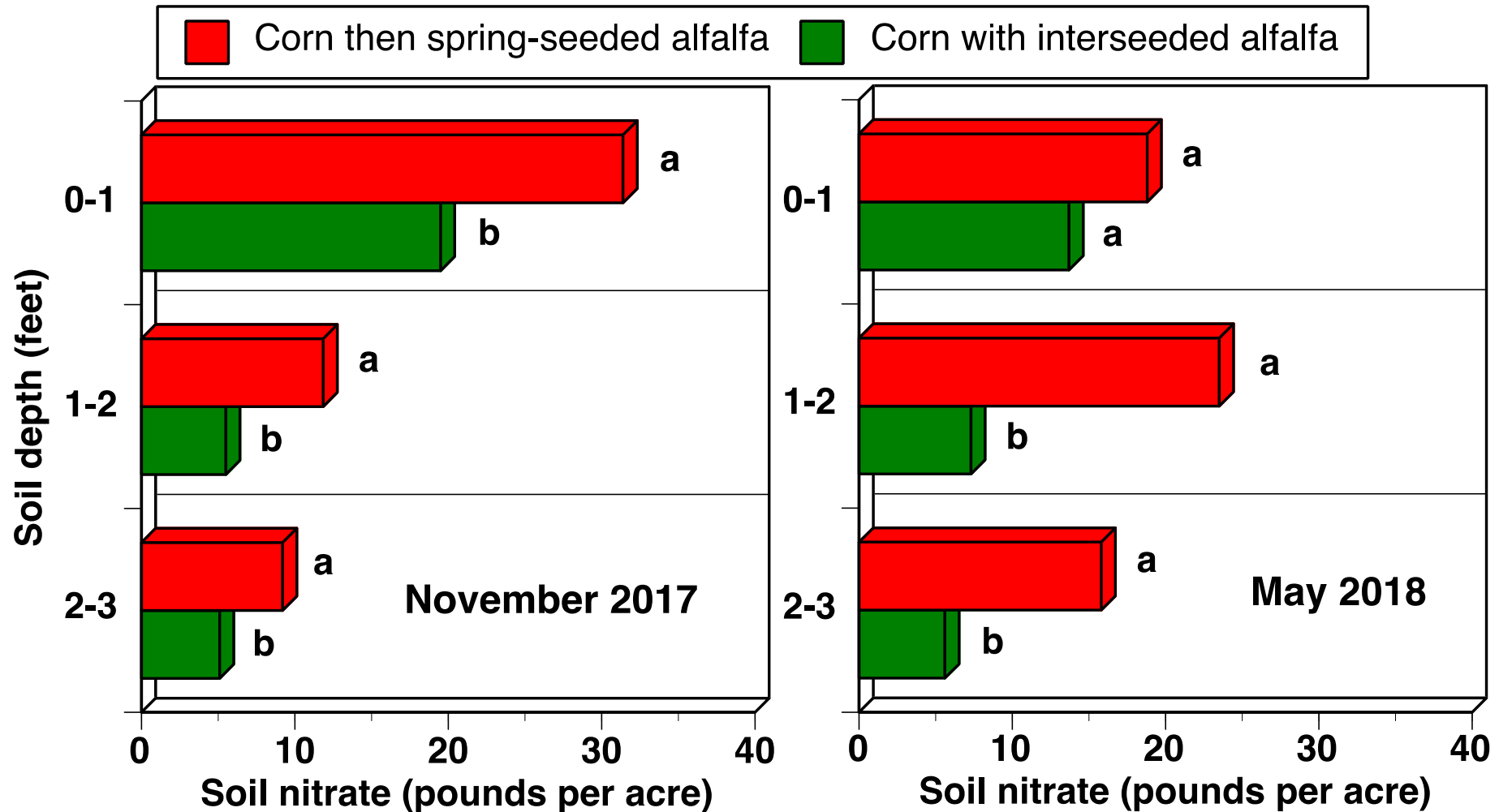
Reductions in runoff  
due to interseeding  
alfalfa in corn

Timing of runoff study	Soil	N	P
Early June during corn production	45%	23%	36%
October after silage corn harvest	86%	72%	62%
Following April before alfalfa production	87%	75%	82%



# Interseeding alfalfa substantially reduces soil nitrate levels after corn silage production

Arlington, Wisconsin



Treatments with unlike letters differ at  $P = 0.05$

# Summary for interseeding alfalfa into corn

- **Fields must have a suitable soil pH, fertility, drainage, and seedbed for alfalfa seeding and avoid weedy fields (esp. summer annual grasses)**
- **Apply manure and fertilizer to support growth of both corn and alfalfa**
- **Plant early- or mid-maturing corn hybrids at a final density of ~32,000 plants per acre (prefer hybrids with quick emergence, strong roots, and excellent stress/drought tolerance)**
- **0 to 10 days after corn planting, drill interseed alfalfa at 16 lbs/acre**
- **Don't interseed if soil moisture is very low and rainfall is not expected**
- **Apply herbicides, prohexadione, fungicide and insecticide (if needed) to promote alfalfa seeding survival and high corn yields**
- **Chop corn in early to mid September at correct moisture for silage.**
- **Avoid chopping when soils are wet, limit wheel tracking, and use low pressure tires (avoid using dump trucks in fields).**
- **Properly fertilize alfalfa with phosphorus, potassium, boron, etc to support forage production and stand longevity.**



Use similar steps when interseeding  
red clover into corn, **BUT** only use  
fungicide to aid establishment



**Priaxor fungicide**

**No fungicide**

# Ongoing work

- **Identify best rates and timing for prohexadione, fungicide, and insecticide application on interseeded legumes**
- **Refine fertilizer, planting and harvest management**
- **Evaluate long-term survival and yield of interseeded legumes**
- **Identify hybrid traits needed to maximize corn yield**
- **Breed forage legumes for improved survival under corn**
- **Evaluate success of the interseeding system in different states**
- **Promote interseeding to producers, industry, NRCS, crop insurance...**



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# QUESTIONS?

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