Integrated Pest Management for the Potato Leafhopper in Alfalfa

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WI Crop Management Conf.

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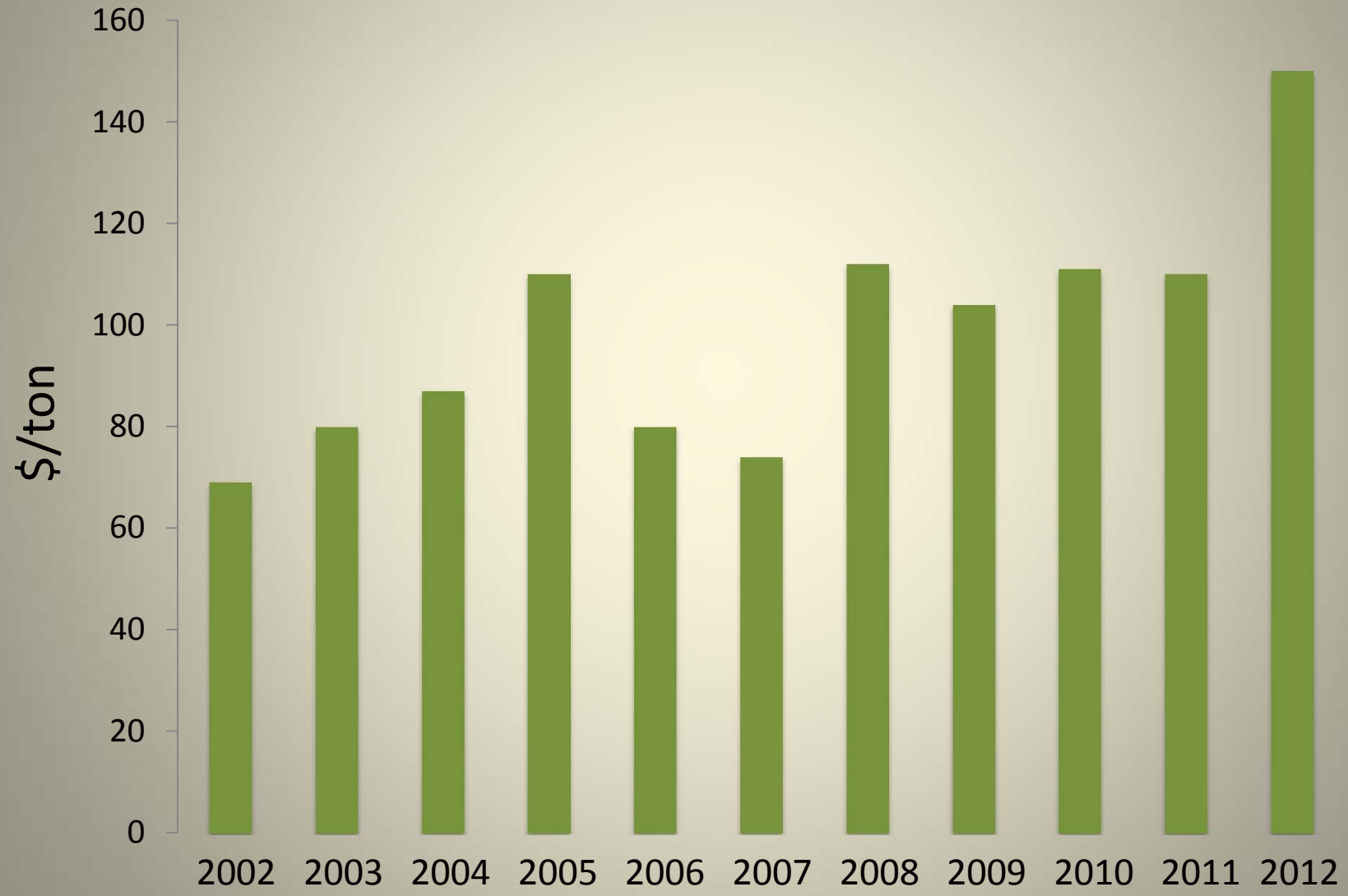
WI Alfalfa in numbers

2011

- 1.5 million acres of dry alfalfa hay harvested (USDA NASS, 2012)
- 430,000 acres seeded (USDA NASS, 2012)
- Between 2nd and 3rd largest crop by acreage (USDA NASS, 2011 and 2012)

Crop Value (WI only)



Source: Gould, B. 2012. Understanding Dairy Markets

Potato leafhopper

- Most economically damaging pest for alfalfa, after 1st crop

- Reduces yield, forage quality, and stand longevity

Integrated Pest Management

- Host plant resistance
- Biological control
- Cultural controls
- Physical control
- Monitoring pest abundance
- Economic thresholds for chemical control

Current Alfalfa IPM

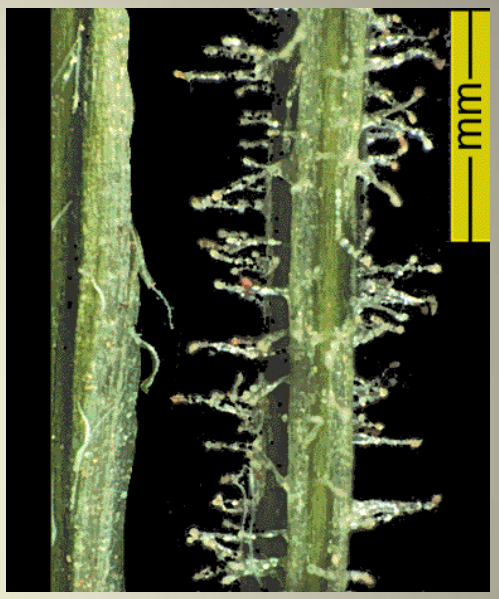
- Monitor for potato leafhopper
- Insecticide sprays at current economic threshold (ET)
- Early harvest if ET is reached within 7 days of planned harvest

Alfalfa stem height (inches)	PLH/net sweep (average)
3	0.2
6	0.5
8-11	1.0
12+	2.0

UW Extension Publication A3646

Alfalfa IPM

- Resistant alfalfa cultivars with glandular hairs released 1997
  - Ability to tolerate greater PLH pressure in established stands (Lefko et al. 2000)
  - Under low PLH pressure, no yield advantage and sometimes a yield drag (Hogg et al. 1998, McCaslin 1998)

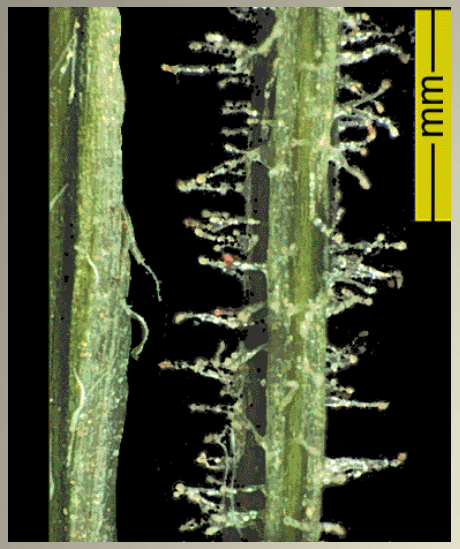


Alfalfa IPM

- Cultural practice of grass intercrops with alfalfa

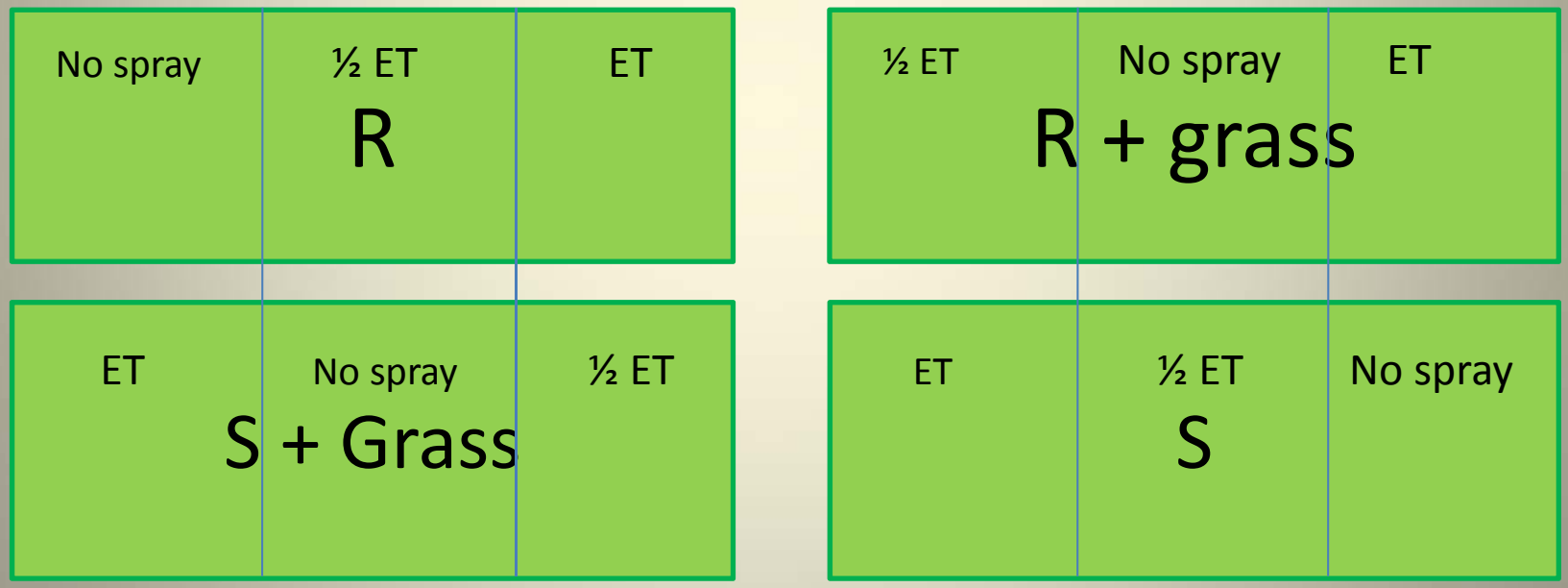
- Orchardgrass and bromegrass can significantly reduce PLH abundance (Roda et al. 1997, Degooyer et al. 1999)
- Grasses also promoted as an intercrop for increased digestible fiber in dairy rations (Lee, 2011)

Study System



Present Study

- 2010-2012 at Arlington Ag Research Station (AARS)
- 2012 spring and fall seeded at US Dairy Forage Research Center (DFRC)

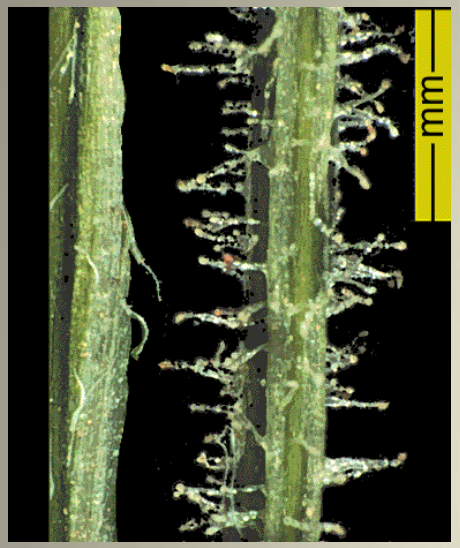


Methods

- Weekly sampling 20 sweeps
- Pyrethroid (a.i. lambda-cyhalothrin) applied at 1.6 oz/acre when PLH has reached 1⁄2 ET and ET, to respective split plot treatments (only AARS)

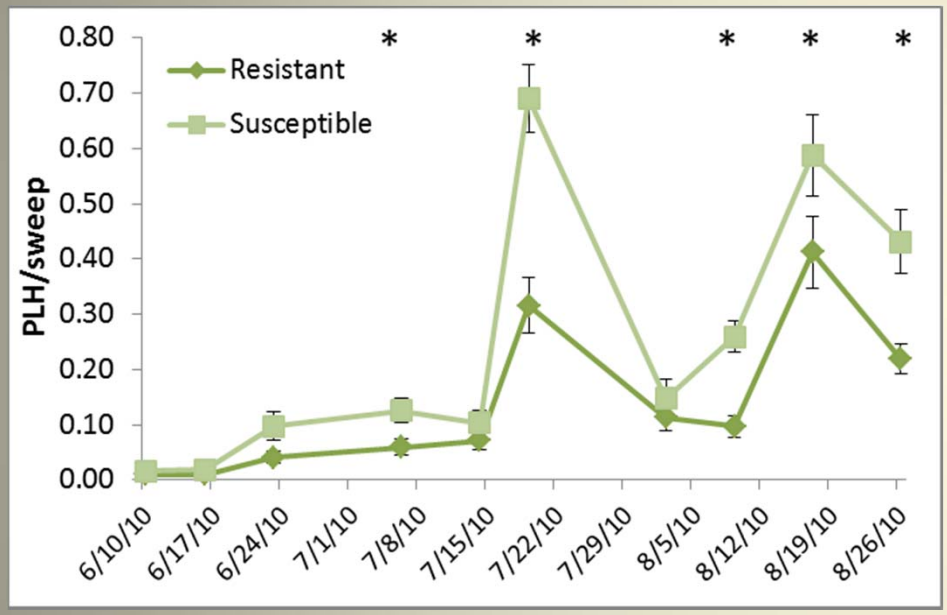
Alfalfa height	Treatment	PLH/sweep
0-10 cm (0-4“)	½ ET	0.1
0-10 cm (0-4“)	ET	0.2
10-20 cm (4-8“)	½ ET	0.3
10-20 cm (4-8“)	ET	0.5
20-30 cm (8-12“)	½ ET	0.5
20-30 cm (8-12“)	ET	1.0
30+ cm (12“+)	½ ET	1.0
30+ cm (12“+)	ET	2.0

