Effect of Rust and other pathogens on on Forage Quality

A.T. Adesogan
O.C.M. Quieroz
S.C. Kim

Department of Animal Sciences

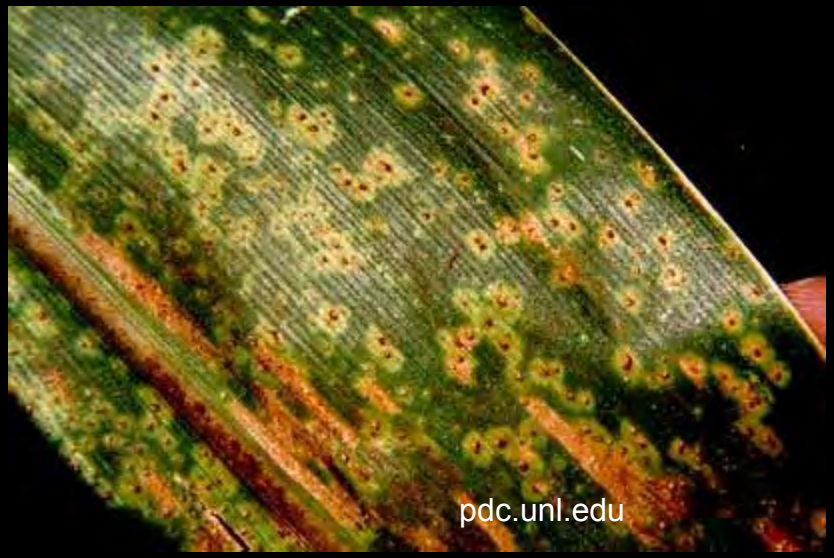
Introduction

- Significant crop losses to disease in ’02 and 03 in FLA
- Southern rust is one of the most common diseases
- Unpredictable incidence, yet v. aggressive
- Cause leaf death, stalk rot, lodging, crop failure

Southern rust

- Aggressive fungal disease; destroys field in 7-10 days
- Dispersed by airborne spores of *Puccinia polysora*
- Forms orange, circular pustules on upper leaf surface.
- Saps nutrients causing leaf death.
- Common with high temps, high humidity

Southern rust



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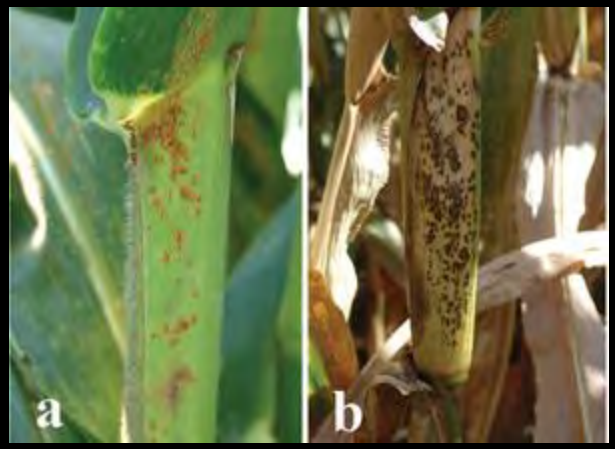

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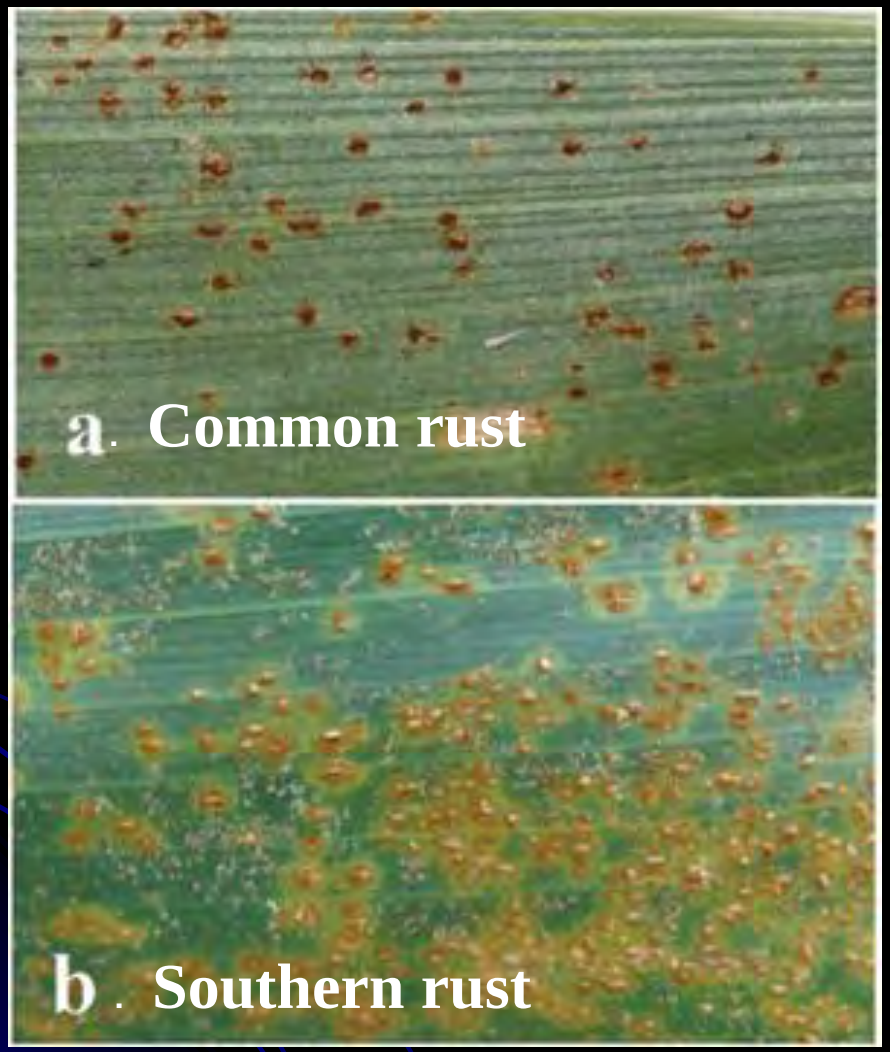

Common Rust
- *P. sorghi*
- 60-77° F
- Both leaf surfaces
- Red to brown
- Sparsely scattered

- Southern rust
- *P. polyspora*
- 77- 90° F
- Upper leaf surfaces
- Orange
- Dense clusters

(Jackson, 2008)

Southern leaf blight

- Appears at end of spring / during fall with warm to hot temperatures (68-90°F) and periods of extended leaf wetness (Raid and Kucharek, 2005).
- Caused by the fungus *Helminthosporium or Bipolaris maydis*
- Causes long, tan to brown, cigar-shaped lesions that can coalesce & make the entire leaf necrotic.
- Infestation begins with the mature leaves and proceeds up the plant.

