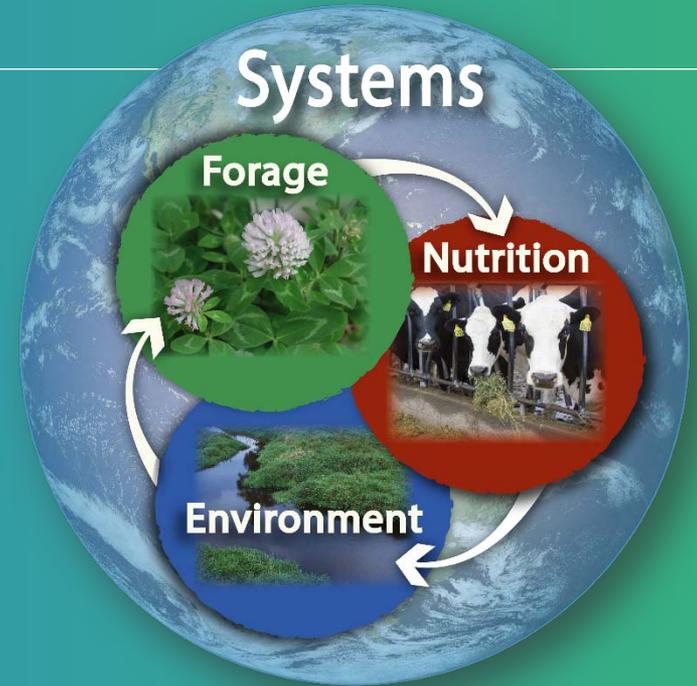




United States Department of Agriculture

Alfalfa varieties differ markedly in seedling survival when interseeded into corn and treated with prohexadione-calcium



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Dairy cattle diets contain >50% forage, often
supplied by silage corn and alfalfa
(typical rotation: corn–corn–corn–establish alfalfa–alfalfa–alfalfa)



Forage yields

Corn: 20 Mg ha⁻¹

Established alfalfa: 10 Mg ha⁻¹

Spring seeded alfalfa: 5 Mg ha⁻¹



Possible solution to low alfalfa yields: Interseed alfalfa into corn to jumpstart full alfalfa production the following year