Potato leafhopper response to IPM system

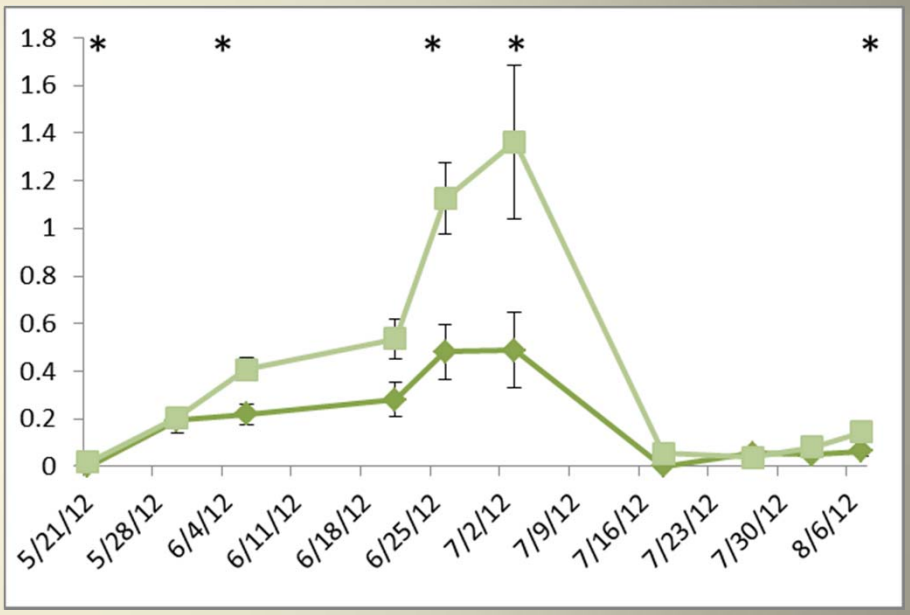


PLH response to alfalfa variety seeding years

Arlington, 2010



DFRC Spring Seeding, 2012



PLH response to alfalfa variety production years

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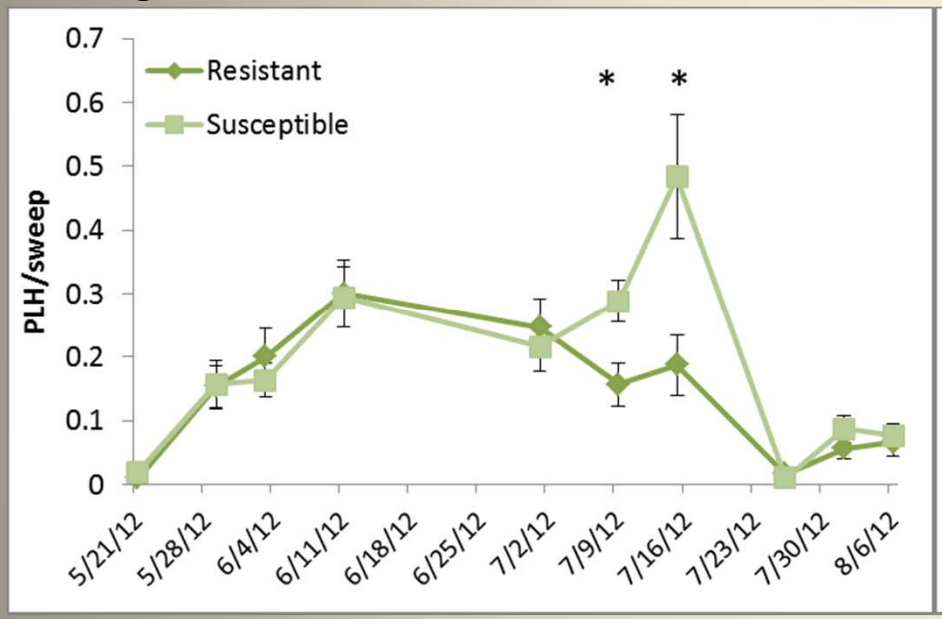
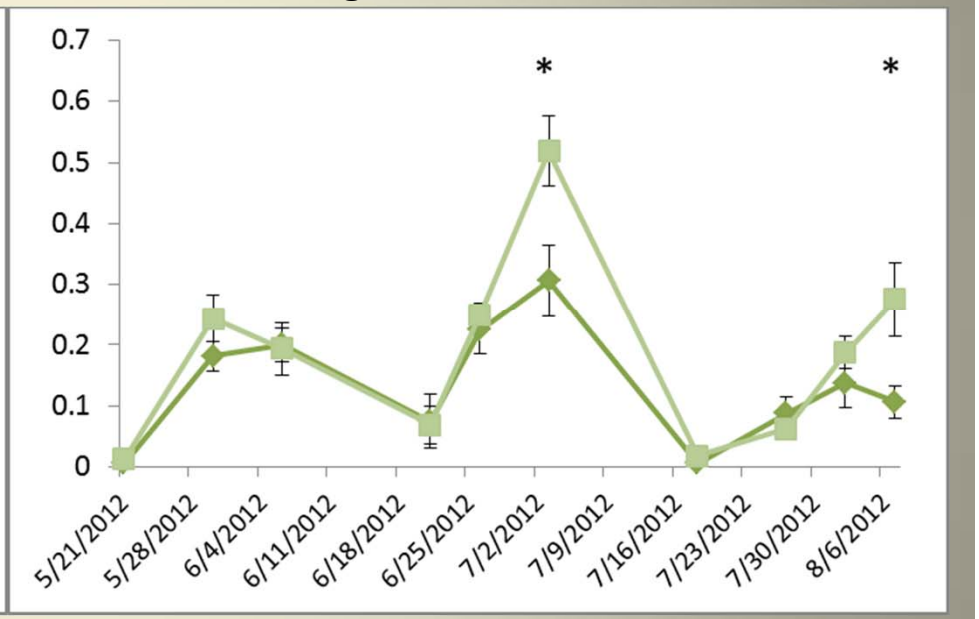


DFRC Fall Seeding, 2012

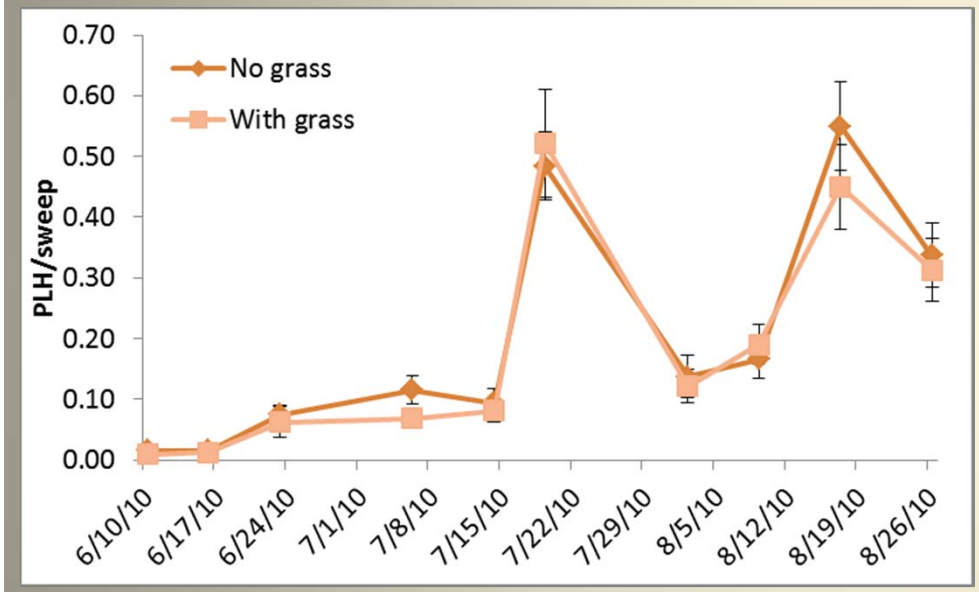


PLH response to alfalfa variety

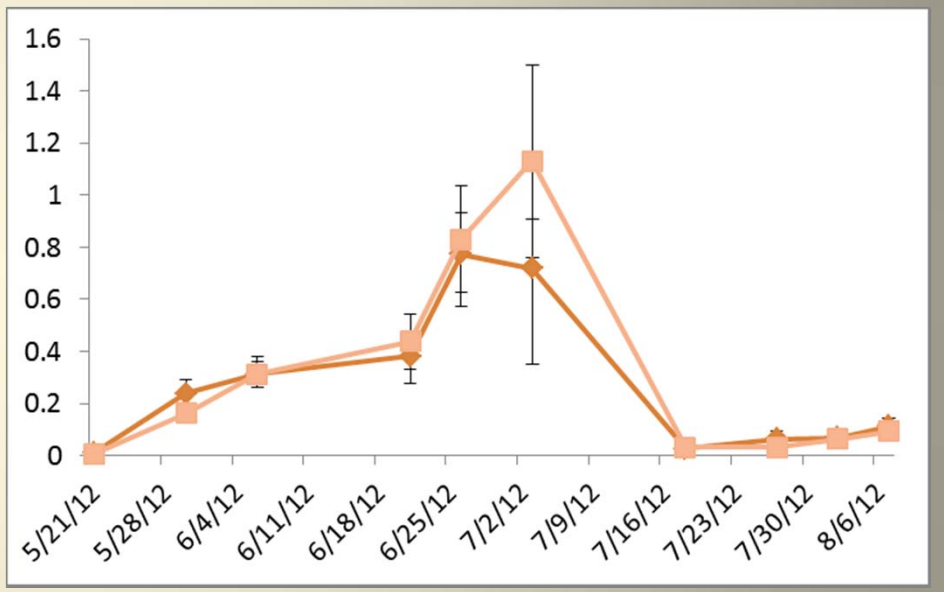
Most notable suppression in seeding years and at peak abundance time points

PLH response to orchardgrass seeding years

Arlington, 2010



DFRC Spring Seeding, 2012



PLH response to orchardgrass production years

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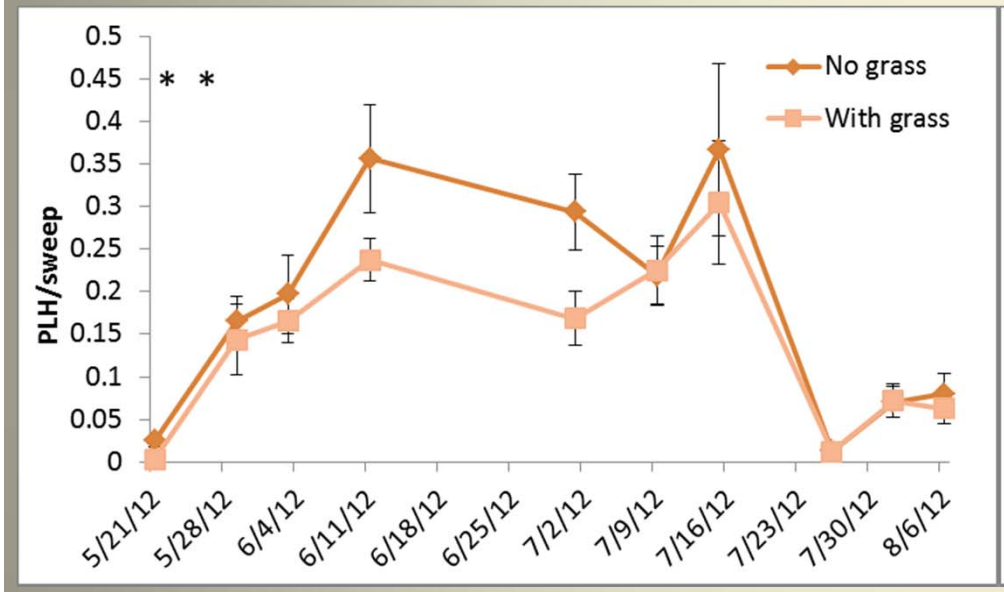

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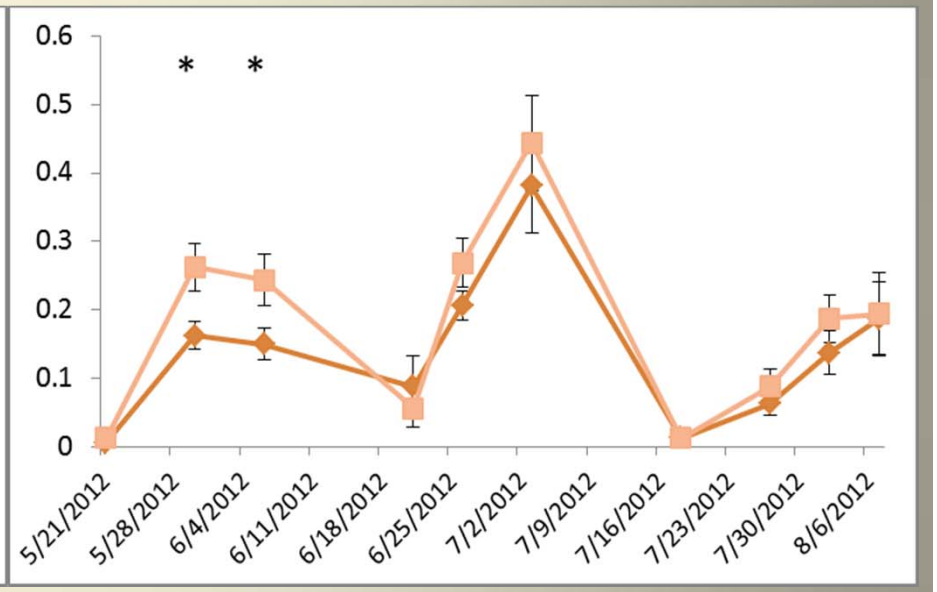
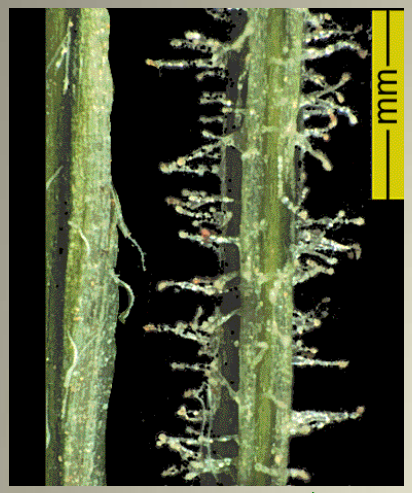


