Effect of *Busseola fusca* and *Fusarium verticillioides* interaction on Fusarium ear rot and fumonisin production in maize in South Africa

(MTM 11/14)

E. Ncube (ARC-GCI)

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Collaborators

- Prof. B Flett – ARC-GCI & North-West University
- Prof. A Viljoen – Stellenbosch University
- Prof. J van den Berg – North-West University
- Prof. JBJ van Rensburg – ARC-GCI
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- Ms A Schoeman – ARC-GCI
- Prof. GP Munkvold – Iowa State University, USA

Introduction

- *F. verticillioides* occurs in many maize-producing regions in South Africa (both subsistence & commercial)
- Studies have been done on the European corn borer in the US
- *B. fusca* x *F. verticillioides* interaction on maize has not been studied in South Africa
- The effect this interaction has on Fusarium ear rot (FER) & fumonisin (FUM) contamination is not known

Introduction

- It is also unknown whether or not *B. fusca* moths have preference for maize plants infected with *F. verticillioides*
- Important to study this interaction given *B. fusca* resistance to Bt maize discovered in recent seasons in South Africa

B. fusca damage on maize

- *Busseola fusca* is considered the most important insect pest of maize in South Africa
- Significant yield losses have been attributed to stem borers

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B. fusca damage on maize ears

Project aims

- To determine:

a) Effect of *B. fusca* x *F. verticillioides* interaction on FER and FUM contamination in both Bt and non-Bt maize hybrids

b) Effect of mechanical damage to maize ears on FER and FUM contamination

c) Role of *B. fusca* frass in *F. verticillioides* infection

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Project aims

d) Oviposition preference, larval survival and growth rate of *B. fusca* on maize infected with *F. verticillioides*

e) Effect of different *F. verticillioides* isolates on growth rate of *B. fusca* larvae

f) Effect of insecticides on the *B. fusca* x *F. verticillioides* interaction and FER & FUM contamination

Actions taken to date

- To determine whether *B. fusca* damage predisposes maize ears to FER and FUM contamination or *B. fusca* contributes in an additional way, perhaps as a vector
- Three trials, i.e. *B*. *fusca* damage & mechanical damage trials, planted during 2008/09, 2009/10 & 2010/11 seasons at the ARC-GCI experimental farm, Potchefstroom

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Materials and methods

B. fusca damage

- Two trials planted at Potchefstroom
- Randomised complete block (RCB) design with 2 border rows on each side of the experimental row
- Three hybrids (Bt [PAN6236B] and its susceptible isohybrid [PAN6126], an unrelated non-Bt hybrid [PAN6723])

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Materials and methods

- **Four treatments**, six replicates:

i) *F. verticillioides* inoculation

ii) *F. verticillioides & B. fusca* infestation

iii) *B. fusca* infestation

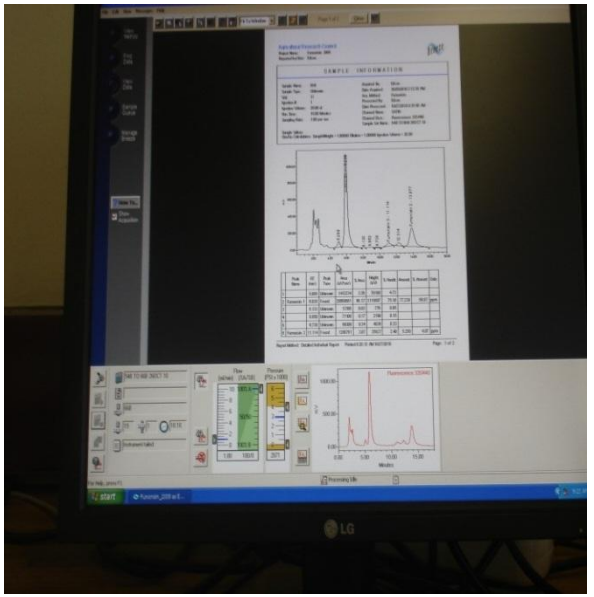
iv) Control

Materials and methods

- A spore suspension of a high fumonisin-producing *F. verticillioides* isolate (MRC826) was inoculated
- *B. fusca* larvae obtained from a mass rearing facility at the ARC-GCI
- *B. fusca* infestation was done 6 weeks after plant emergence