Problem: Excessive competition between co-seeded species

- Interseeded alfalfa is prone to stand failure
- Corn yields are reduced

Solution: Use growth regulators to lessen interspecies competition

- Prohexadione-calcium (e.g. Apogee, Kudos) promising in preliminary studies

Interseeded alfalfa in July

Control

Prohexadione



Interseeded alfalfa in August

Control



Prohexadione



Interseeded alfalfa in October

Control



Prohexadione



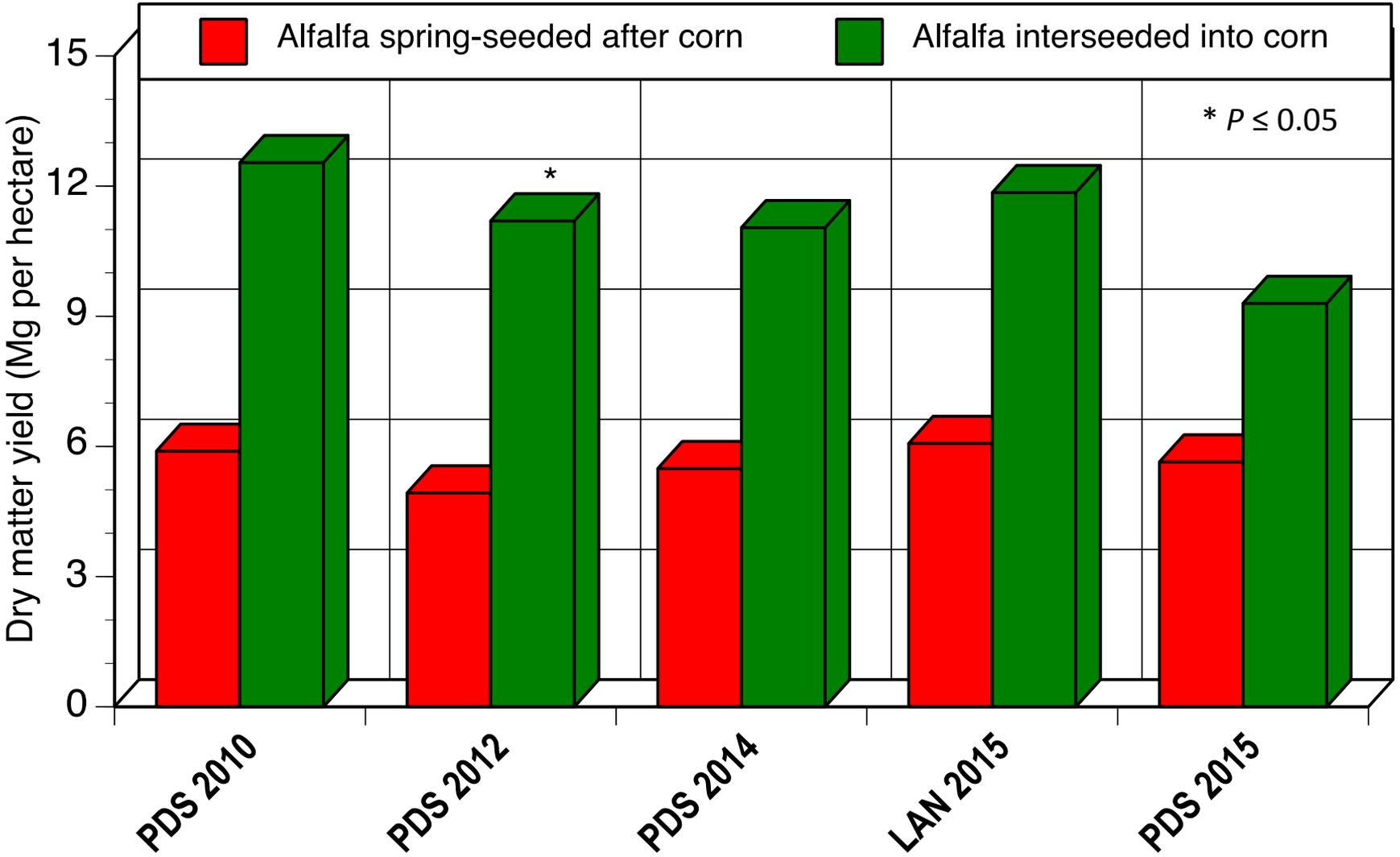
1st year alfalfa growth in early June

Inter-
seeded
into
corn

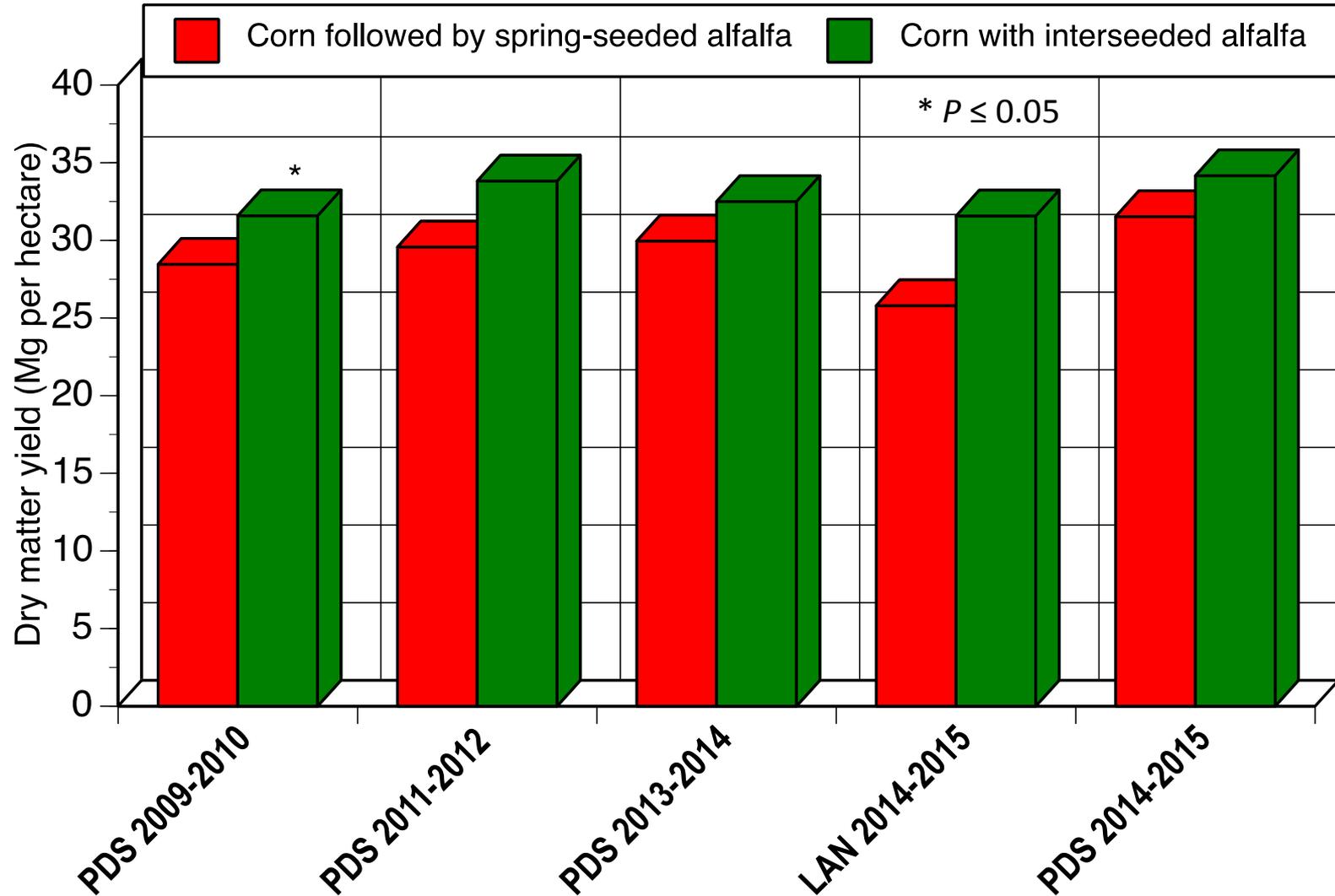


Spring
seeded
after
corn

Successful establishment by interseeding roughly doubles first year alfalfa yields. Prior year prohexadione application boosts interseeded alfalfa yields by up to 15%.



Thus far, successful establishment of alfalfa by interseeding with prohexadione increases total yields of corn plus first year alfalfa by about 13% (~3.6 Mg per hectare)



Problem!

**Frequent stand failure of
interseeded alfalfa at some locations**

Potential solution

**Identify alfalfa varieties that are well-
adapted for interseeding into corn**

Methods for alfalfa variety evaluation in corn

- Replicated field trials were conducted in 2015 on a silt loam soils near Prairie du Sac, WI (good interseeding survival site) and Arlington, WI (poor interseeding survival site).
- Clearfield corn was planted in rows spaced 0.76 m apart in mid May at 90,000 seeds ha⁻¹ with 210 kg ha⁻¹ of N fertilizer.
- Immediately after corn planting, alfalfa varieties were interseeded with a drill at 18 kg ha⁻¹ into 0.76 X 12 m whole plots.
- Weed control PRE with Roundup and POST with Pursuit.
- Sprayed 0 or 0.5 kg a.i. ha⁻¹ of prohexadione-calcium (formulated as 'Apogee' plus AMS, COC, and citric acid) on 20 cm tall alfalfa in 0.76 x 6 m subplots.
- Corn harvested as silage in mid September and then plots uniformly compacted with wheel traffic.