PLH response to orchardgrass

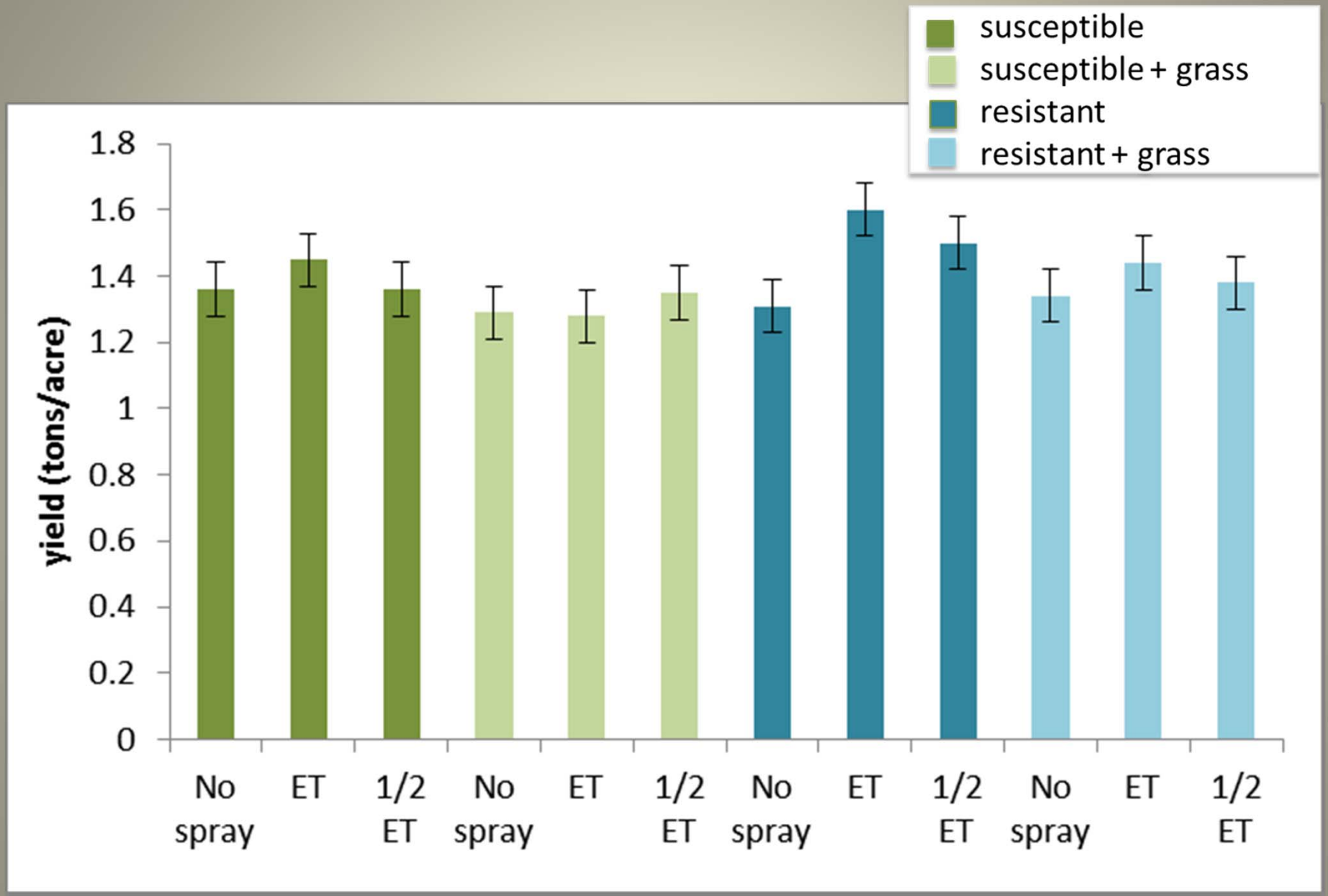
-No difference in seeding years

-Conflicting results in production years

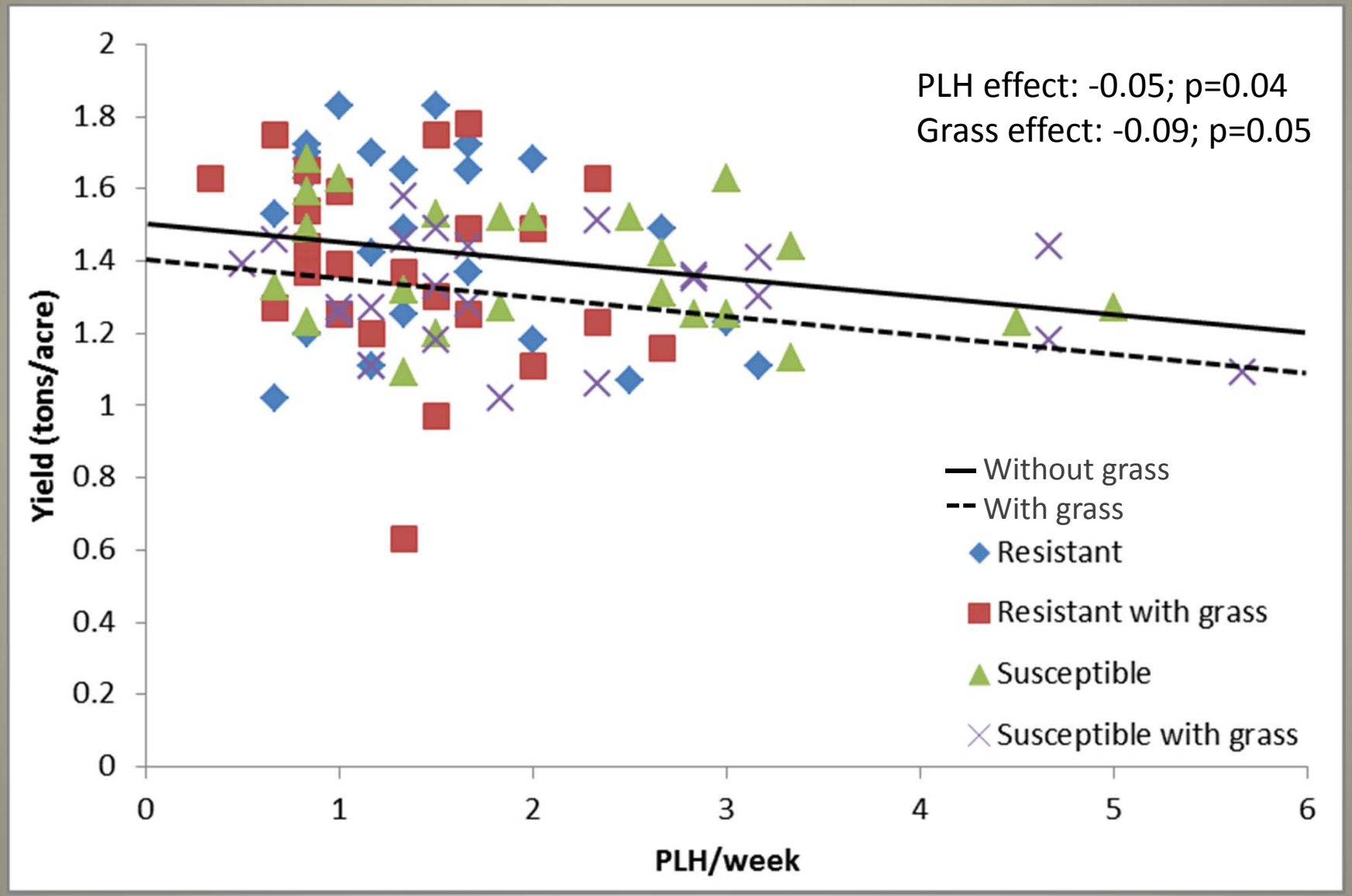
Yield and forage quality response



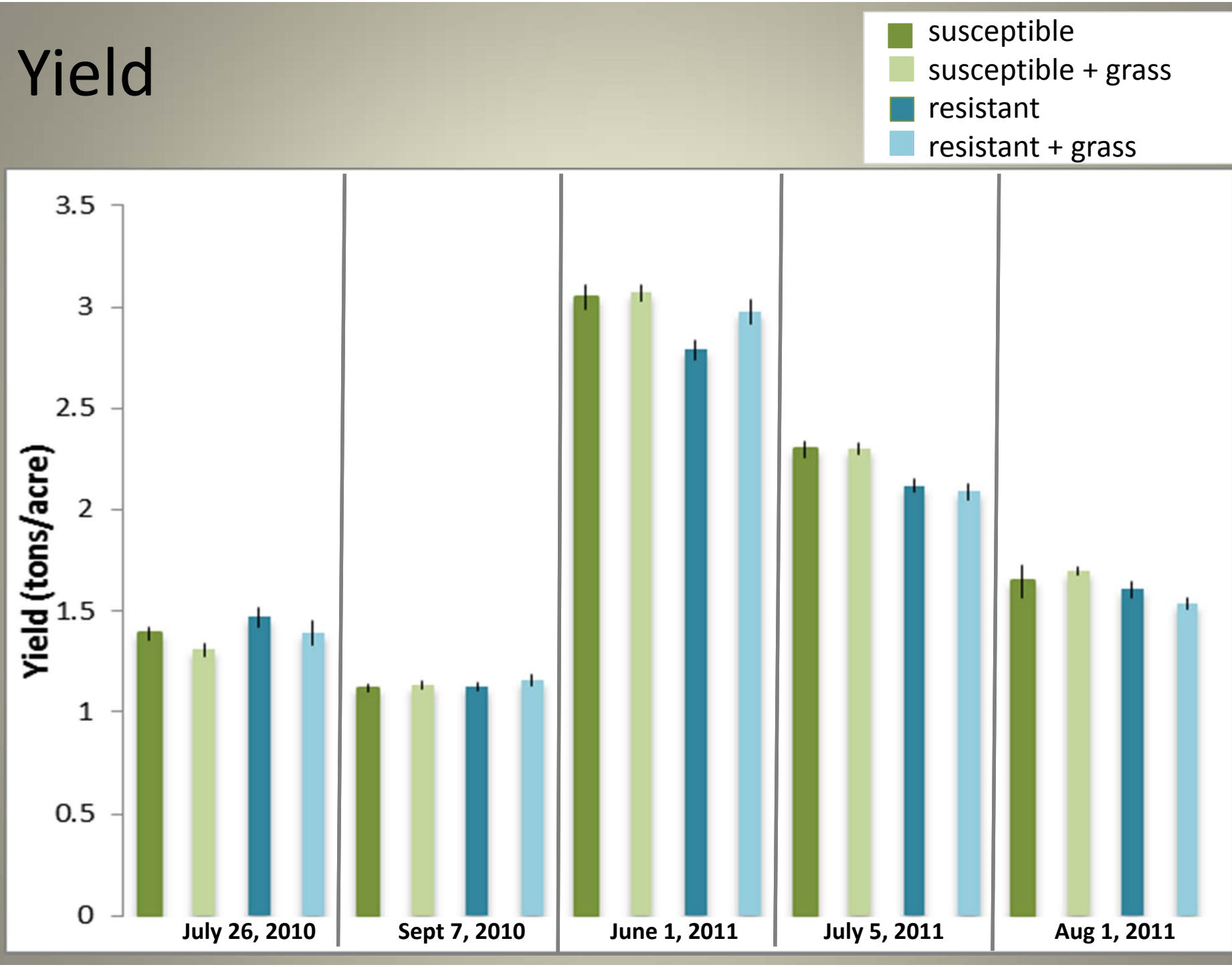
Yield response to insecticide sprays at AARS



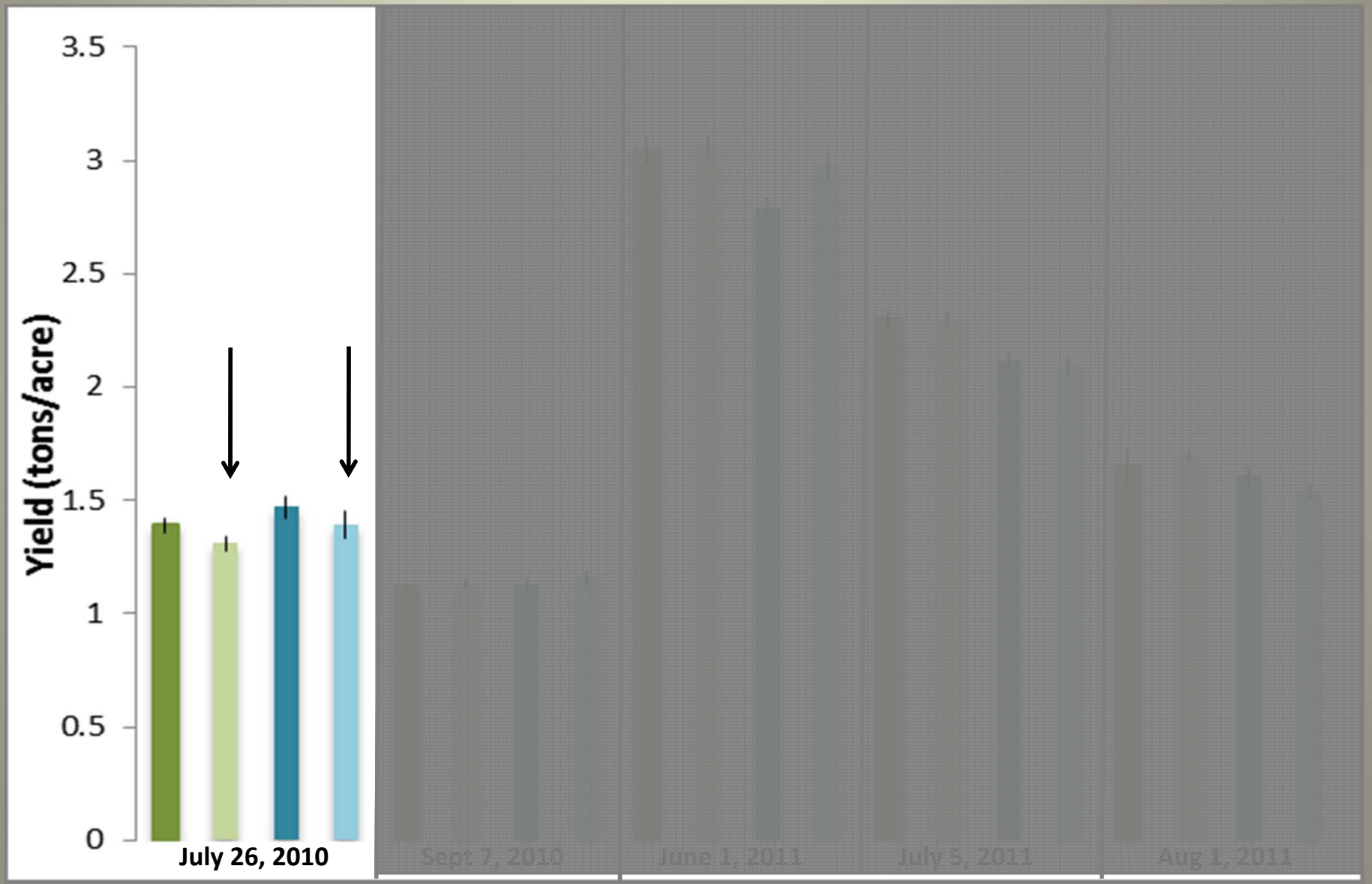
PLH effect on yield July 26, 2010



Yield


susceptible
susceptible + grass
resistant
resistant + grass
Yield (tons/acre)
3.5
3
2.5
2
1.5
1
0.5
0
July 26, 2010
Sept 7, 2010
June 1, 2011
July 5, 2011
Aug 1, 2011