Southern leaf blight

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Challenges

- Few resistant varieties hybrids exist and these may lack traits needed for silage production
- Fungicides can only control the disease when applied early in the season

Knowledge gap

- Little is known about:
  - Rust effects on nutritive value of corn silage
  - Safety of feeding rust-infected corn

Objective

- To determine how the level of southern rust infestation affects nutritive value, fermentation and bunk life of corn silage.
- To determine if a microbial inoculant can improve the quality of rust-infested corn silage

Methods

- Pioneer 33V16 hybrid grown on a 130-acre field (July 6, 07)
- Infested by rust after tasseling
- Abound fungicide applied by crop duster (Sept, 7 07)
- Uneven coverage allowed some rust to persist
- Field classified into clean, medium rust or high rust areas

Rust treatments

Clean

Medium rust

High rust

High-rust treatment

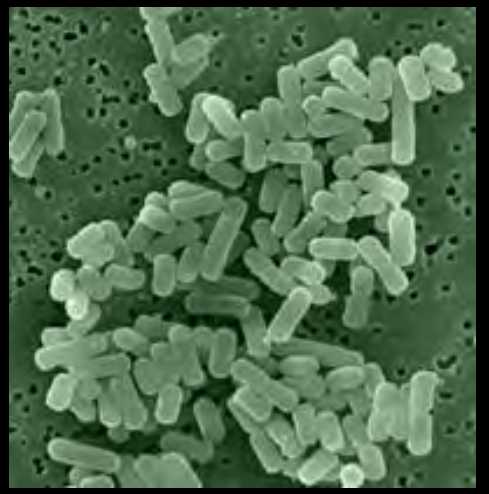
Treatments

No.	Rust	Inoculant
1	Clean	–
2	Medium	–
3	High	–
4	Clean	+
5	Medium	+
6	High	+

Each treatment was ensiled in four replicate, 5 gallon mini silos for 97 days

Inoculant

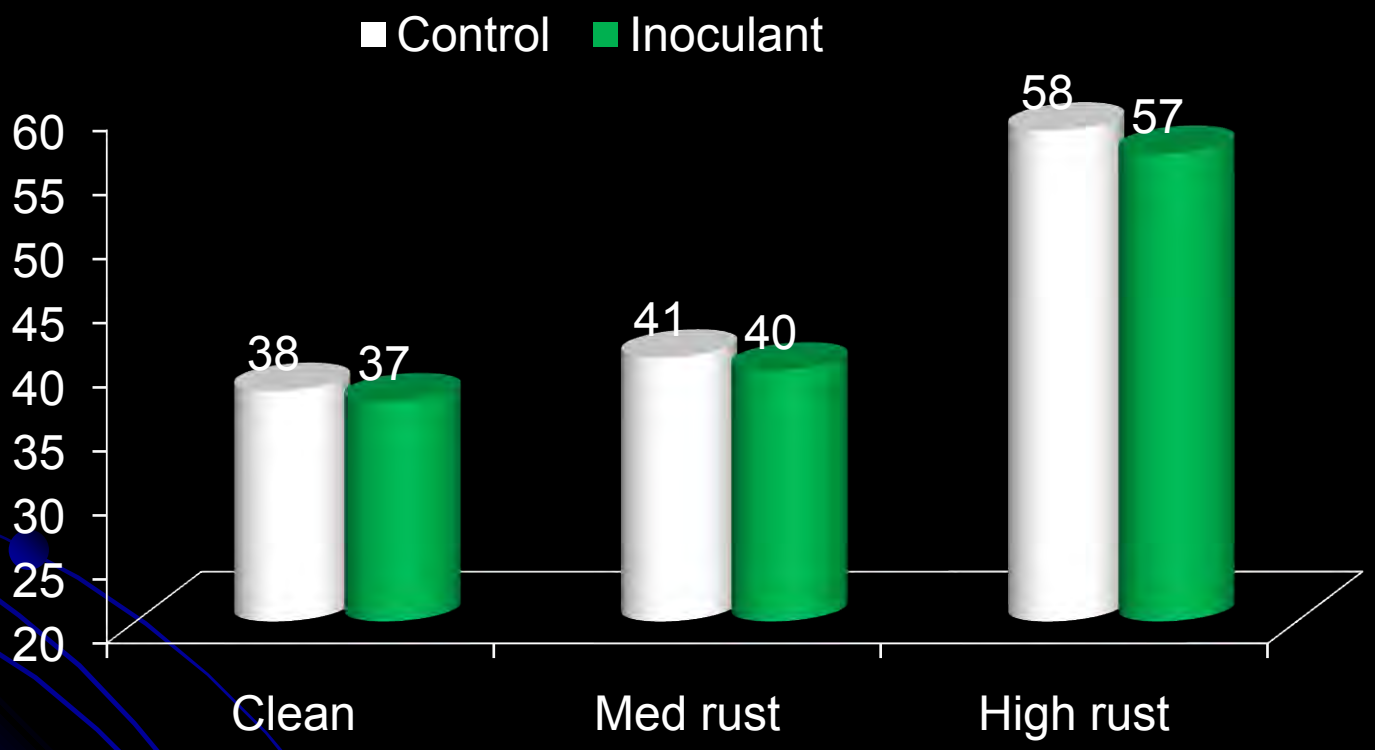
- Buchneri 500 (Lallemand Animal Nutrition)
- Combo inoculant
- Applied at a rate that supplied 4.99 x 10^{10} cfu/g of :
  - *Pediococcus pentosaceaus*
  - *Lactobacillus buchneri*



Corn forage composition

	Clean	Medium rust	High rust
DM, %	39	41	58
NDF, %	45	49	55
ADF, %	26	29	33
CP, %	8	8	9
In vitro NDFD %	35	34	33
In vitro DMD, %	64	59	55
Mycotoxins, ppm	0	0	0