Reported traits of 20 evaluated alfalfa varieties

- Fall dormancy: 2 to 5
- Disease resistance index: 9 to 35
- Other traits (2-3 varieties per trait)
 - Highly resistant to *Aphanomyces* race 3 root rot
 - HR to potato leafhoppers
 - HR to aphids and/or nematodes
 - High “quality” or multifoliate expression
 - Grazing or “traffic” tolerance
 - Salt tolerance
 - “Lodging” resistance
 - Glyphosate tolerance



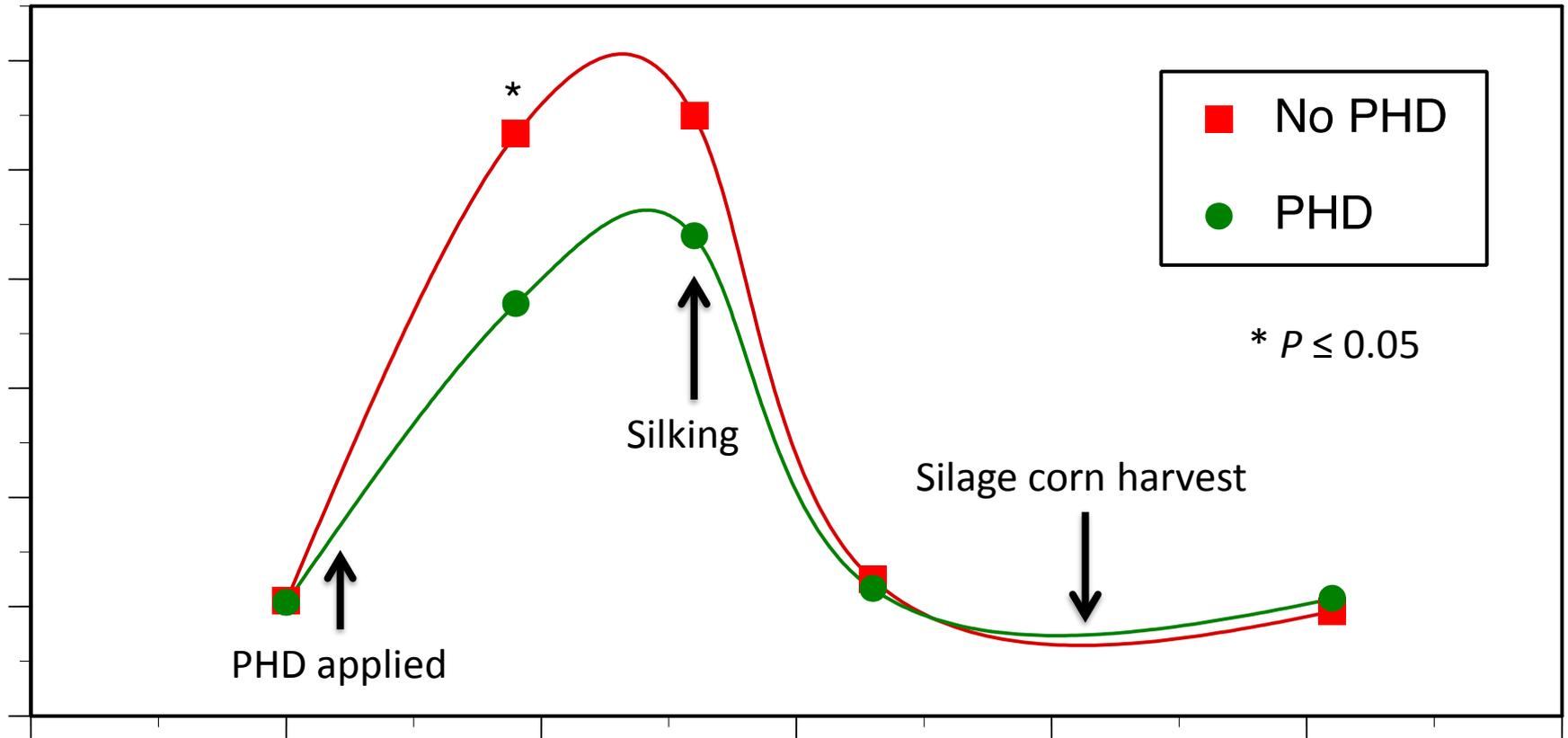
Alfalfa measurements

- Stand density and plant height between June 2015 and October 2015
- Leaf and stem mass in mid July and early August 2015
- Foliar disease ratings in early August 2015
- First cut stand density and dry matter yield in 2016

Results

Prohexadione reduced mid season height of alfalfa interseeded into corn

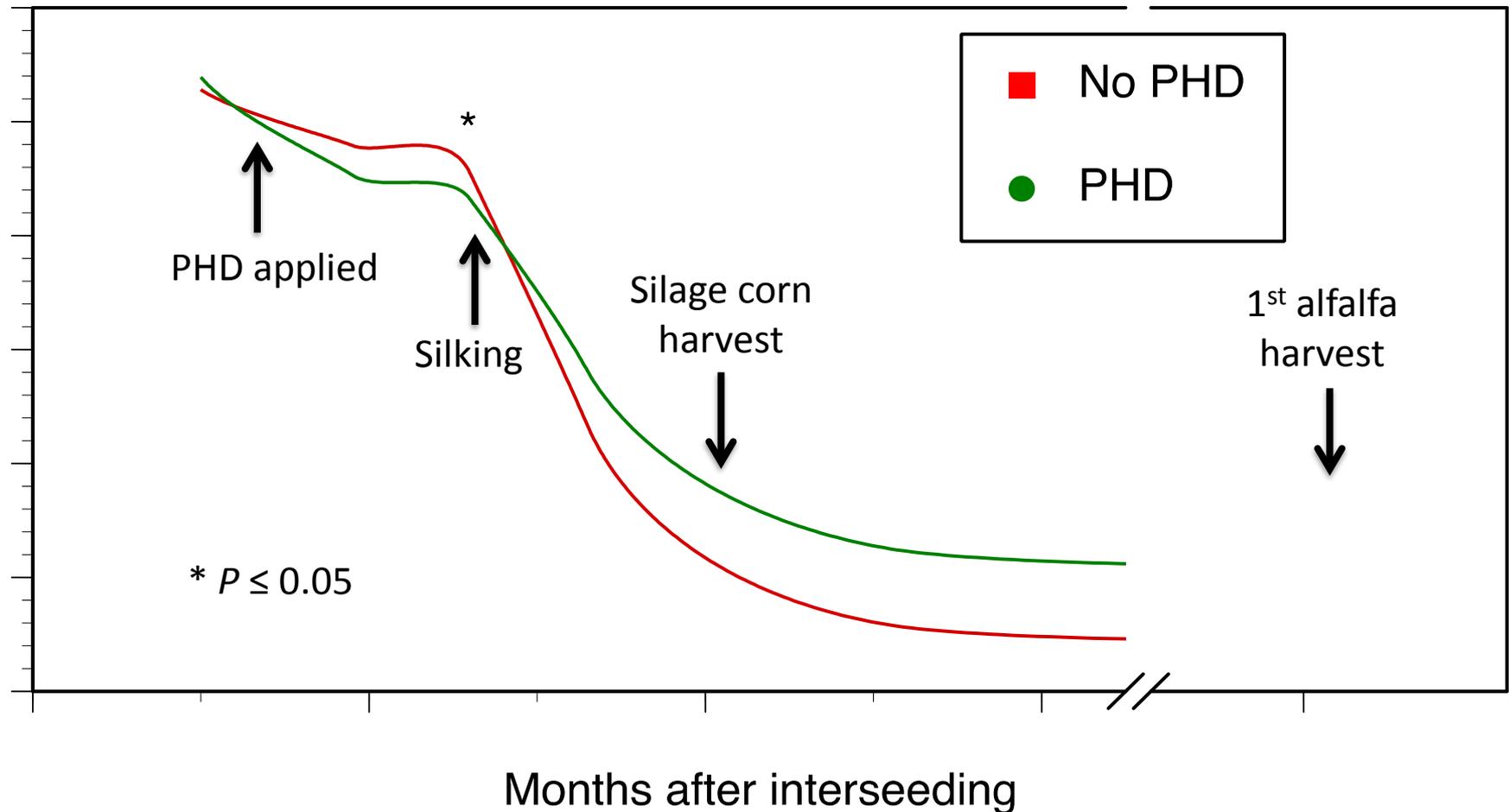
(average of 20 varieties at PDS and Arlington in 2015)