Yield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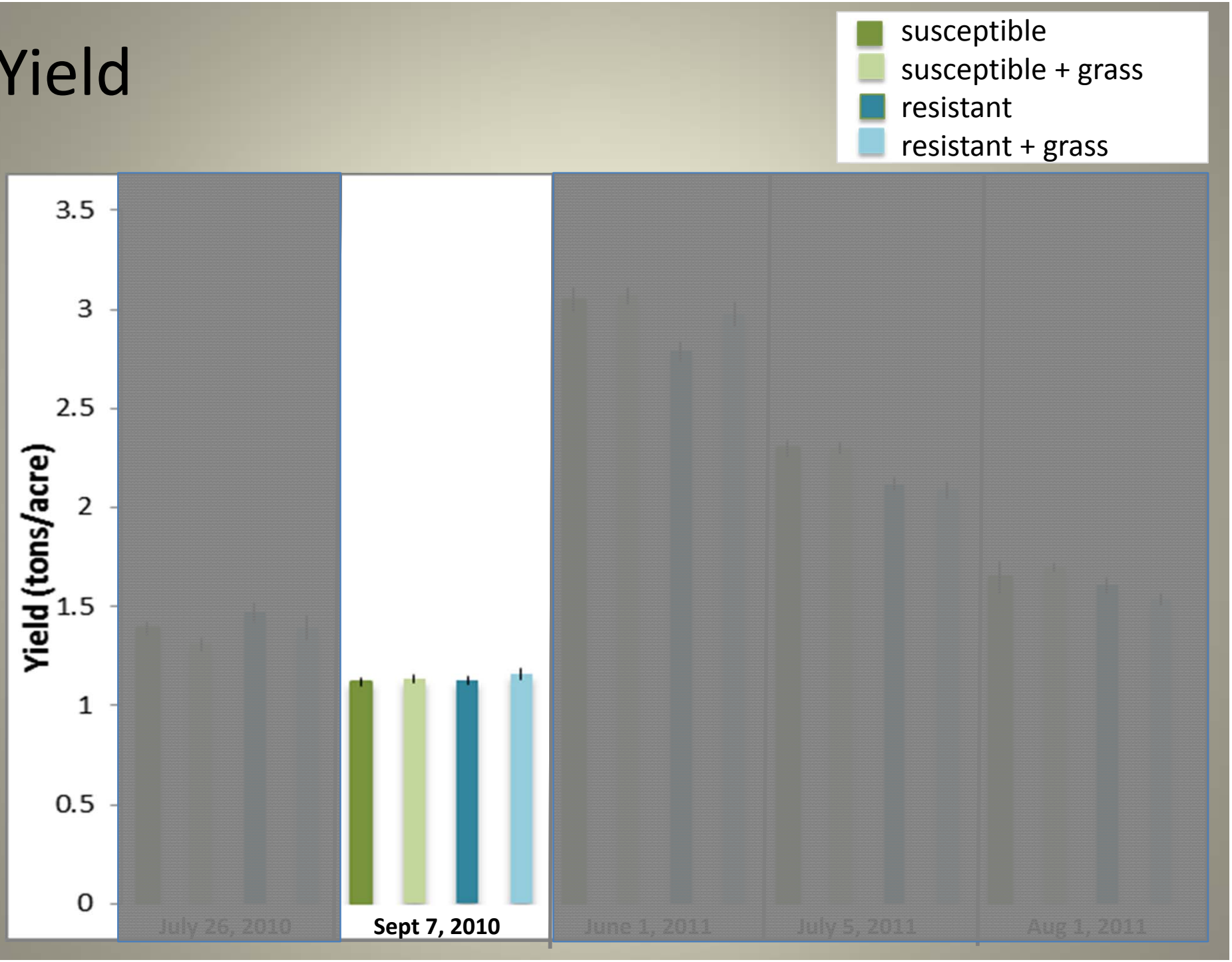
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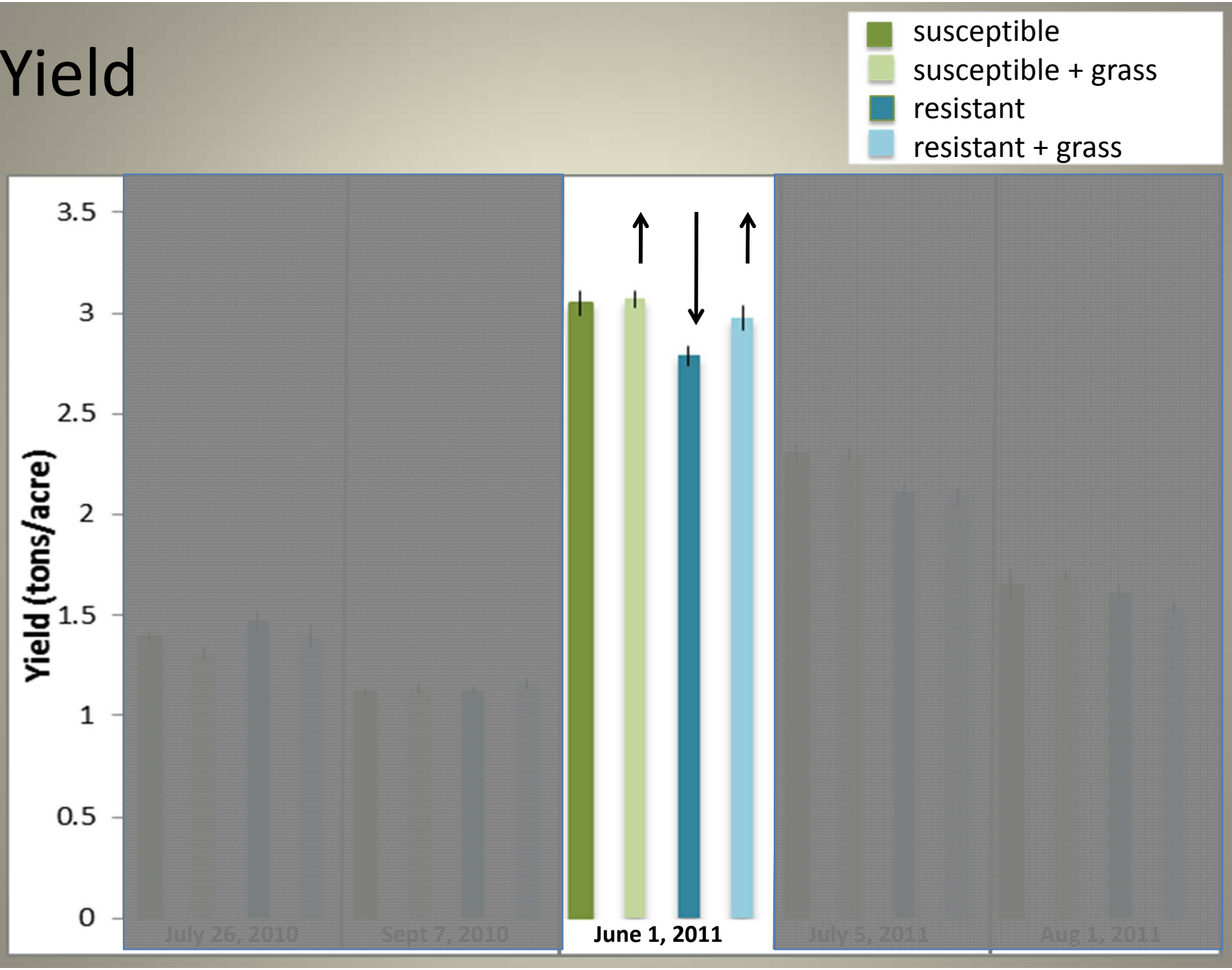
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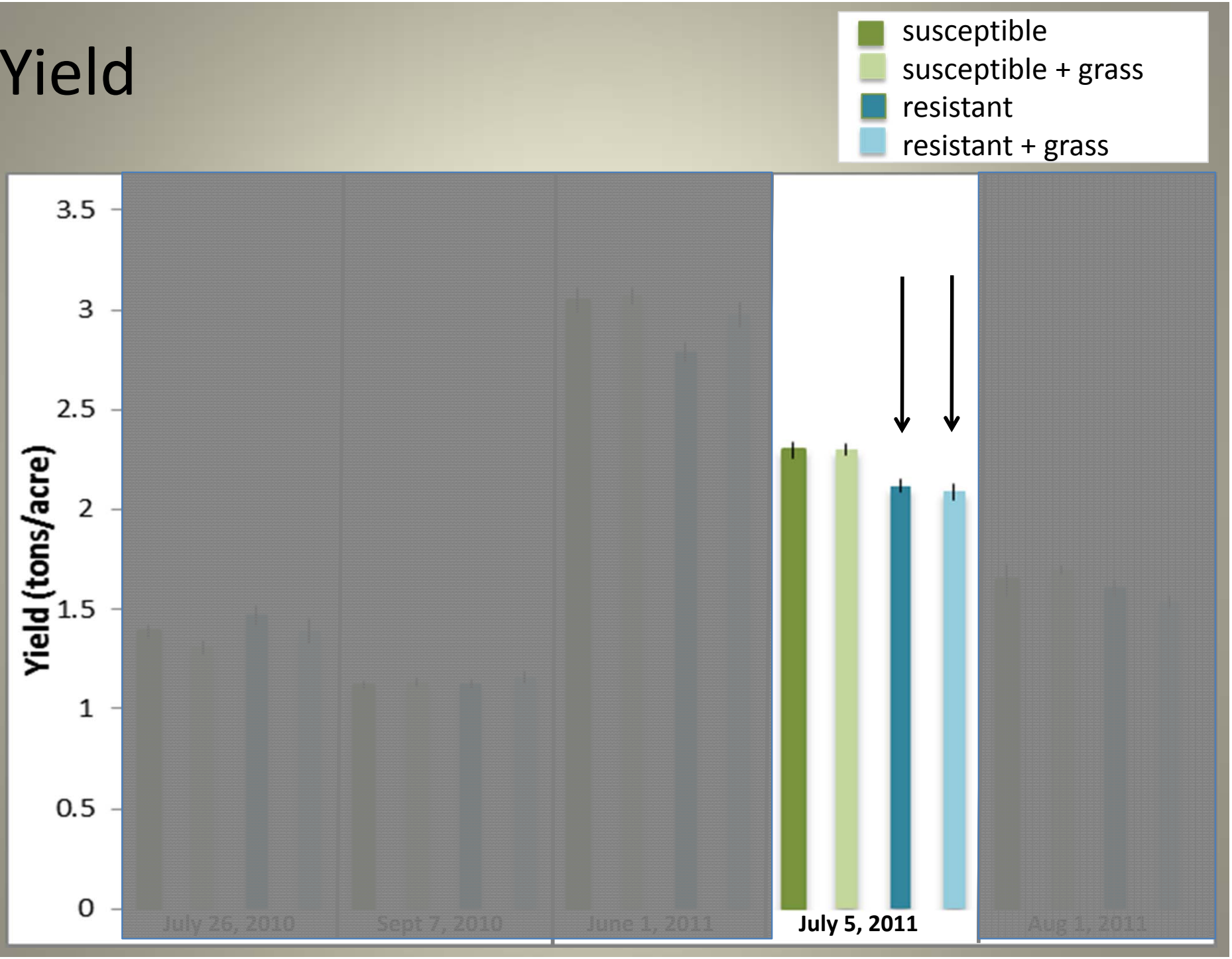
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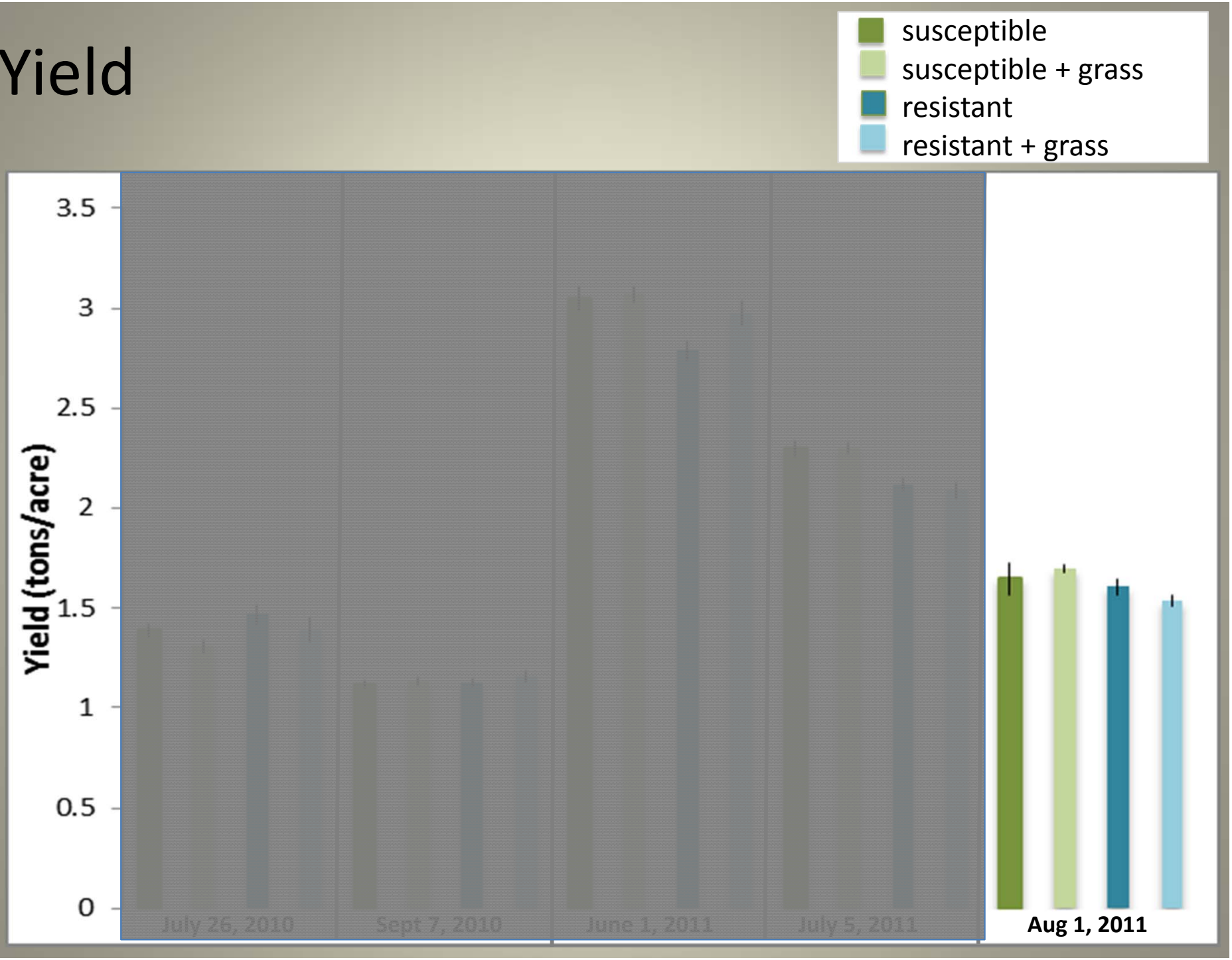
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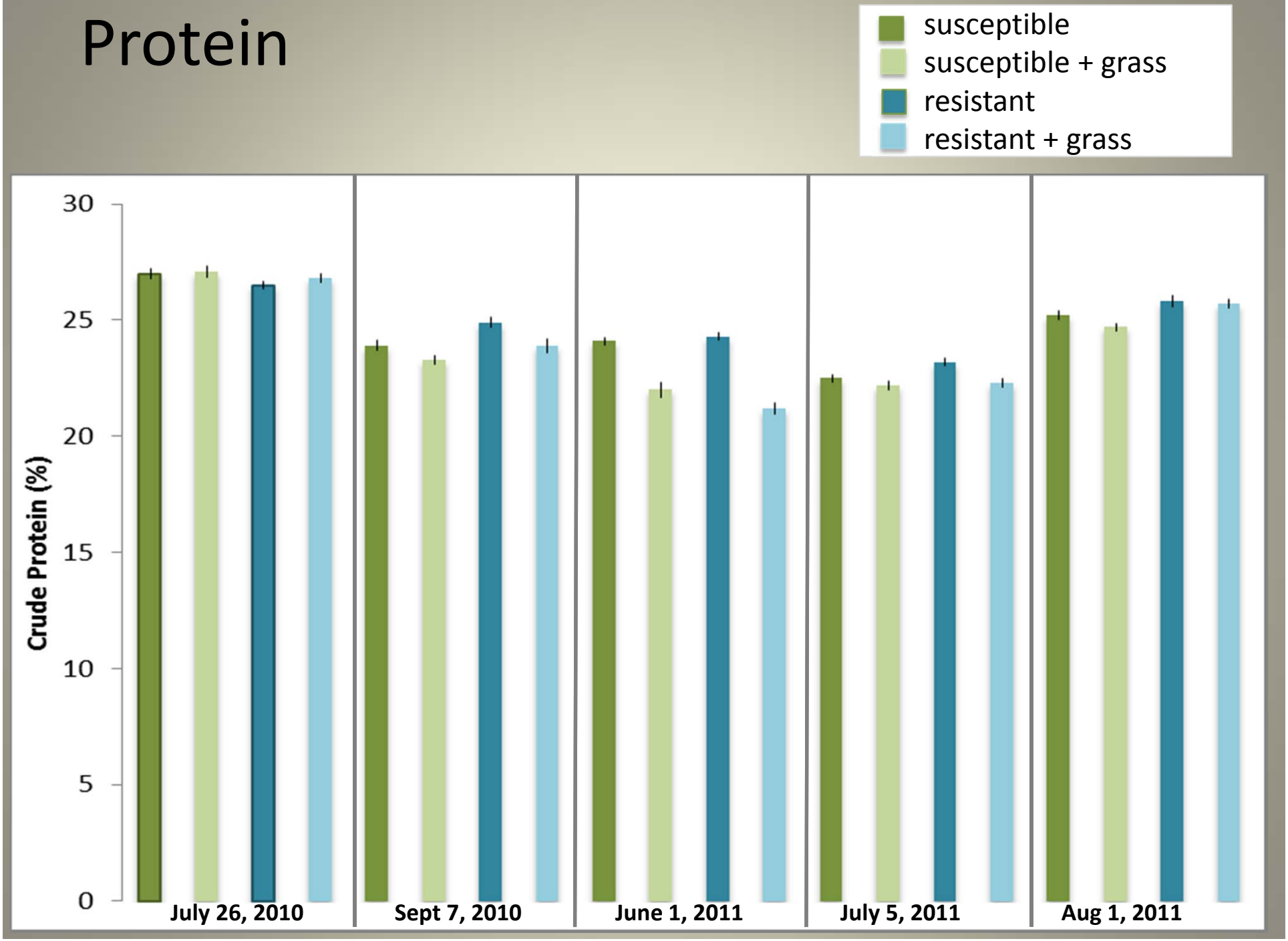
IPM system and yield