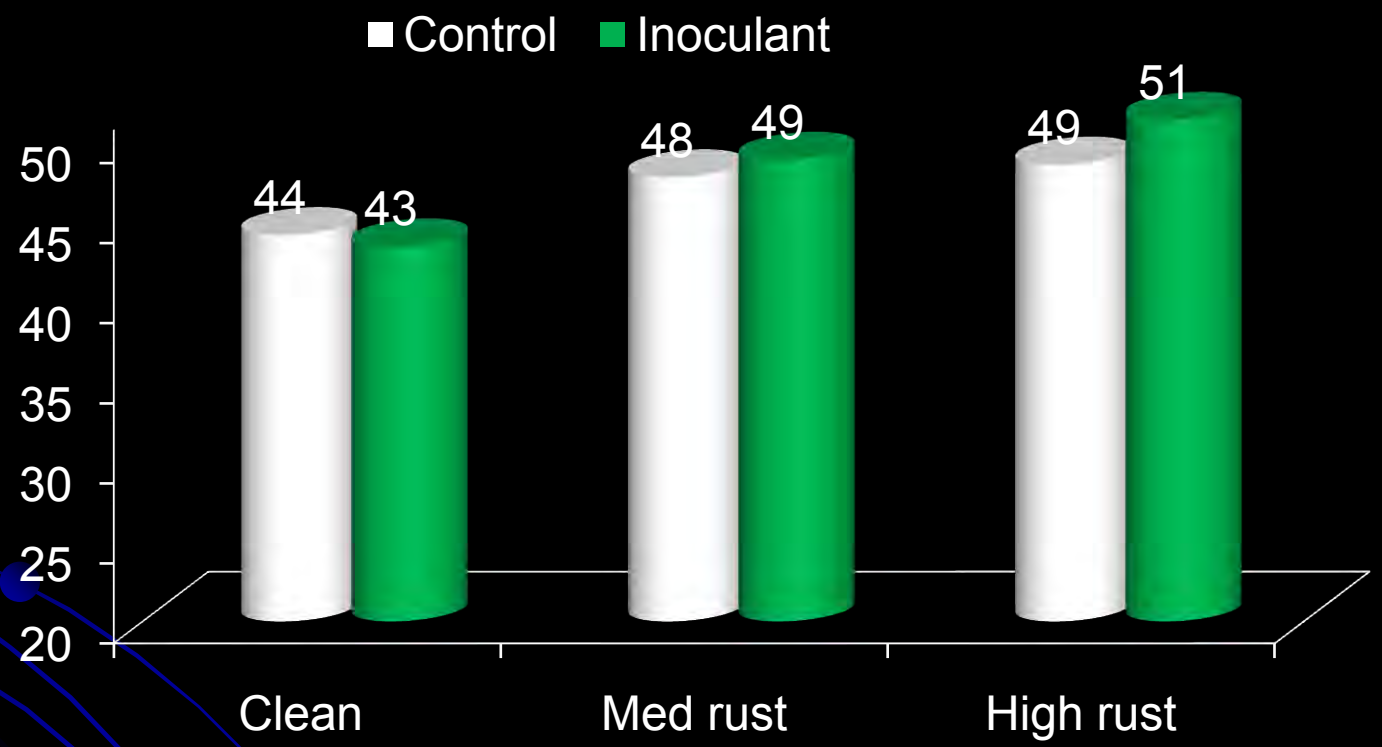
Treatment effects on silage % DM



Effects:
Rust level ***
Inoculant ***
Interaction; ns

DM % increased by rust; slightly decreased by inoc.