Prohexadione improved late season plant survival of alfalfa interseeded into corn

(average of 20 varieties at PDS and Arlington in 2015)

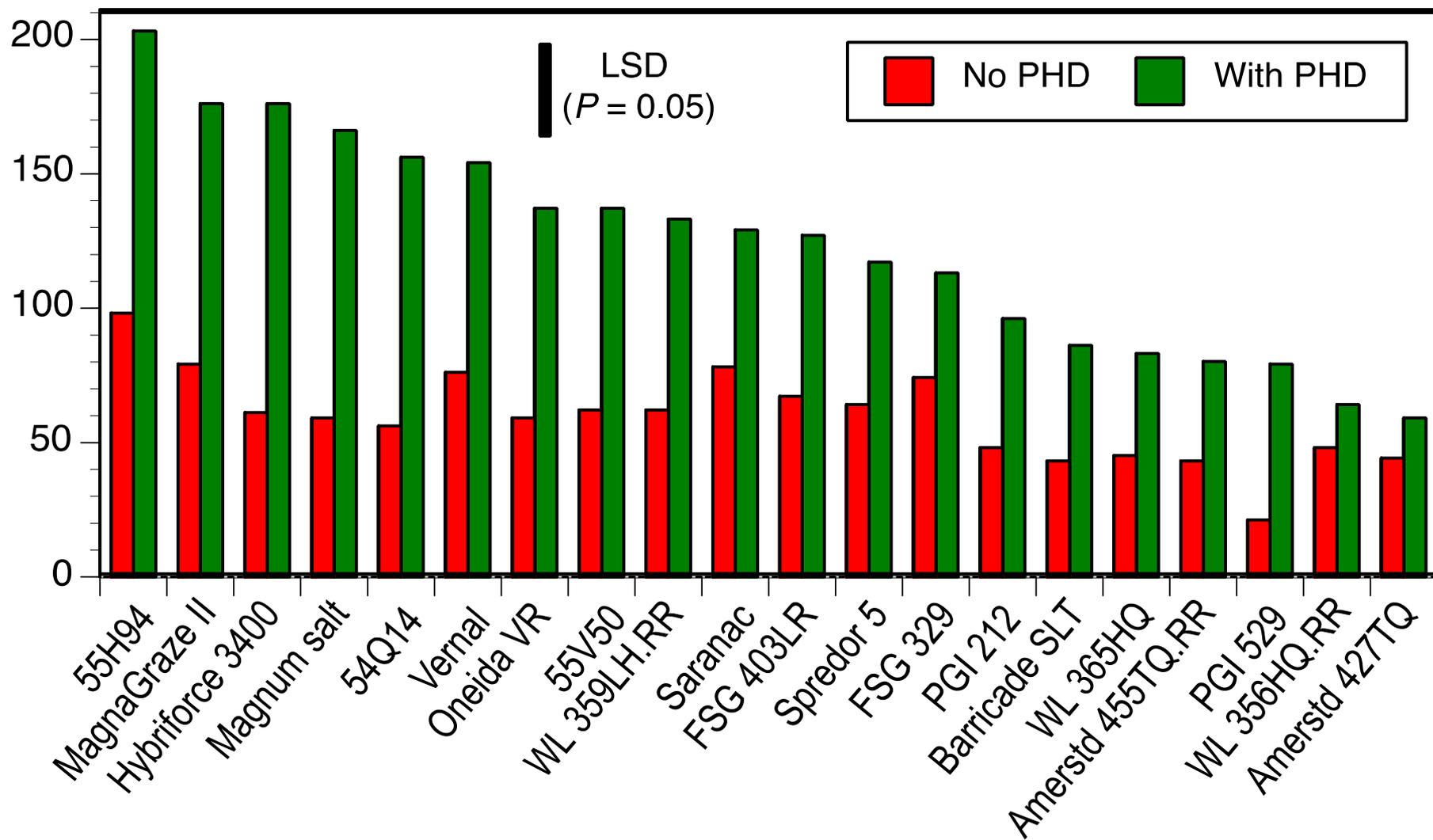
eeded into corn



Alfalfa varieties differed substantially in plant survival when interseeded into corn and treated with prohexadione (PHD)

(average of PDS and Arlington in 2015)