- The first cutting of the seeding year had lower yield in plots with orchardgrass
- The first cutting of the production year had higher yield in plots with orchardgrass
- Resistant alfalfa had comparable yield with susceptible alfalfa in 3 of the 5 cuttings but expressed yield drag in 2 of 5

Protein


susceptible
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resistant
resistant + grass
Crude Protein (%)
30
25
20
15
10
5
0
July 26, 2010
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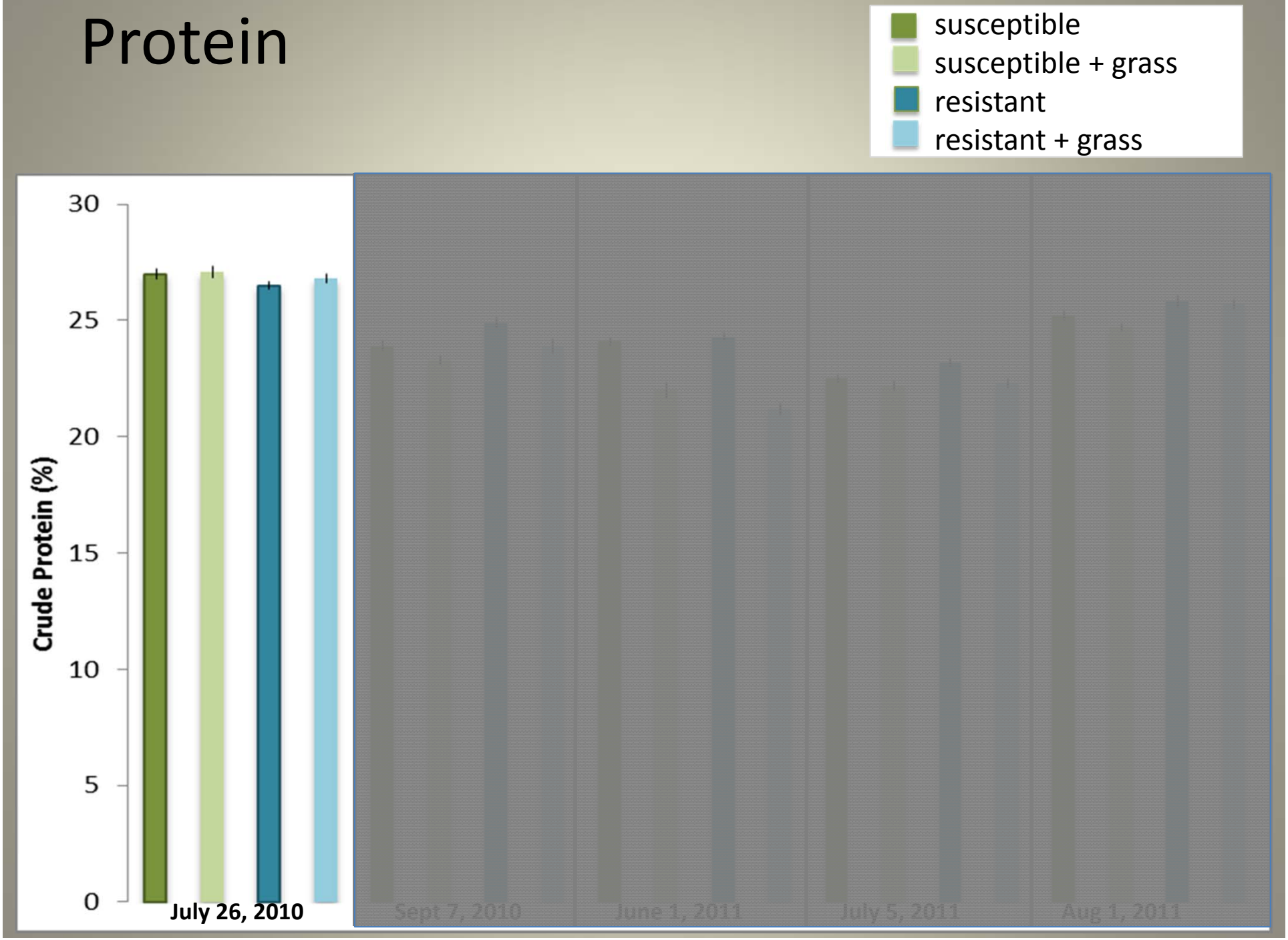