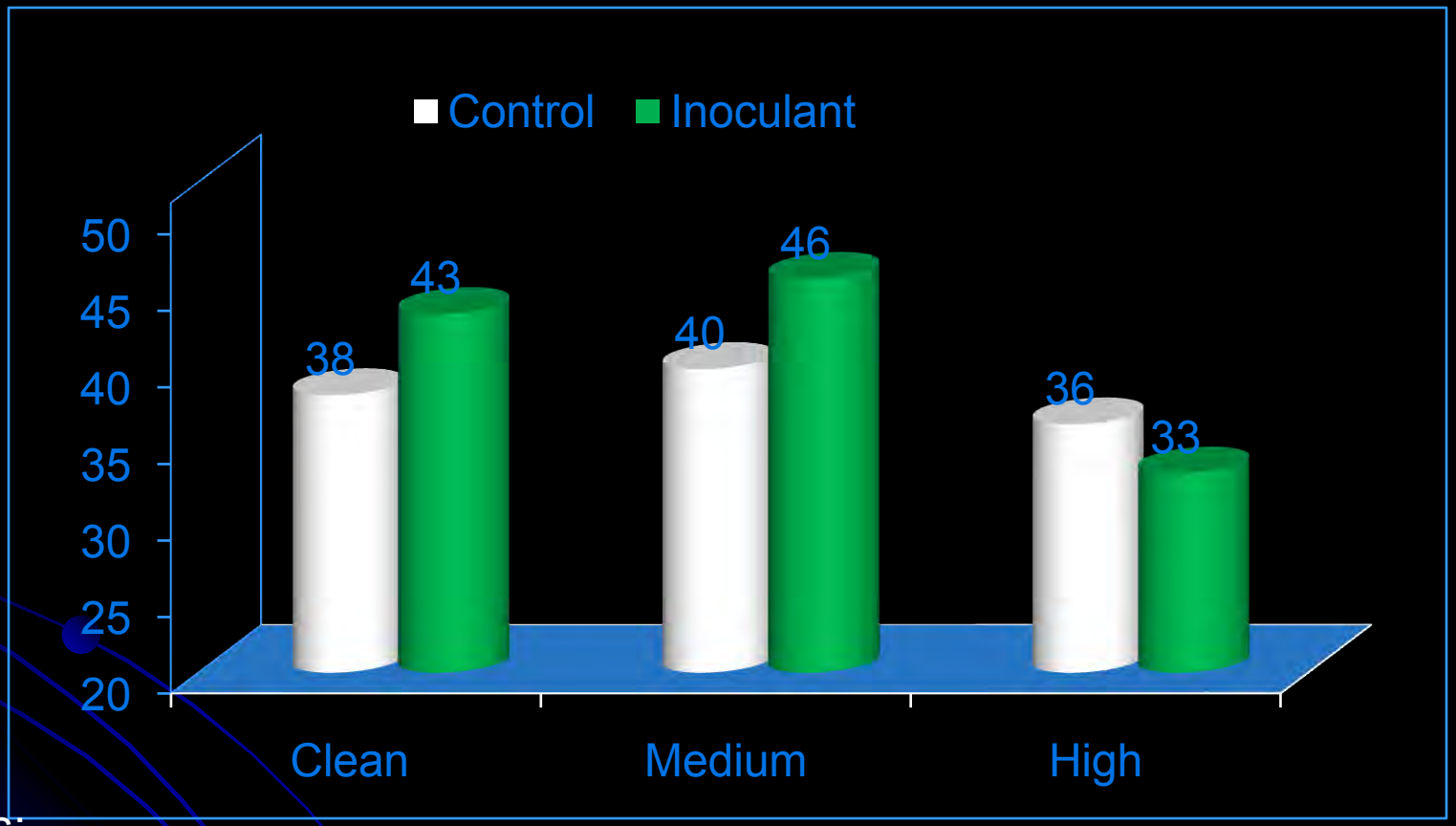
Treatment effects on silage % NDF



Effects:
Rust level ***
Inoculant : ns
Interaction: ns

NDF% increased by rust; same trend for ADF

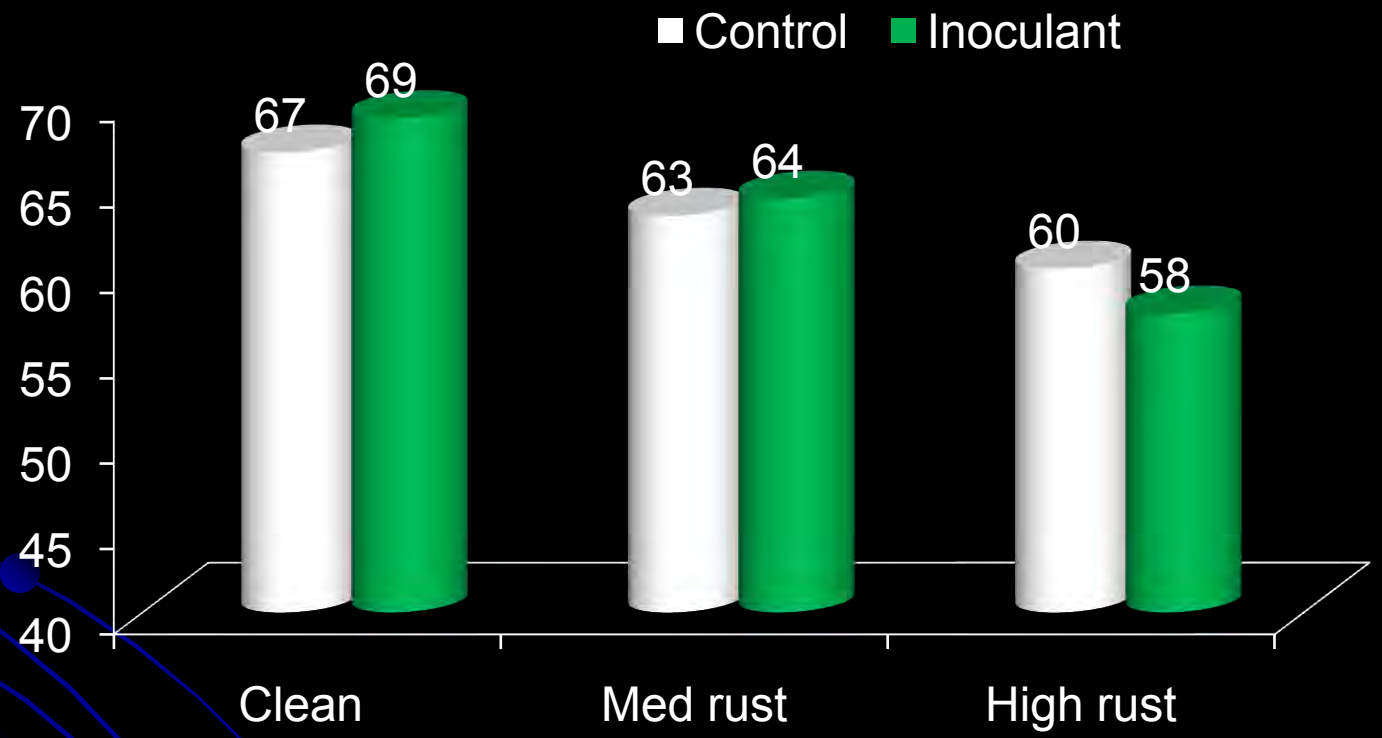
Treatment effects on NDF digestibility, %



Effects:
Rust level ***
Inoculant : *
Interaction: ***

NDF digestibility was lowest in high rust;
Inoc. increased values in clean & medium rust silages

Treatment effects on DM digestibility, %



Effects:
Rust level ***
Inoculant : ns
Interaction: ns

DM digestibility was reduced by rust

Nutritive value conclusions

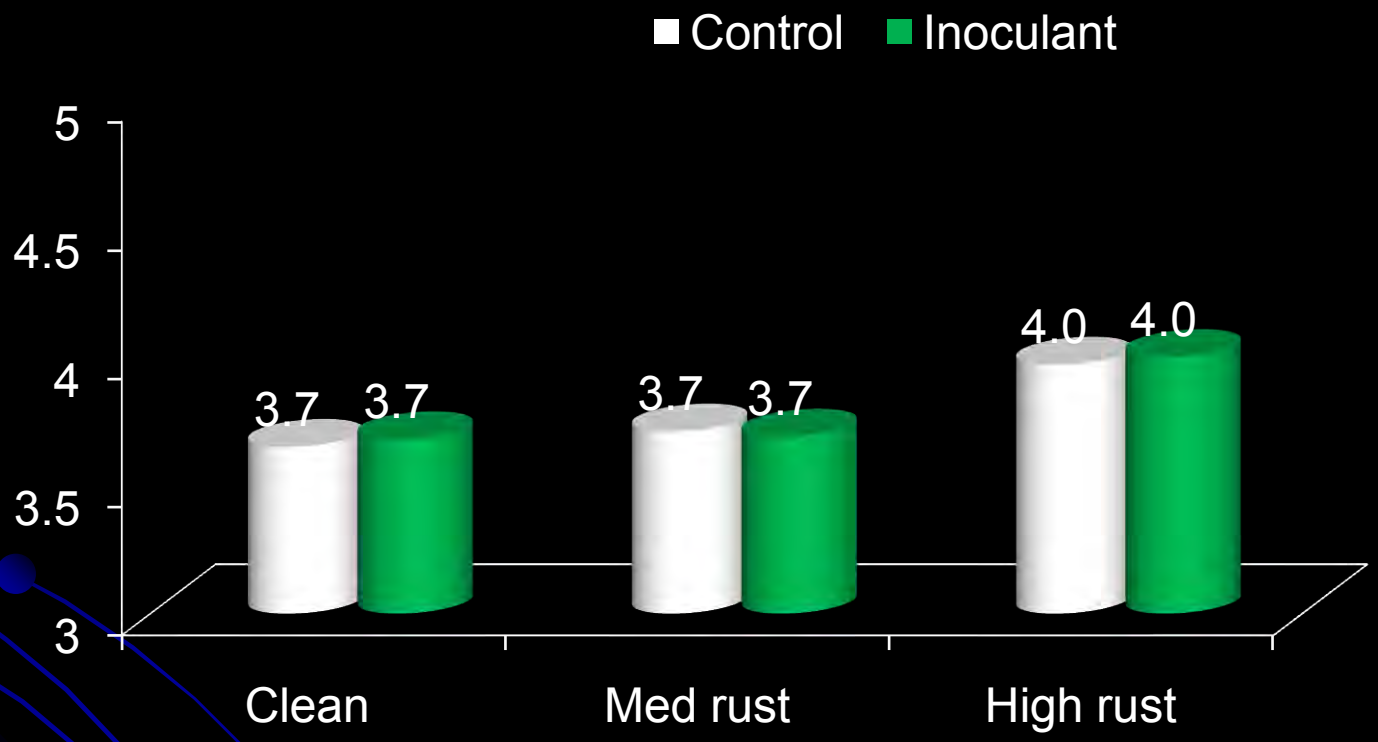
Rust infestation:

- Dried the forage
- Increased NDF content
- Decreased digestibility of NDF and DM

Inoculant treatment:

- Increased NDF digestibility in clean & medium rust silages

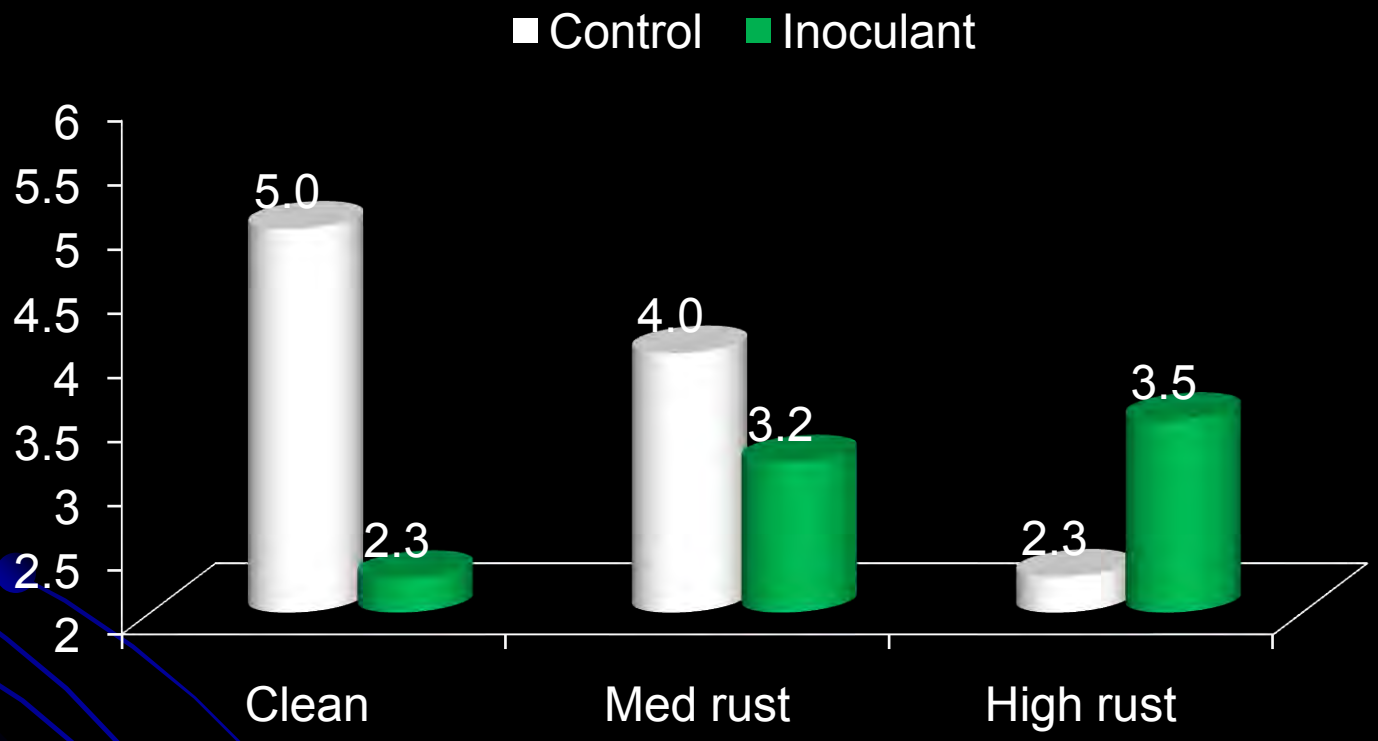
Treatment effects on pH



Effects:
Rust level ***
Inoculant : ns
Interaction: ns

pH was slightly increased by rust

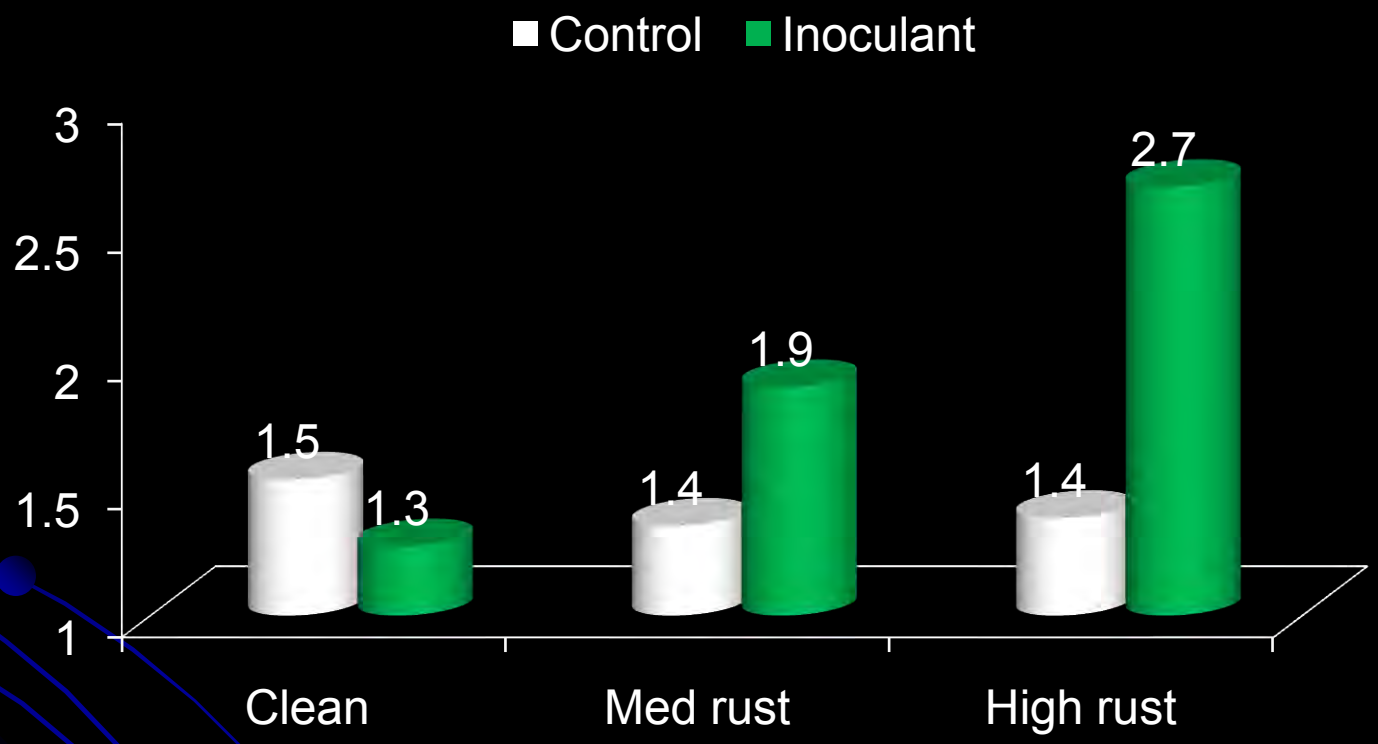
Treatment effects on Lactate %



Effects:
Rust level **
Inoculant : ***
Interaction: ***

Inoc. reversed the decrease in lactate caused by rust

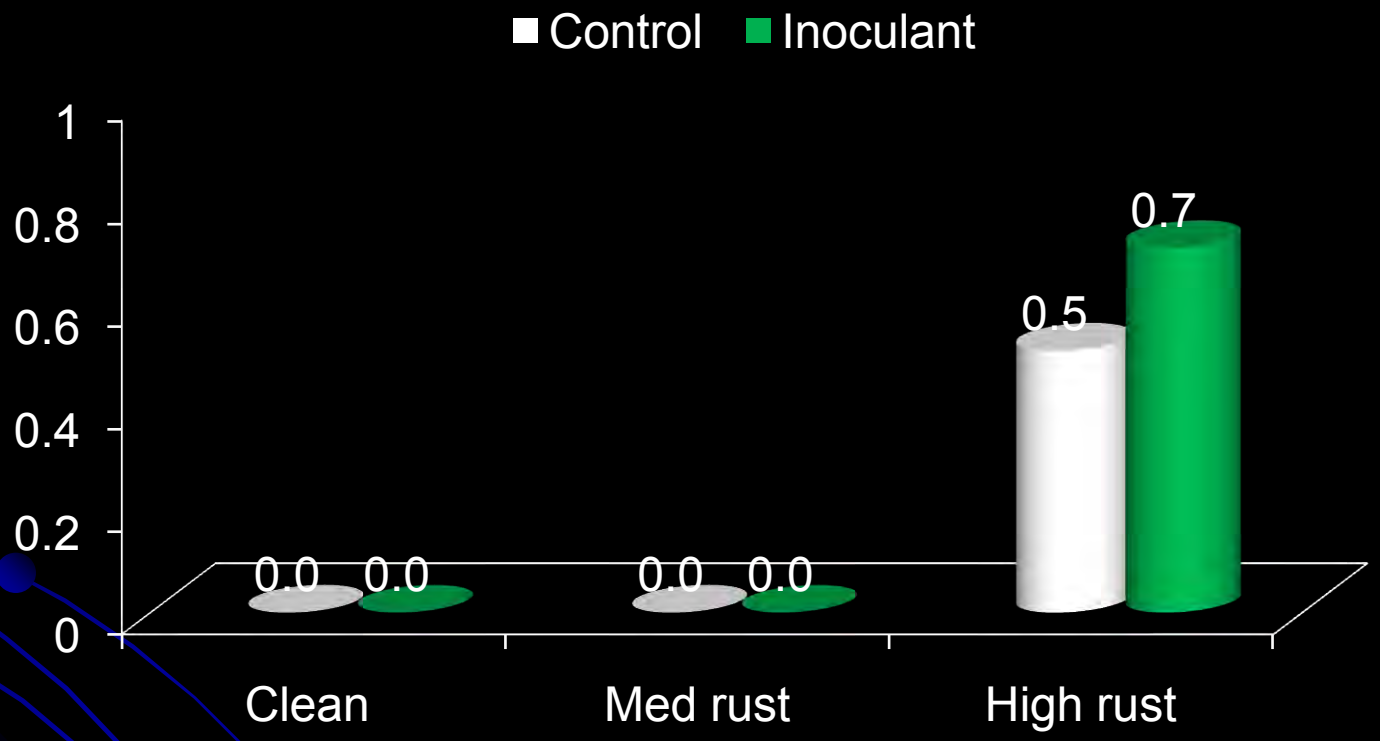