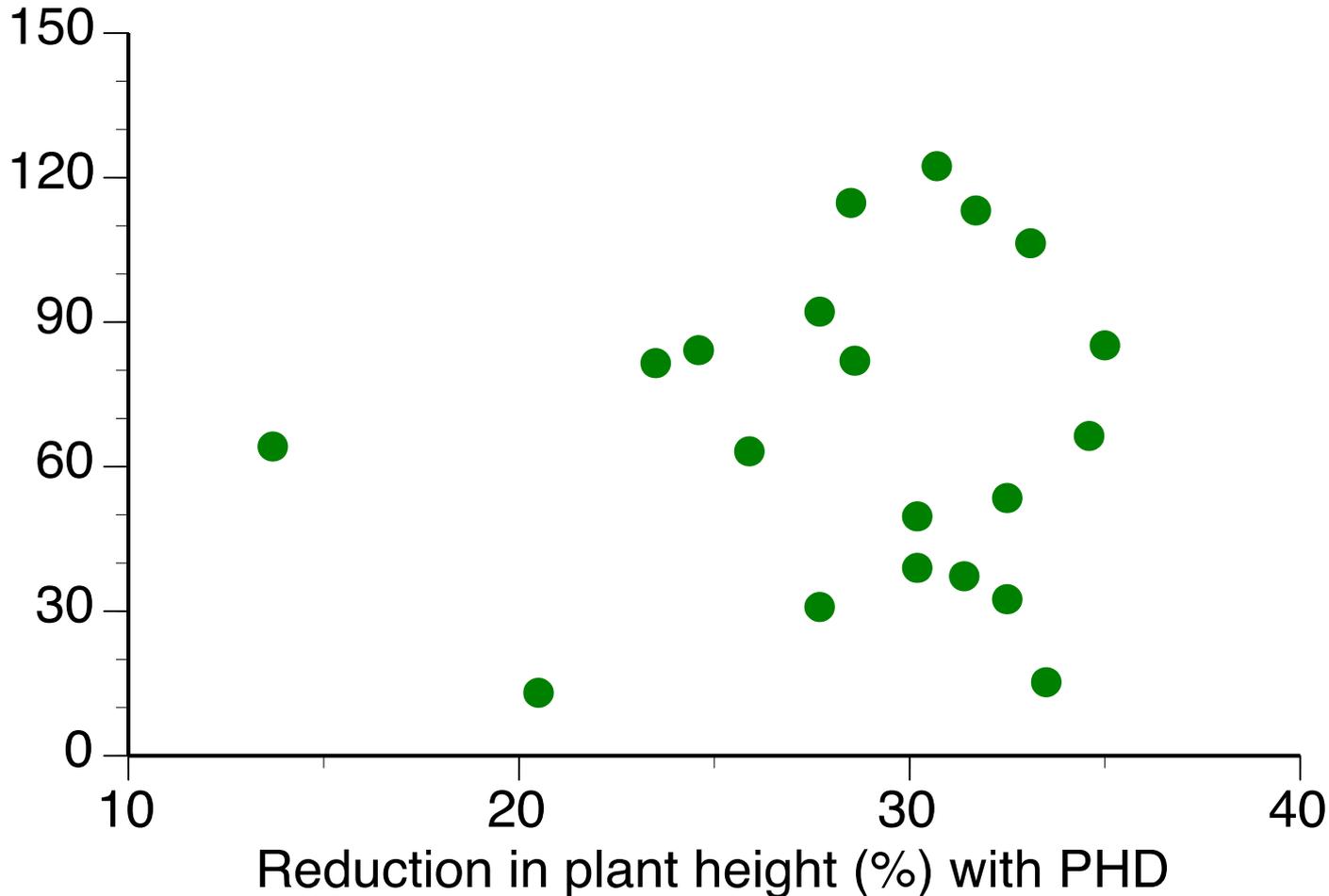
Alfalfa stand density after silage corn harvest (plants per square meter)



Improvements in stand density of interseeded alfalfa not related to height suppression by prohexadione (PHD)

(20 varieties, average for PDS and Arlington in 2015)