Protein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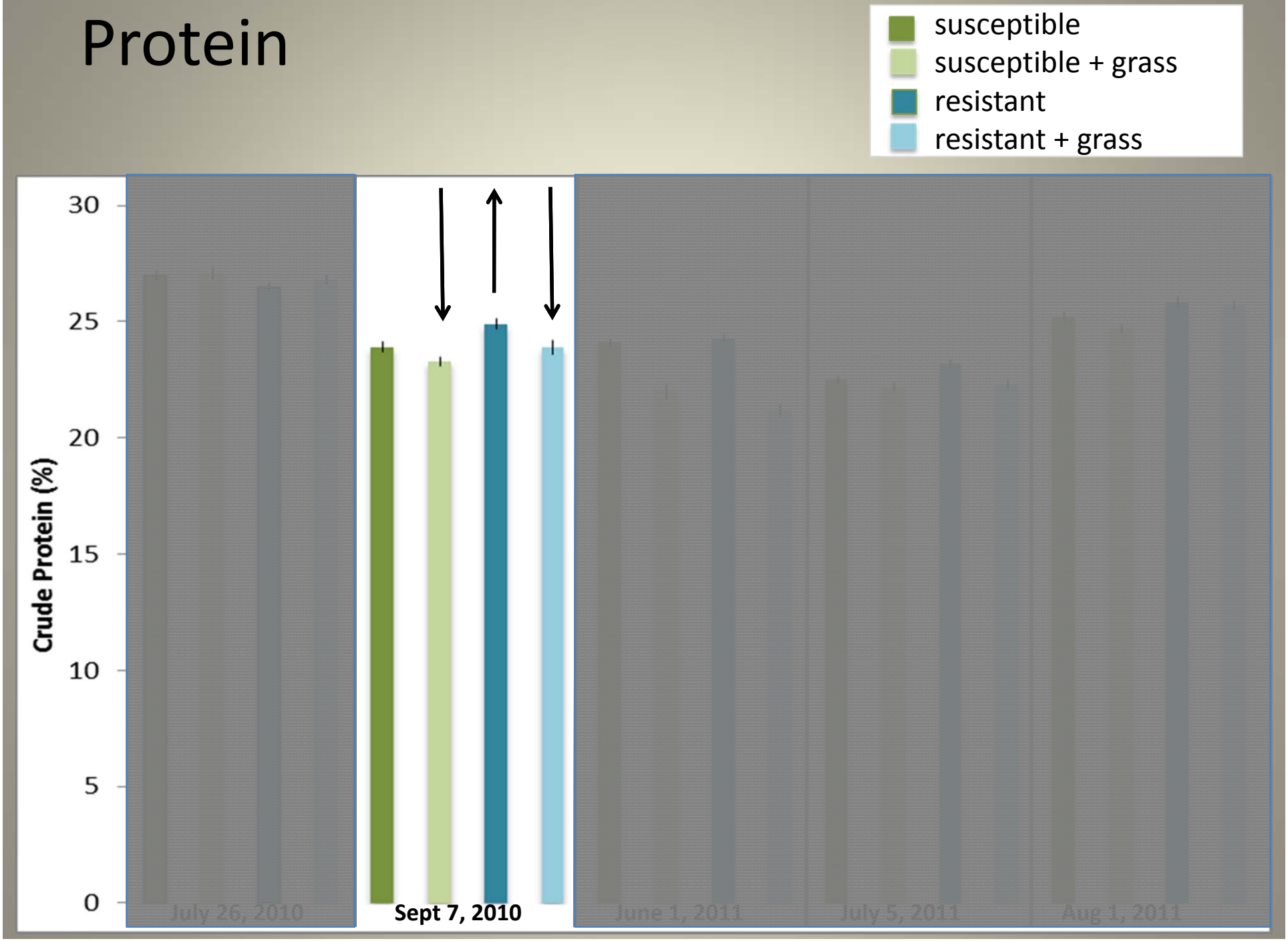
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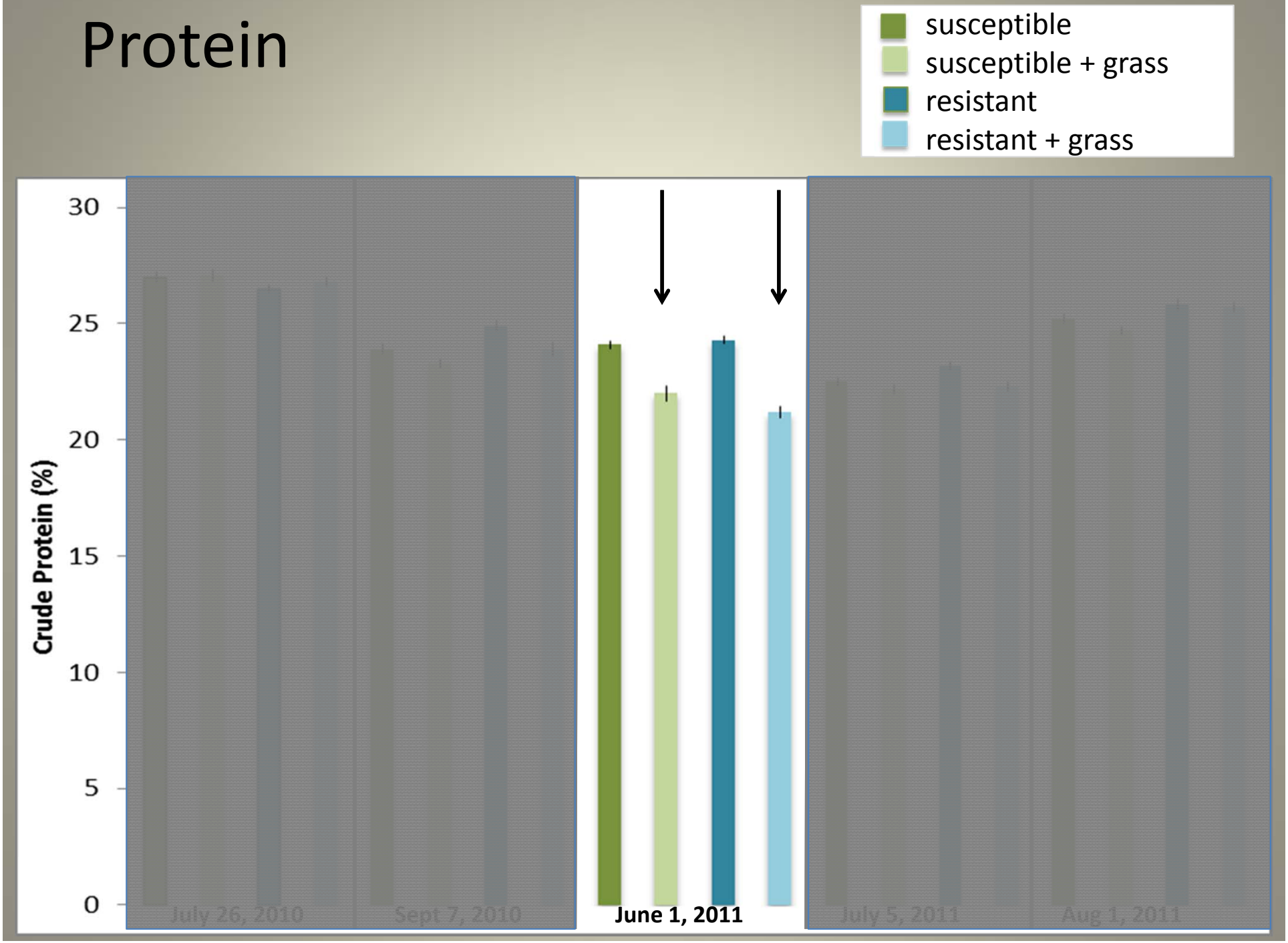
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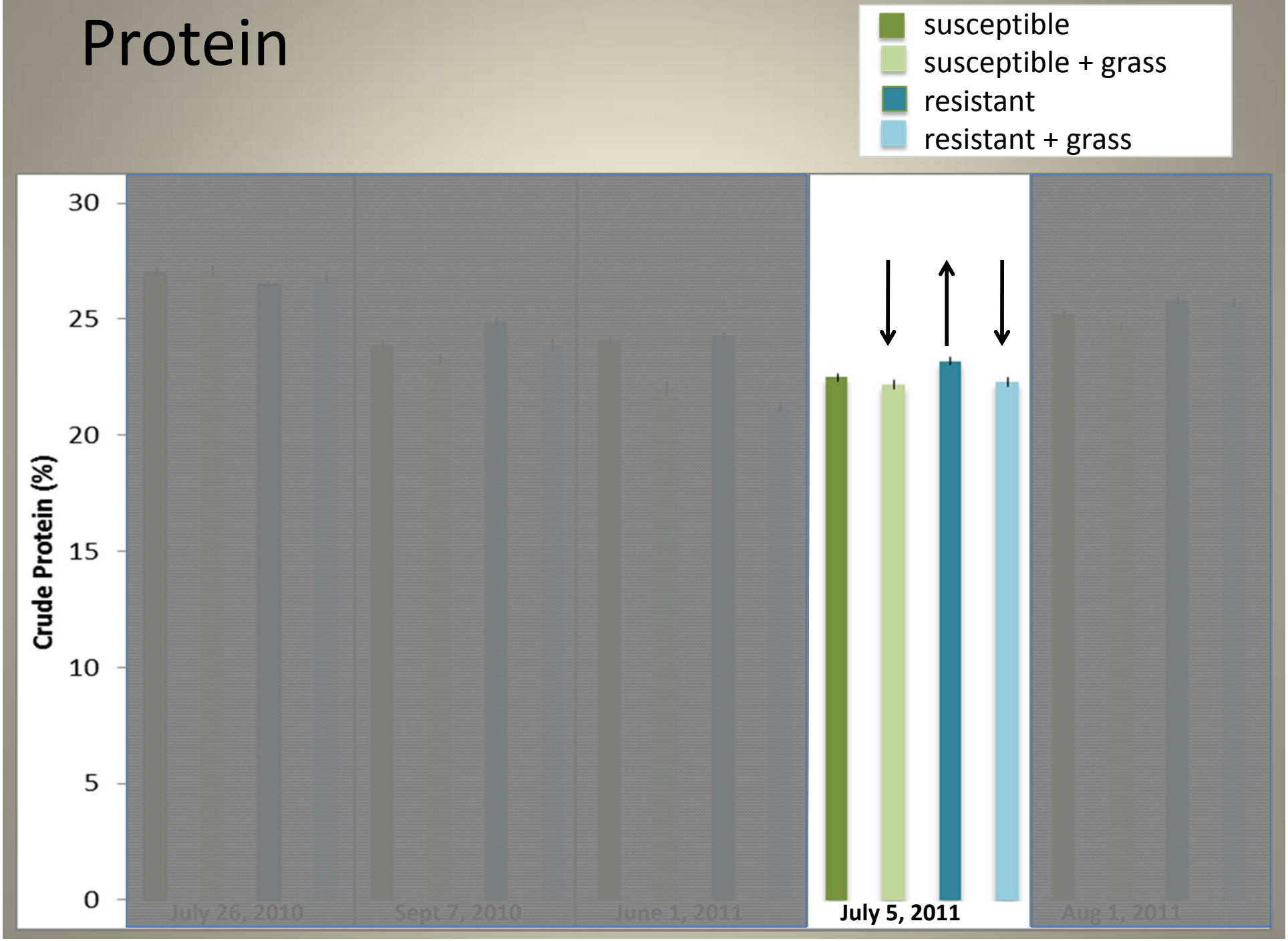
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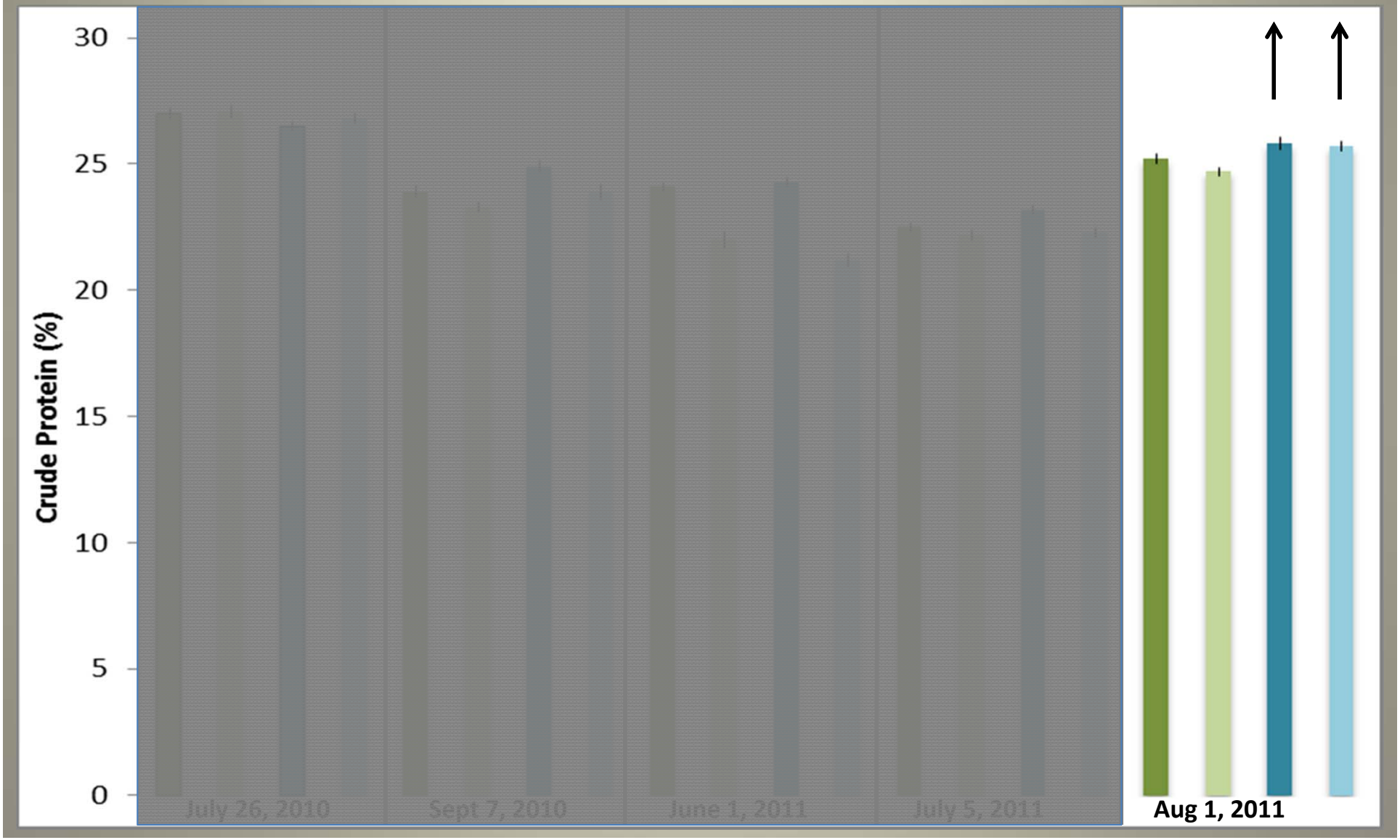
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IPM system and protein

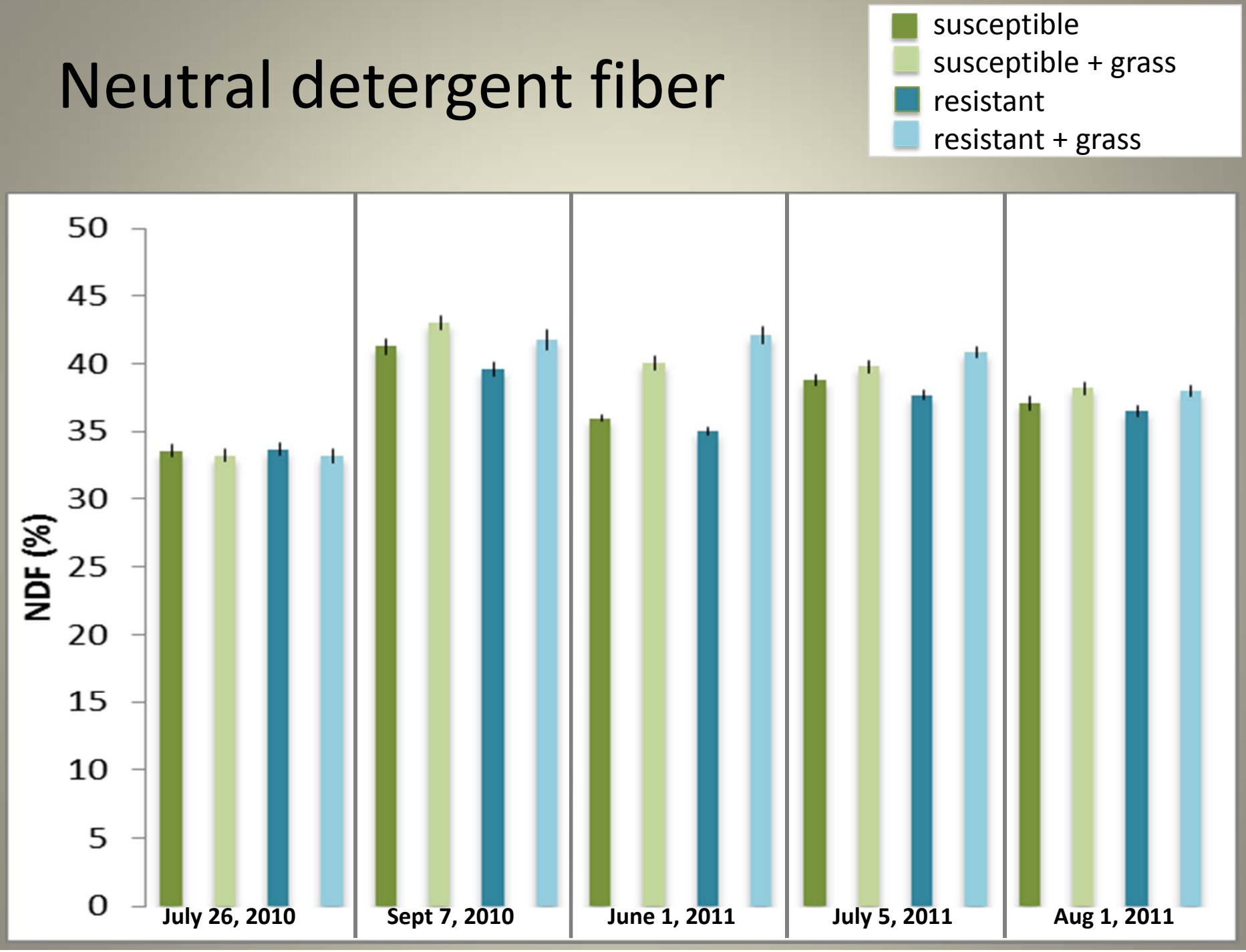
- Plots with grass typically had lower protein content
- Resistant alfalfa typically had higher protein content than susceptible alfalfa