Treatment effects on Acetate %



Effects:
Rust level *
Inoculant : **
Interaction: **

Inoc. reversed the decrease in acetate caused by rust

Treatment effects on Butyrate %



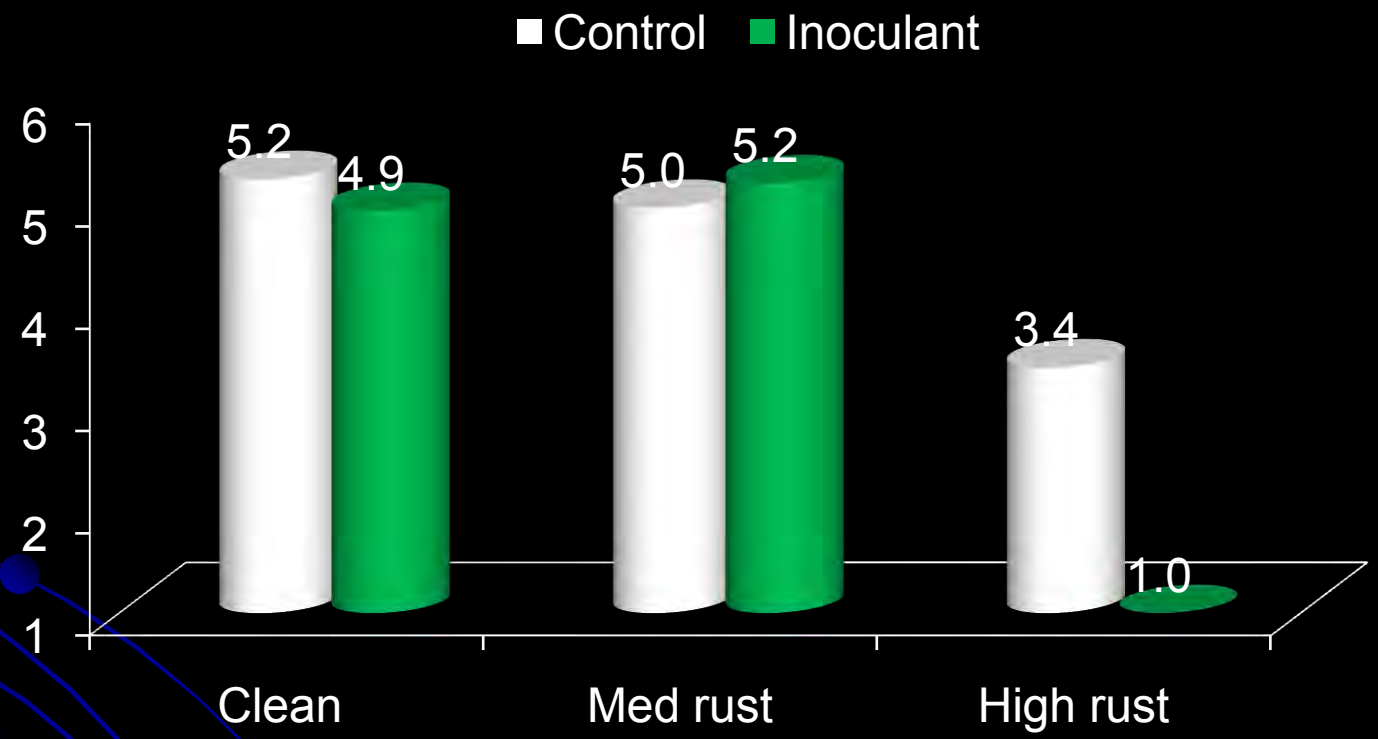
Effects:
Rust level ***
Inoculant : *
Interaction: **

Butyrate was detected in the high-rust silage

Fermentation conclusions

- Rust infestation:
  - Reduced the pH & fermentation acid production
  - Caused a poorer type of fermentation
- Inoculant treatment:
  - Reduced some adverse effects of rust on the fermentation