Stand density gains (plants per sq meter) with PHD

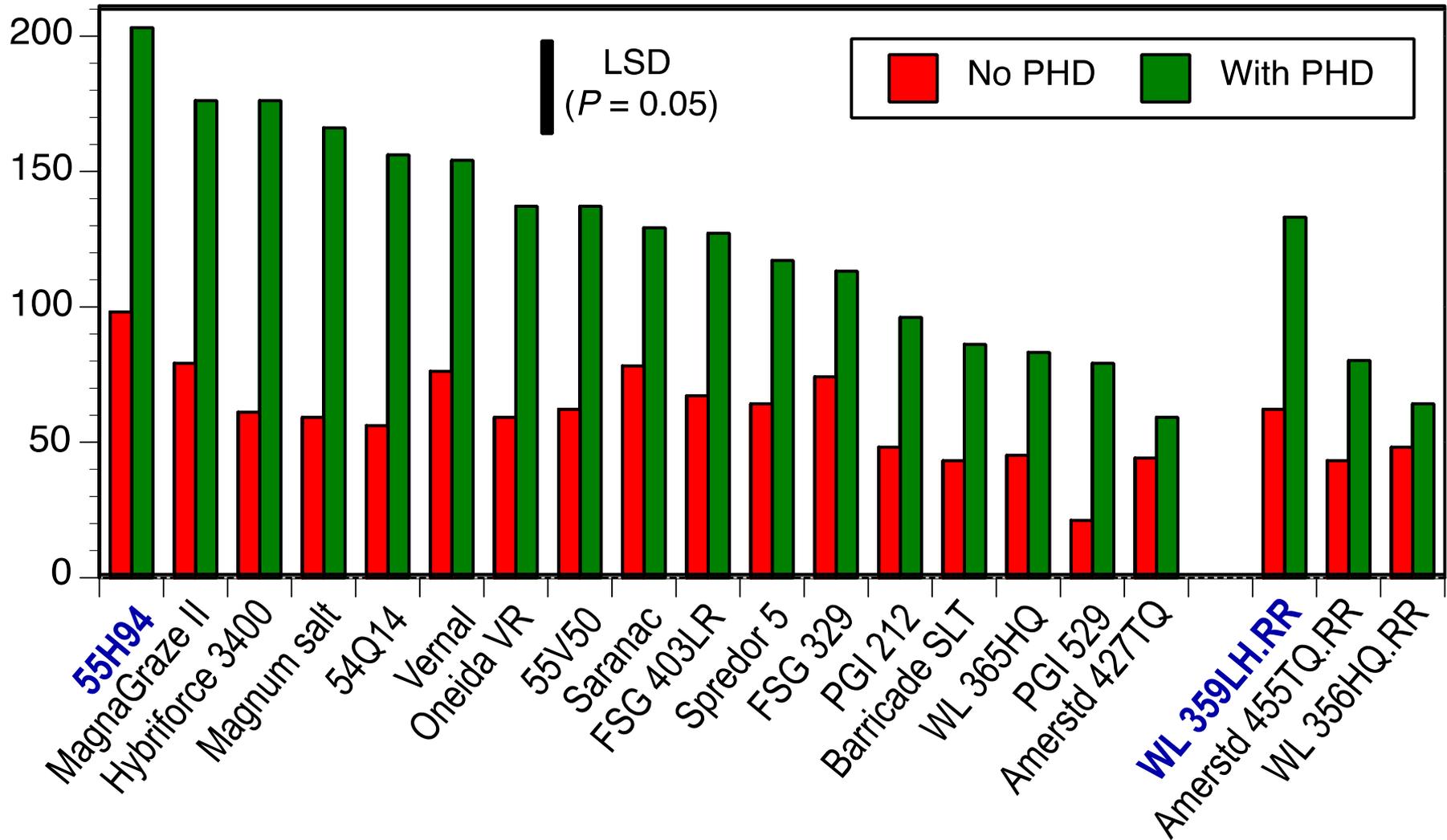


Plant density gains also not related to PHD effects on leaf or stem mass, disease severity, or most reported plant traits...

...but two varieties with leafhopper resistance had the best plant survival when treated with prohexadone (PHD)

(average of PDS and Arlington in 2015)

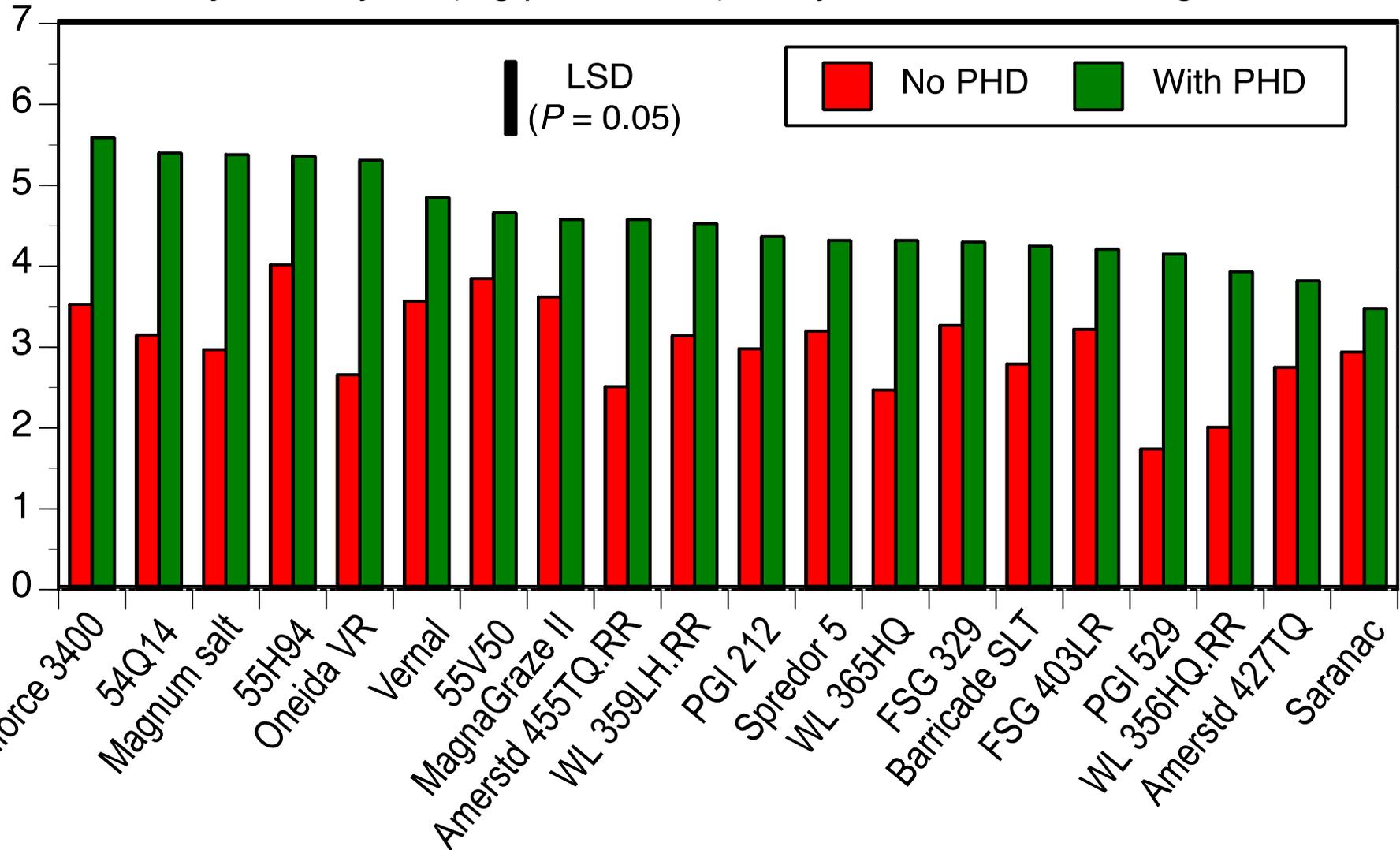
Alfalfa stand density after silage corn harvest (plants per square meter)



Alfalfa varieties differed in yield when interseeded into corn and treated with prohexadione (PHD)

(average of PDS and Arlington in 2016)