Potato leafhopper and protein

PLH had a significant negative effect on protein

- July 26, 2010 (p=0.02)
- August 1, 2011 (p=0.04)

Neutral detergent fiber



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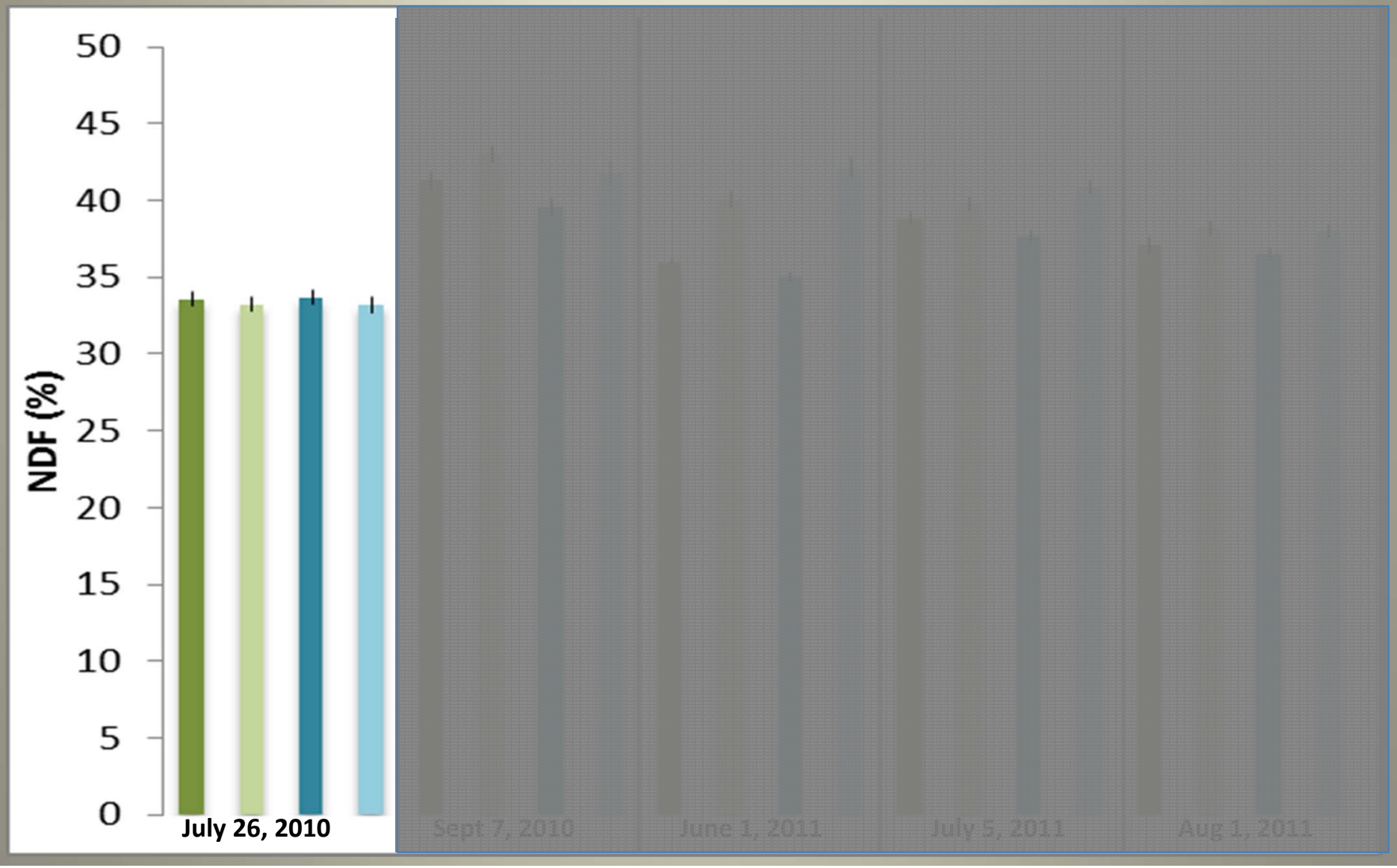

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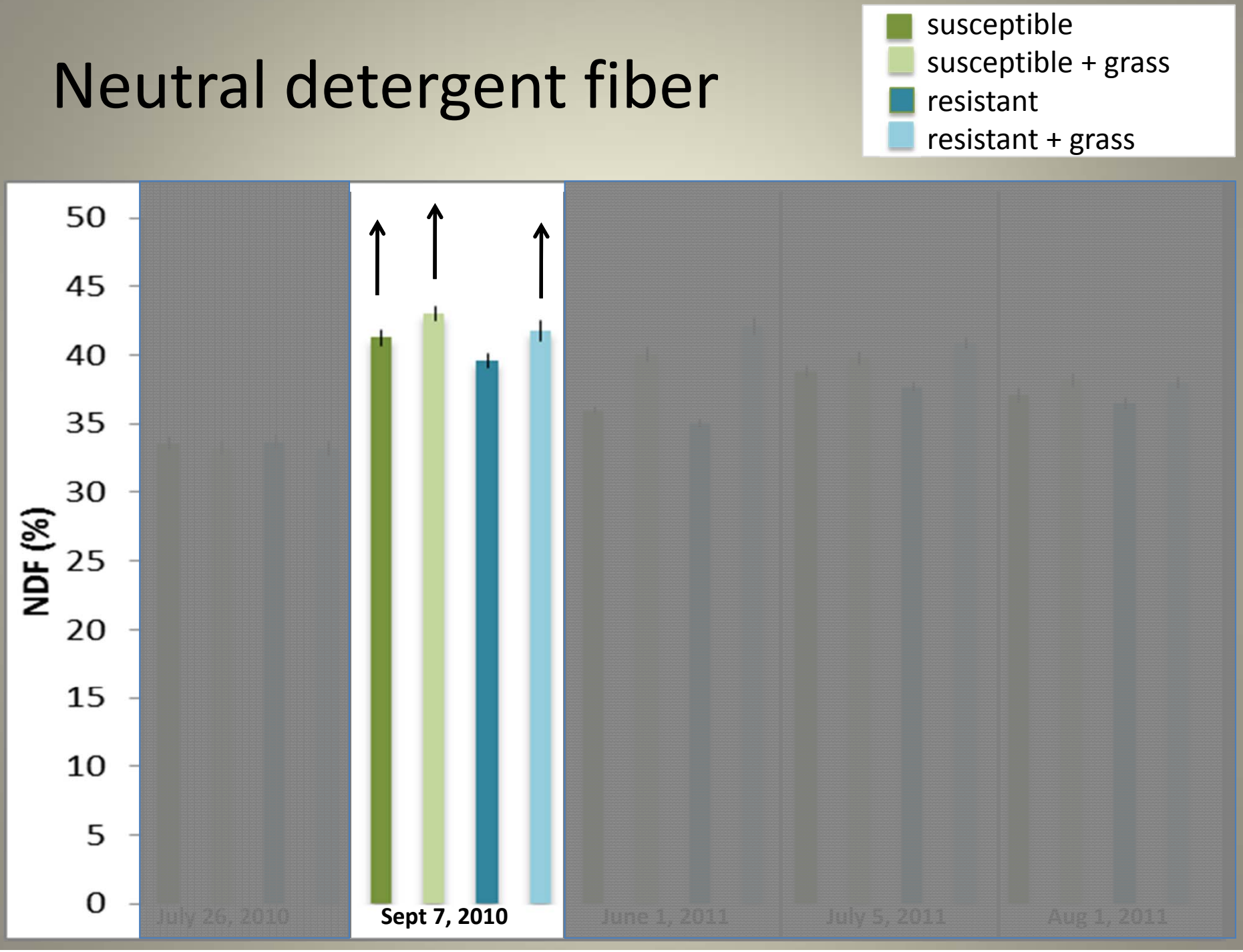

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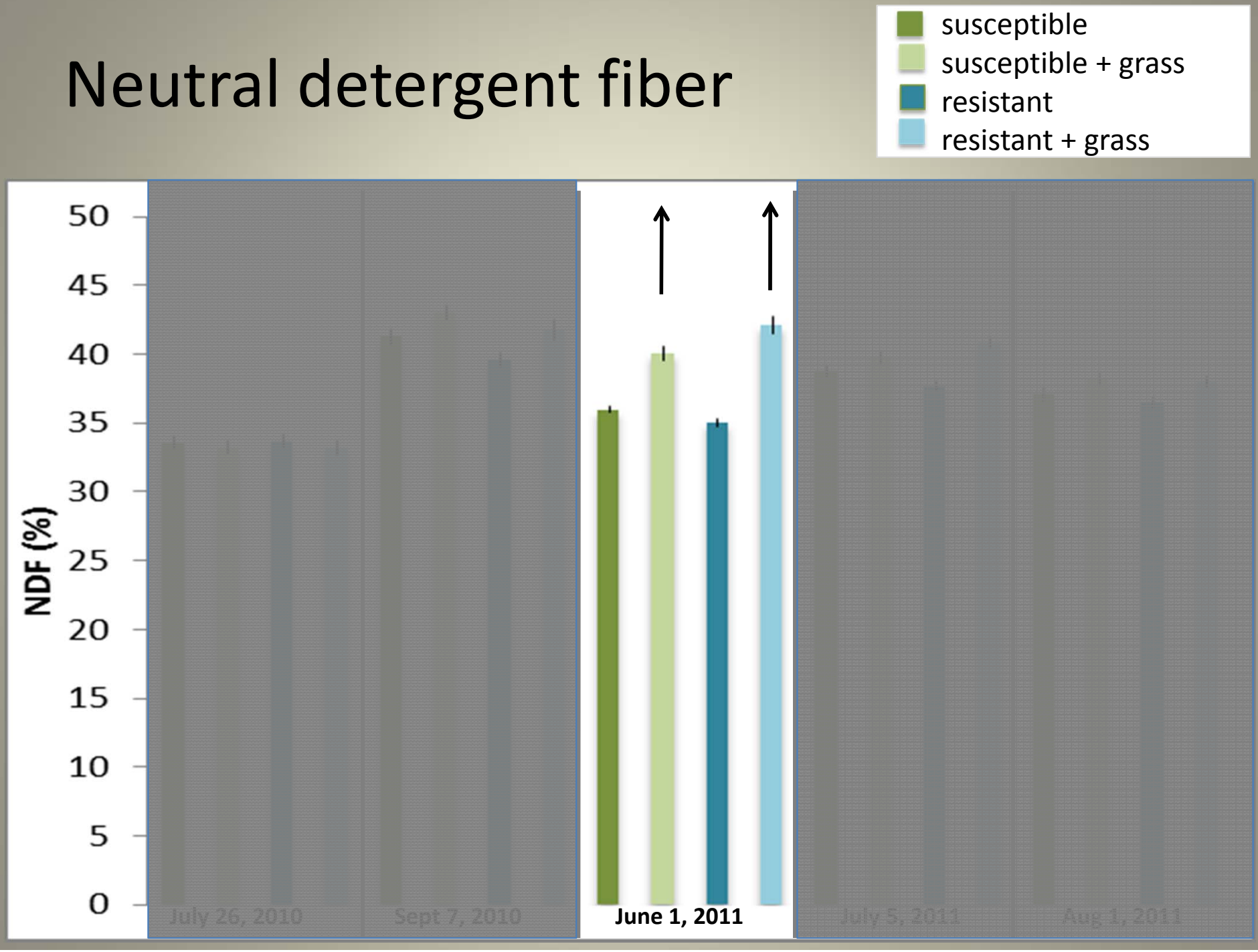

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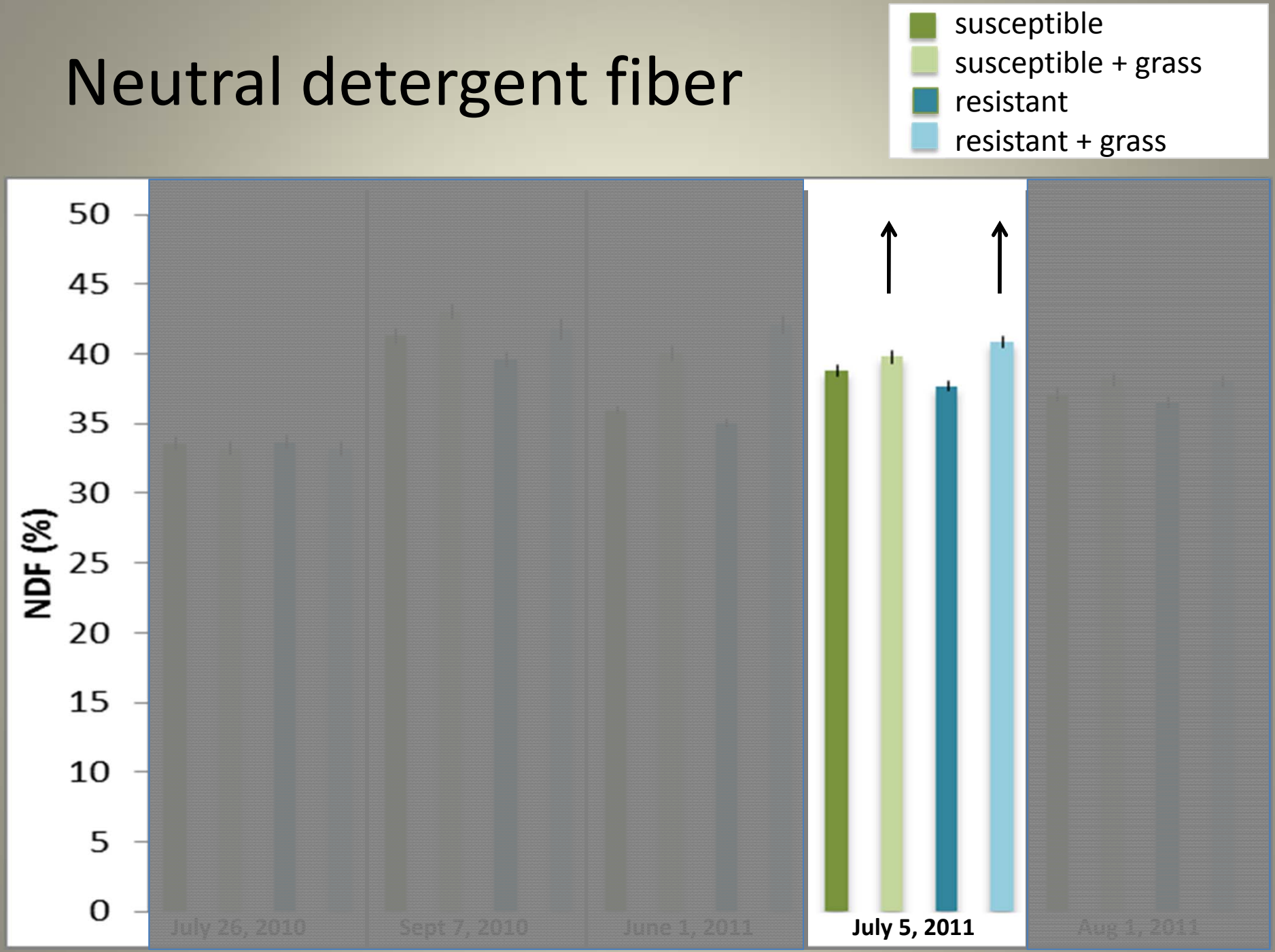