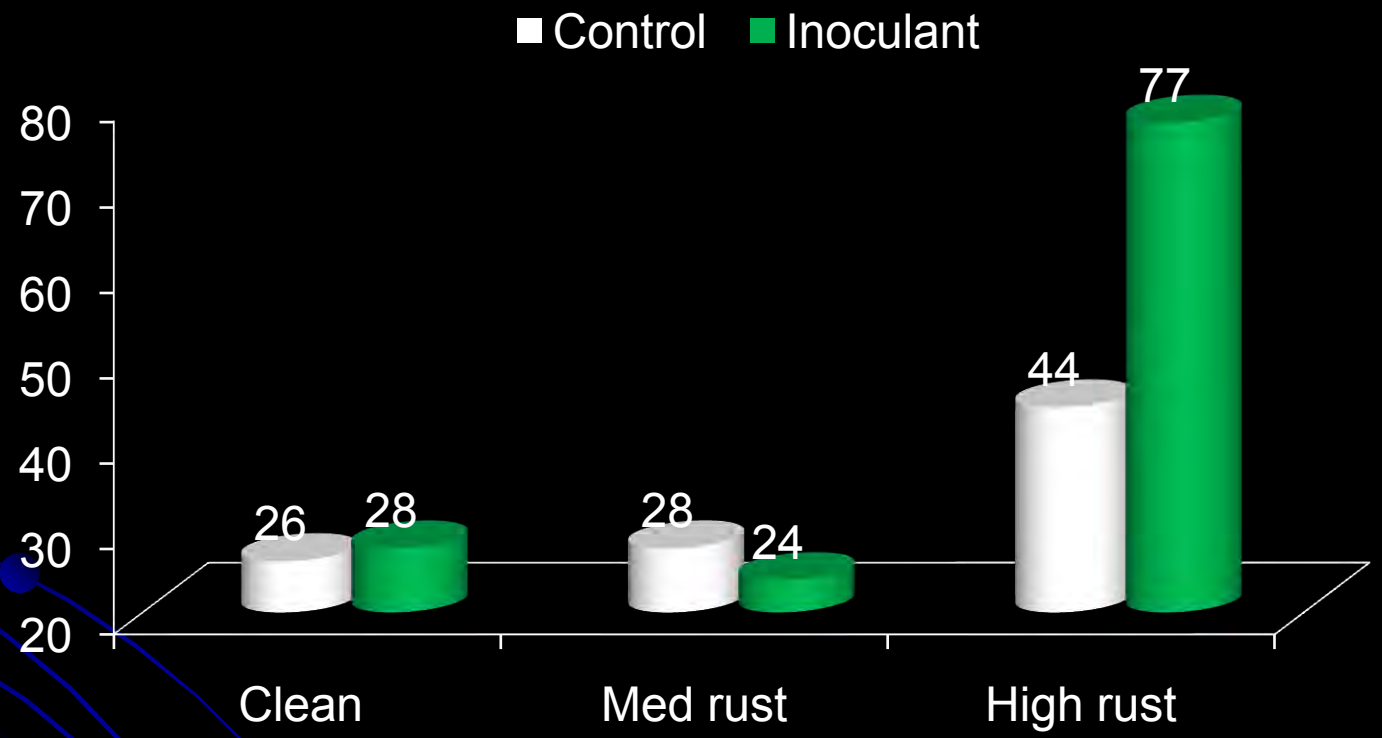
Treatment effects on Molds, log cfu/g



Effects:
Rust level ***
Inoculant : ns
Interaction: ns

Molds were less in high-rust silages

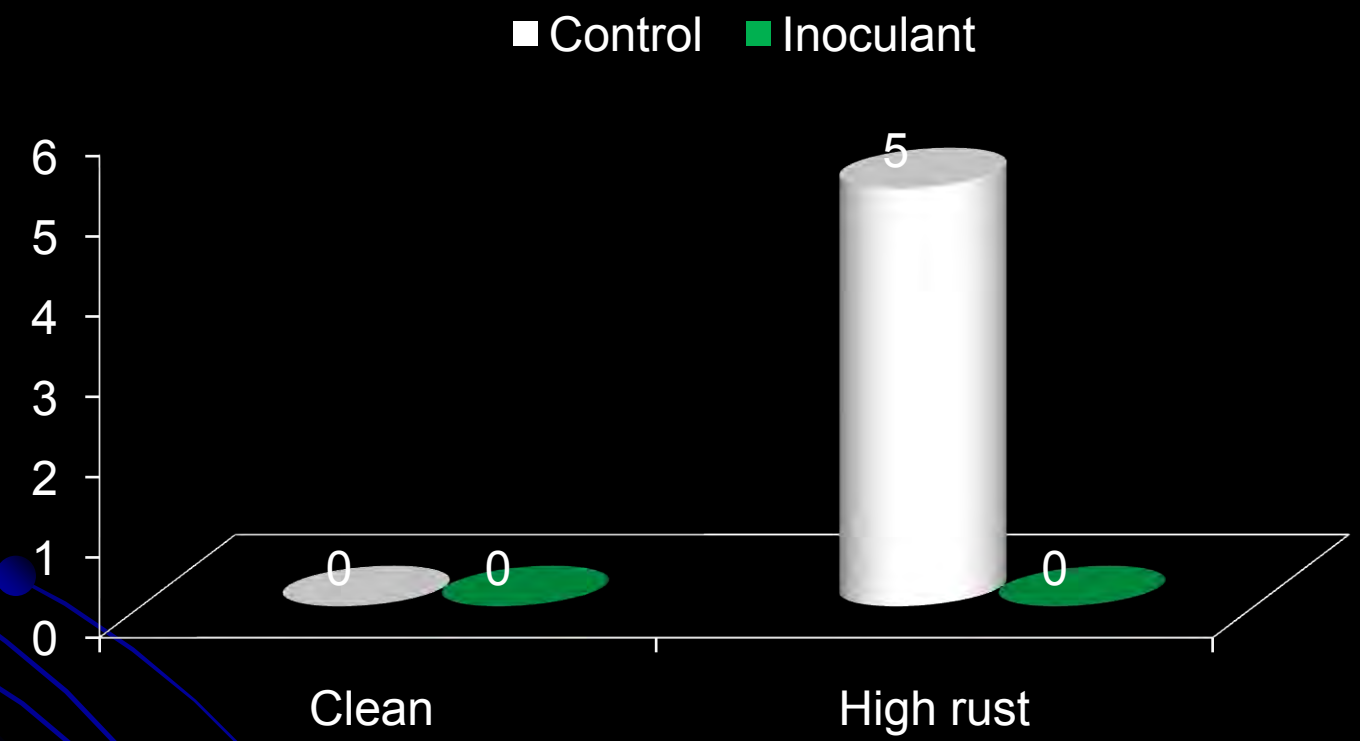
Treatment effects on hours of bunk life



Effects:
Rust level **
Inoculant : x
Interaction: *

High-rust silages were more stable, particularly when inoc.-treated

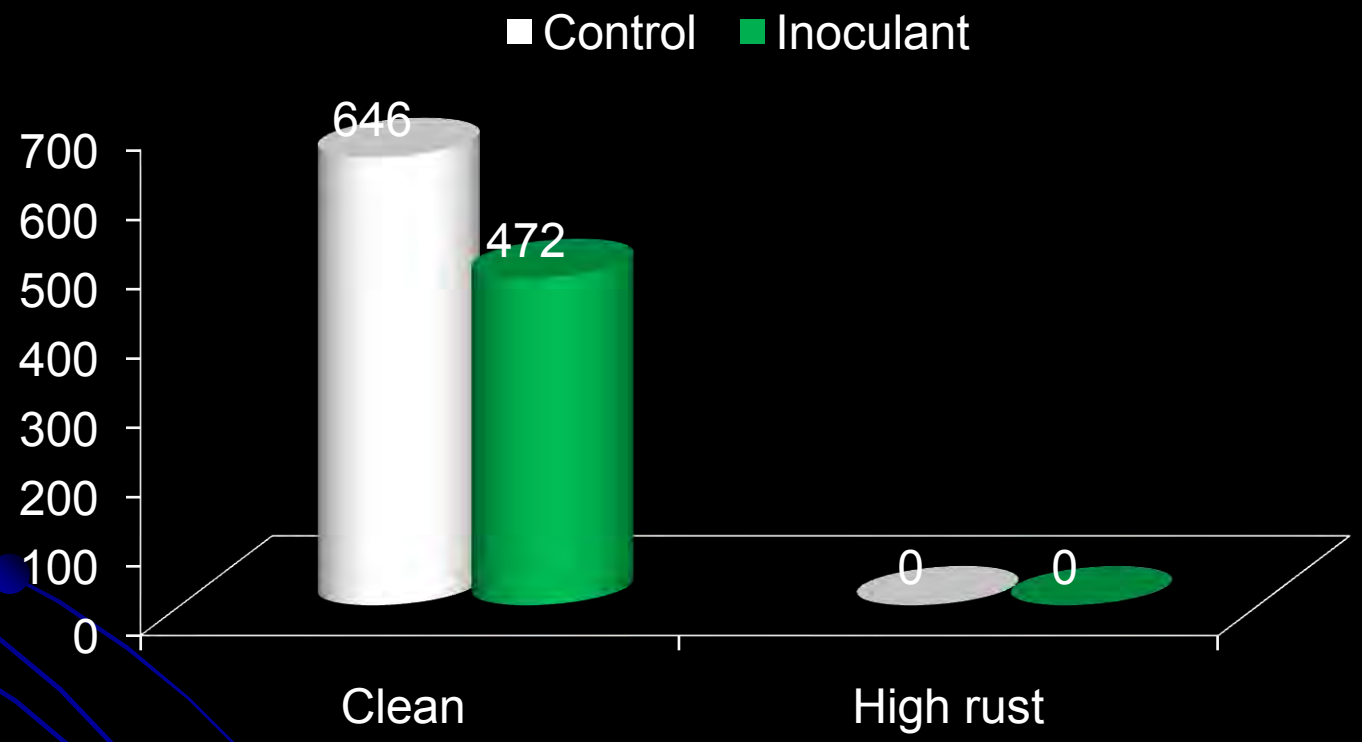
Treatment effects on aflatoxin, ppm



Effects:
Rust level x
Inoculant : x
Interaction: x

High-rust control silages had more aflatoxin than FDA allows (20 ppb in feeds)

Treatment effects on zearalenone, ppm



Effects:
Rust level ***
Inoculant : ns
Interaction: ns

Zearalenone was only detected in clean corn

Mold, mycotoxin & bunk life conclusions

- Rust reduced molds and improved bunk life but made the silage unsafe to feed due to excess high aflatoxin levels

- High zearalenone in clean silages suggests late-harvested summer corn should be fed with mycotoxin binders.

Take home messages

- Rust infestation can reduce nutritive value and fermentation
- High rust infestation can cause dangerously high aflatoxin levels
- Inoculant application can reduce some adverse effects of severe rust infestation
- Use rust-resistant summer corn
- Feed late-harvested summer corn with a mycotoxin binder

Acknowledgements

- SMI Check-Off
- A. Pedroso; M. Huisden; K. Arriola; T. Kang