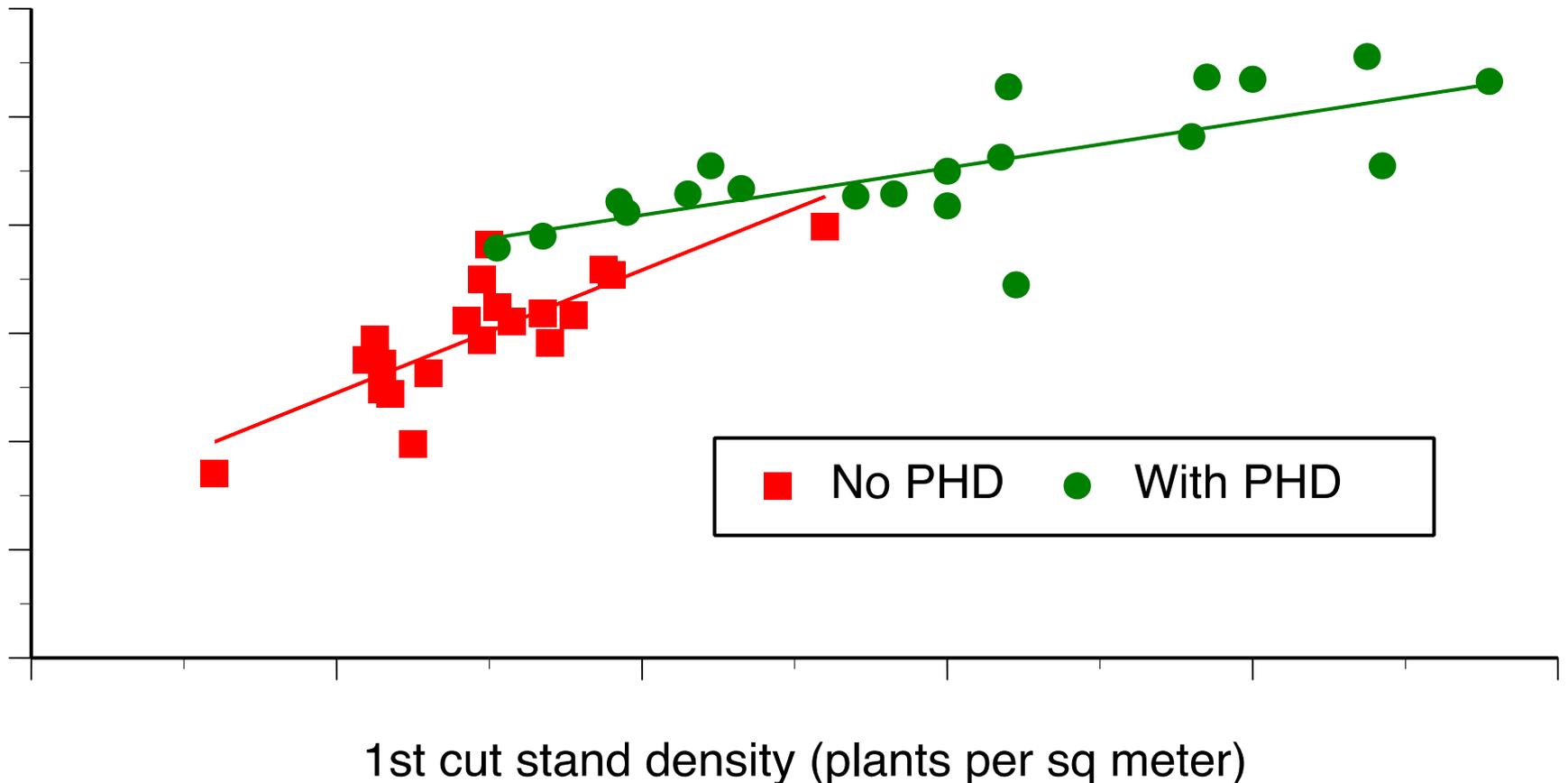
1st cut dry matter yield (Mg per hectare) one year after interseeding into corn



Yields positively associated with stand density of interseeded alfalfa and prohexadione (PHD) treatment of seedlings

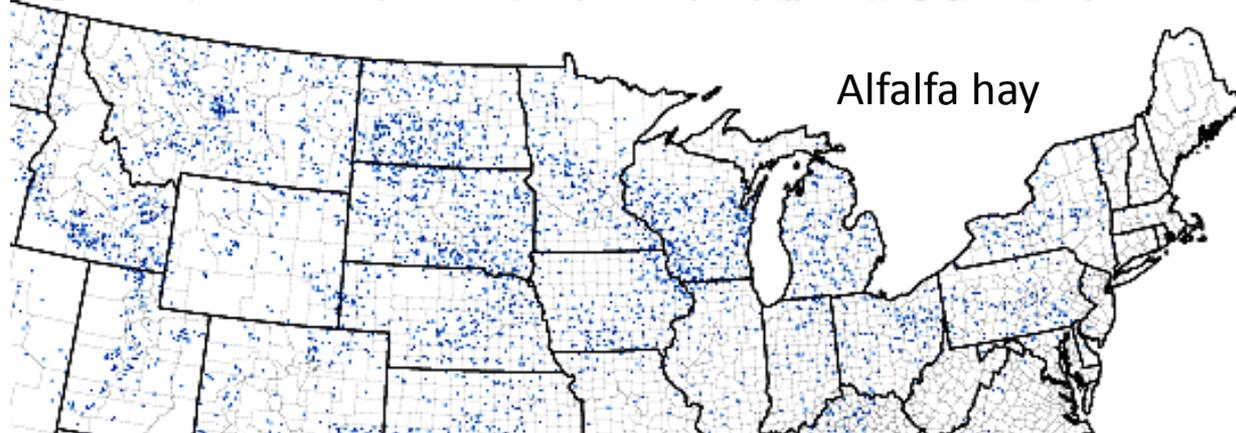
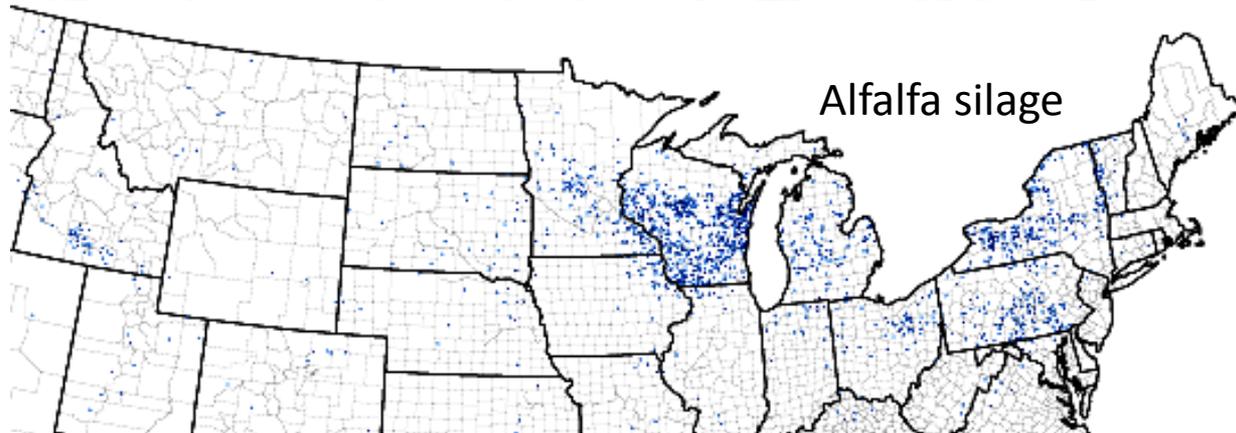
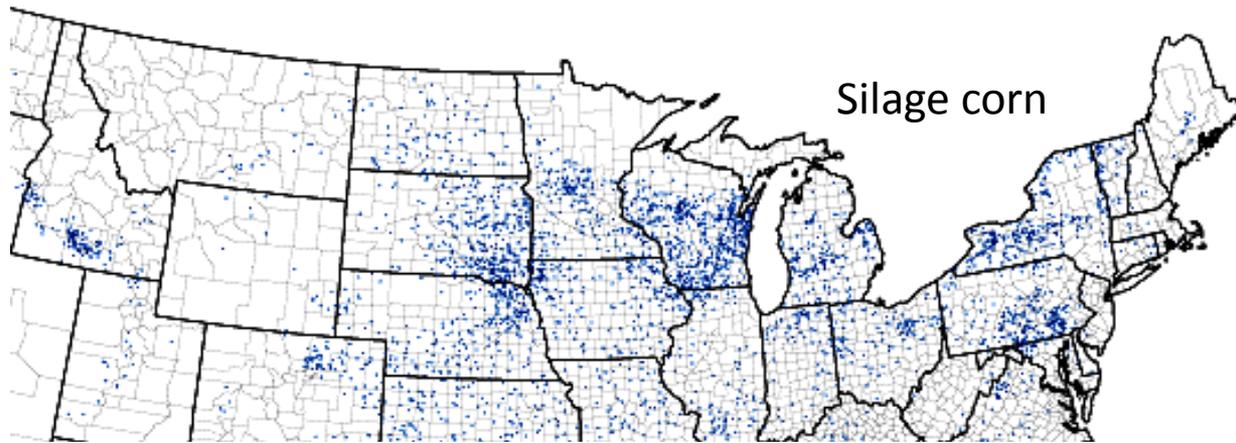
(20 varieties, average for PDS and Arlington in 2016)