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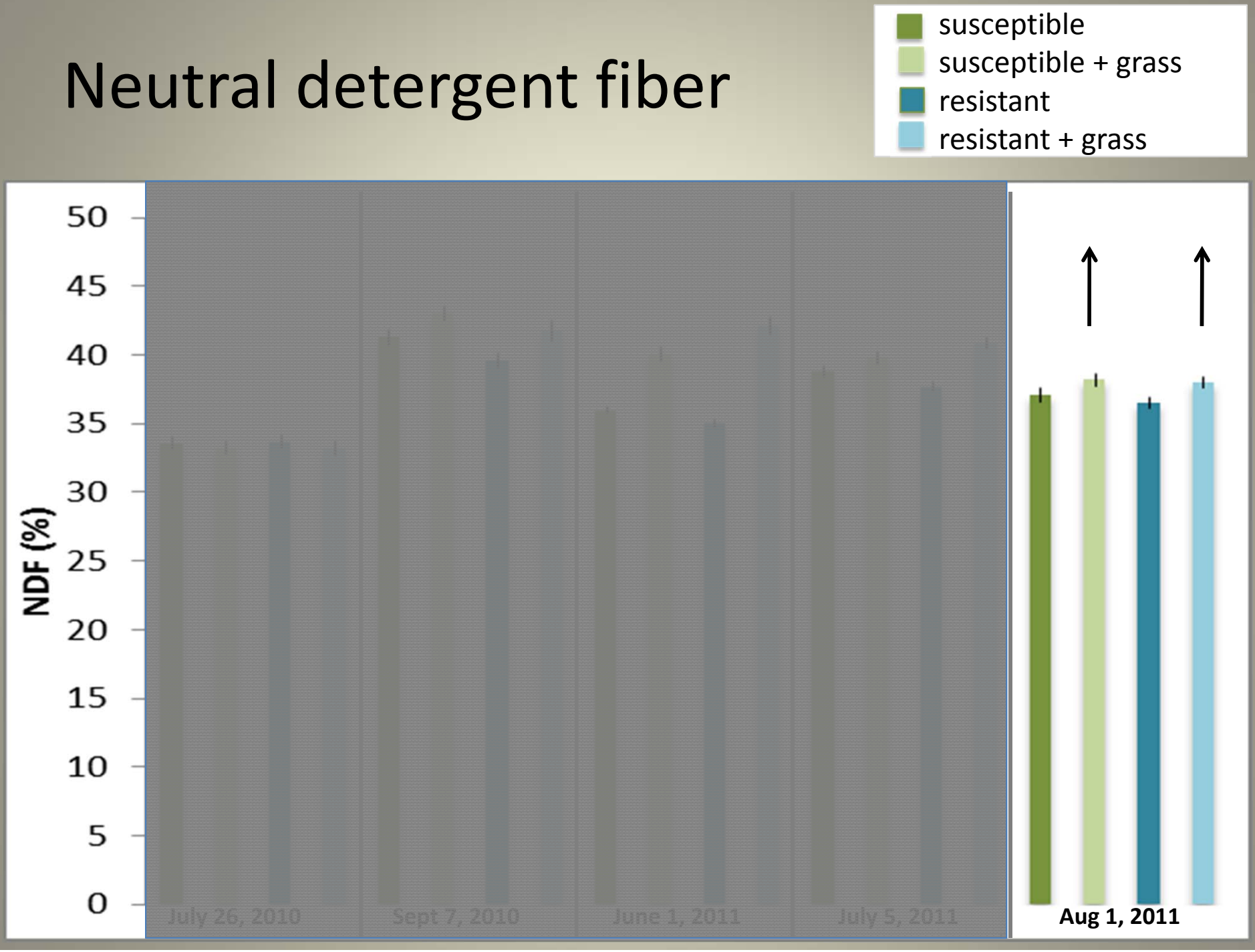


IPM system and NDF

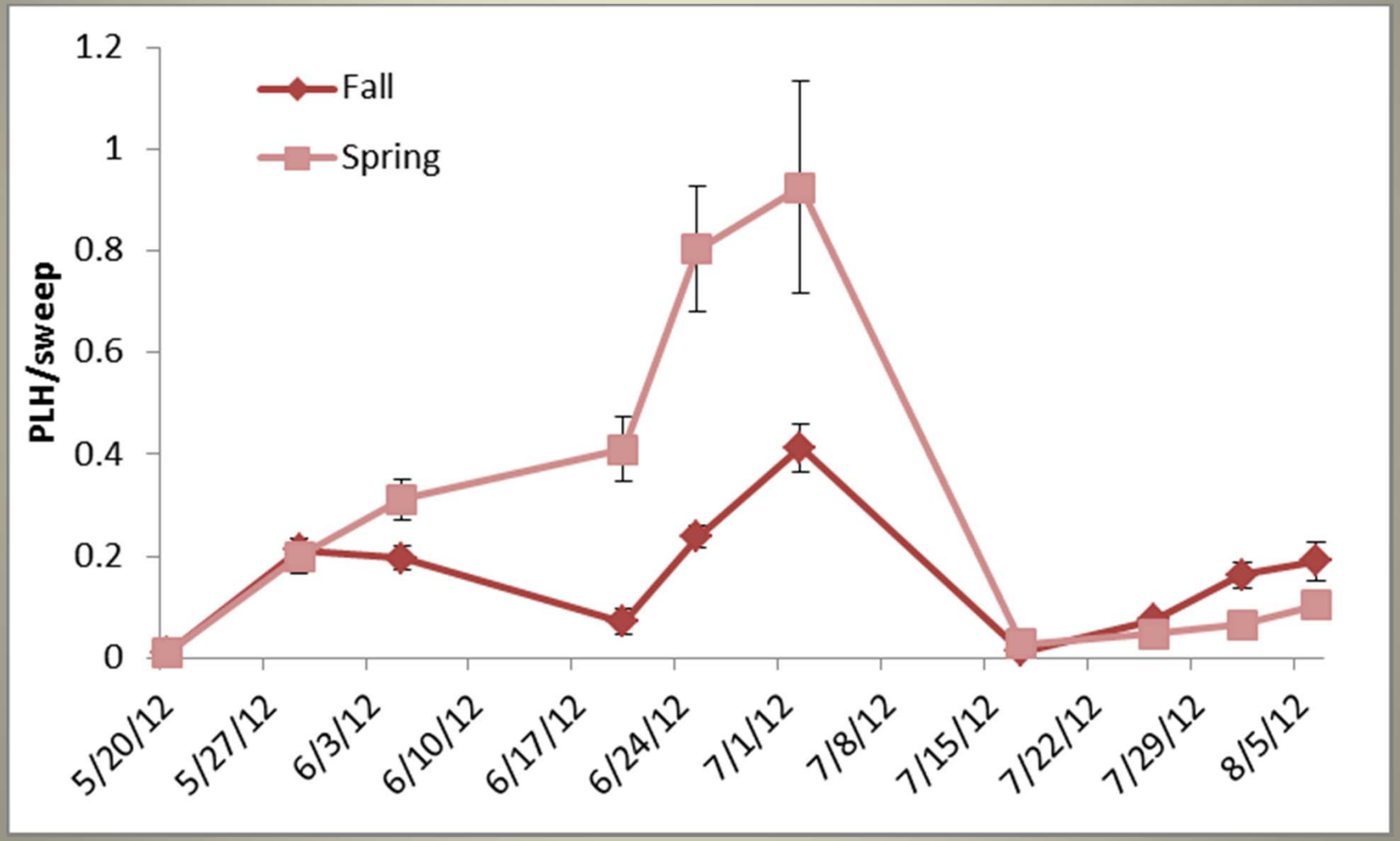
- Plots with grass had higher NDF
- Susceptible alfalfa sometimes had higher NDF content than resistant alfalfa

Potato leafhopper and NDF

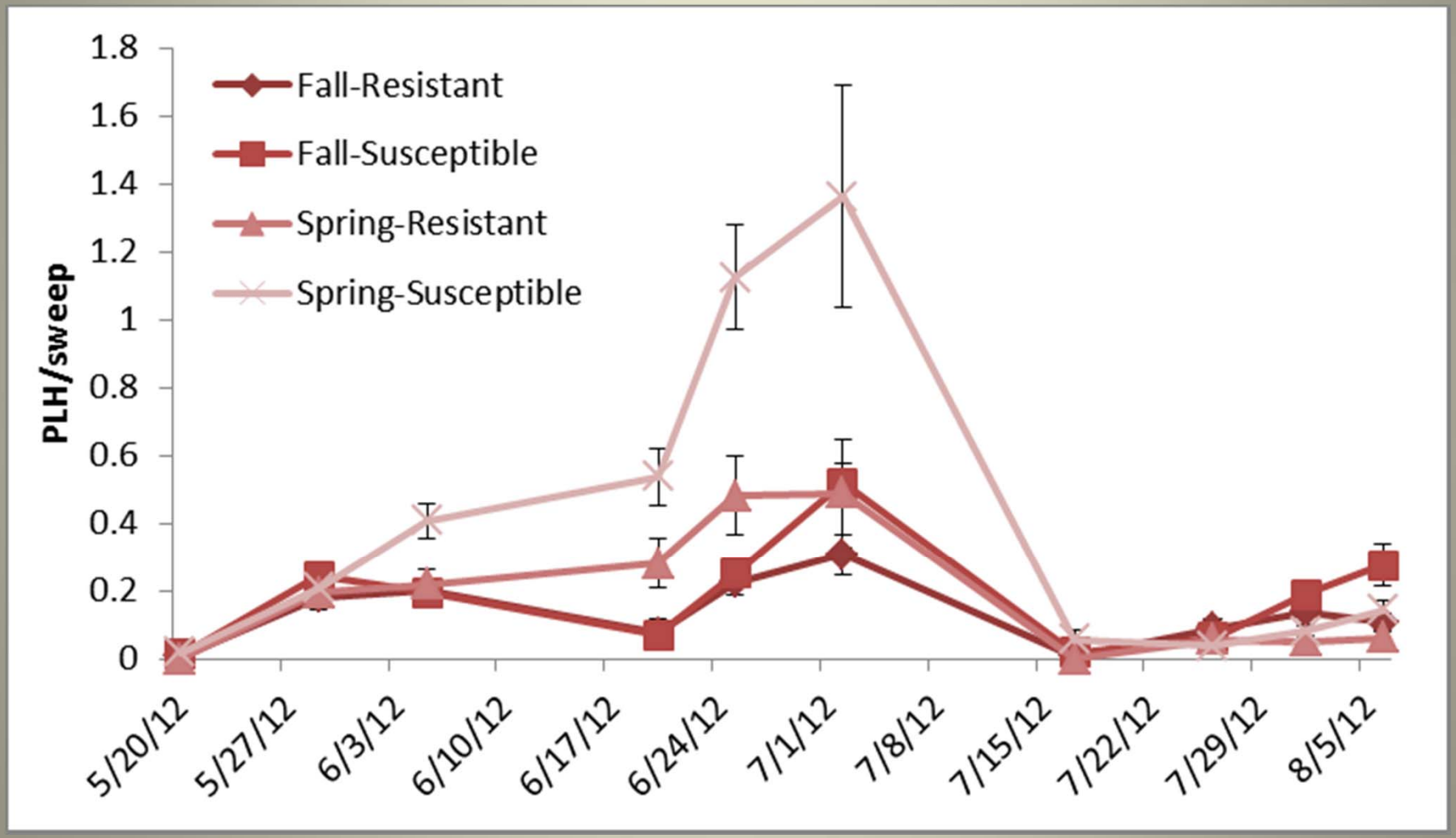
PLH decreased NDF on July 5, 2011 ($p=0.02$)

Trial layout at DFRC

Effect of seeding on PLH at DFRC



Effect of seeding and alfalfa variety



Summary

- Only 1 of the 5 cuttings presented experienced economically damaging PLH populations.
- Potato leafhoppers only had an impact on yield when economic threshold populations were reached.
- Resistant alfalfa significantly suppressed potato leafhopper in the seeding year even when pest pressure was low.
- The effect of orchardgrass intercropped with alfalfa on potato leafhoppers was minimal.

Ongoing work

- Plans to cage PLH this coming summer at DFRC to artificially create economically damaging populations and better understand the insect-injury crop-damage response

Acknowledgements

- My advisor, Eileen Cullen
- My labmate, Ebony Murrell
- Statistical consultants: Cecile Ane and Nick Kueller

Funding: UW-Madison College of Agricultural & Life Sciences - HATCH

Yield response to insecticide sprays at AARS

Treatment	**July 26, 2010 yield (tons/acre)[a]**
Susceptible alfalfa - no orchardgrass	
No spray	**1.36 ± 0.08[a]**
Economic Threshold	**1.45 ± 0.08[a]**
½ Economic Threshold	**1.36 ± 0.08[a]**
Susceptible alfalfa - with orchardgrass	
No spray	**1.29 ± 0.08[a]**
Economic Threshold	**1.28 ± 0.08[a]**
½ Economic Threshold	**1.35 ± 0.08[a]**
Resistant alfalfa - no orchardgrass	
No spray	**1.31 ± 0.08[a]**
Economic Threshold	**1.60 ± 0.08[a]**
½ Economic Threshold	**1.50 ± 0.08[a]**
Resistant alfalfa - with orchardgrass	
No spray	**1.34 ± 0.08[a]**
Economic Threshold	**1.44 ± 0.08[a]**
½ Economic Threshold	**1.38 ± 0.08[a]**