matter yield (Mg per ha) one year after interseeding into corn



Preliminary economic analysis

- When used in a 2 year corn – 3 year alfalfa rotation, switching from conventional spring seeding to interseeding of alfalfa could improve net return of first year alfalfa by roughly \$270 per hectare
- Assumption: 80% success rate for alfalfa establishment by interseeding and a 5% reduction in corn yield, \$125 per hectare cost for prohexadione...
- The fine print: Performance will vary with assumptions and may differ on your farm.



- 2 million hectares of silage corn and 0.8 million hectares of alfalfa are sown annually in the cold temperate regions of the USA
- Interseeding may be a good option in this region where alfalfa cannot be established after silage corn harvest

Conclusions thus far from interseeding studies

- Successful interseeding of alfalfa into corn doubles 1st year yields of alfalfa, but yields of corn are sometimes reduced. Total yields of silage corn plus alfalfa are increased.
- Prohexadione (PHD) usually doubles stand density and improves subsequent yield of interseeded alfalfa.
 - Best survival if PHD sprayed at ≥ 0.5 kg a.i ha⁻¹ on 20 to 30 cm tall alfalfa.
 - Alfalfa varieties differ greatly in plant survival when treated with PHD; goal is high survival with PHD applied at ≤ 0.25 kg a.i ha⁻¹.
 - Prohexadione suppression of interseeded alfalfa does not mitigate competition with corn.

Ongoing research

- Evaluate additional conventional and glyphosate-resistant alfalfa varieties for survival when interseeded into corn (Grabber et al. in WI, Williamson in PA, and Cassida in MI).
- Develop herbicide options for conventional corn and interseeded alfalfa (Renz et al. in WI)
- Optimize nitrogen fertilizer management for corn with interseeded alfalfa (Osterholtz et al. in WI)
- Identify optimal corn populations and hybrids for interseeded alfalfa (Grabber et al. in WI)
- Assess planting and harvest dates for corn and timing of alfalfa interseeding into corn (Grabber et al. in WI).
- Evaluate effects of interseeded alfalfa on runoff and nitrate leaching potential from cropland (Osterholtz et al. in WI).



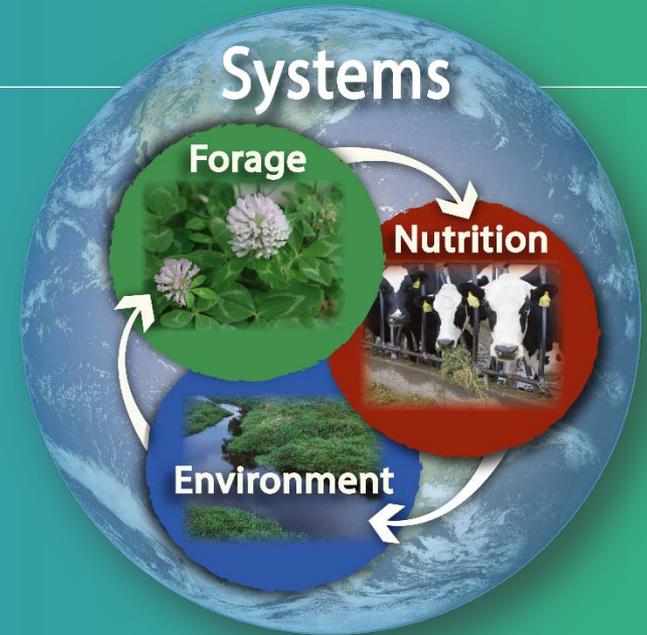
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QUESTIONS?

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In 0.76 x 6 m subplots, sprayed 0 or 500 g a.i. per hectare prohexadione-calcium (formulated as 'Apogee' plus AMS, COC, and citric acid) on ~20 cm tall alfalfa about 5 weeks after planting



Prohexadione (PHD) typically doubles stand survival of interseeded alfalfa during establishment and forage production

(Alfalfa interseeded at PDS during 2011 & 2013 and harvested for forage the following year)