Materials and methods

- All ears were hand harvested
- FER was visually rated
- Fumonisins were quantified using HPLC
- *B. fusca* damage was evaluated by measuring the feeding tunnel length
- ANOVA was performed using Statgraphics5+



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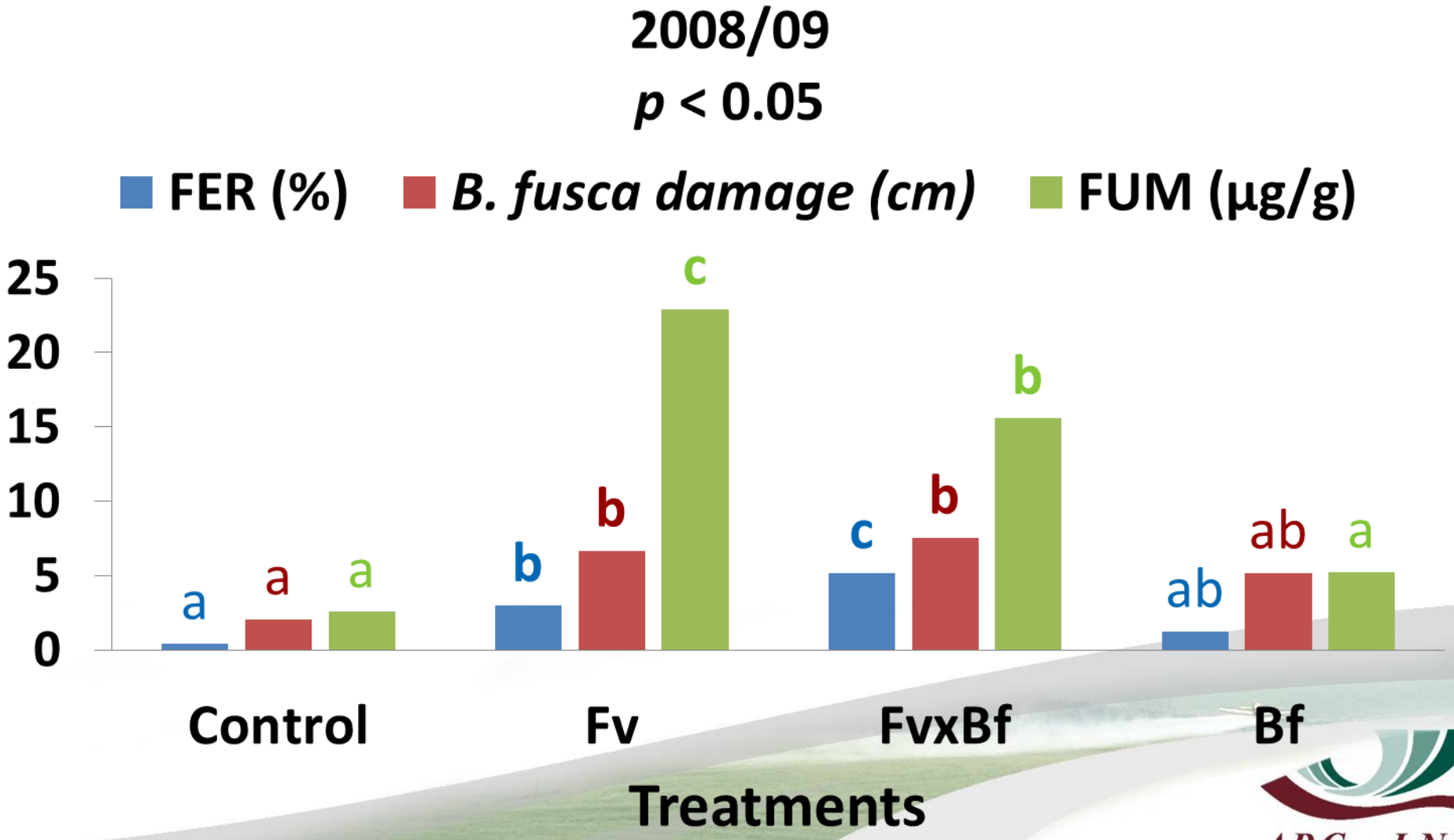
Results (*B. fusca*): non-Bt hybrid



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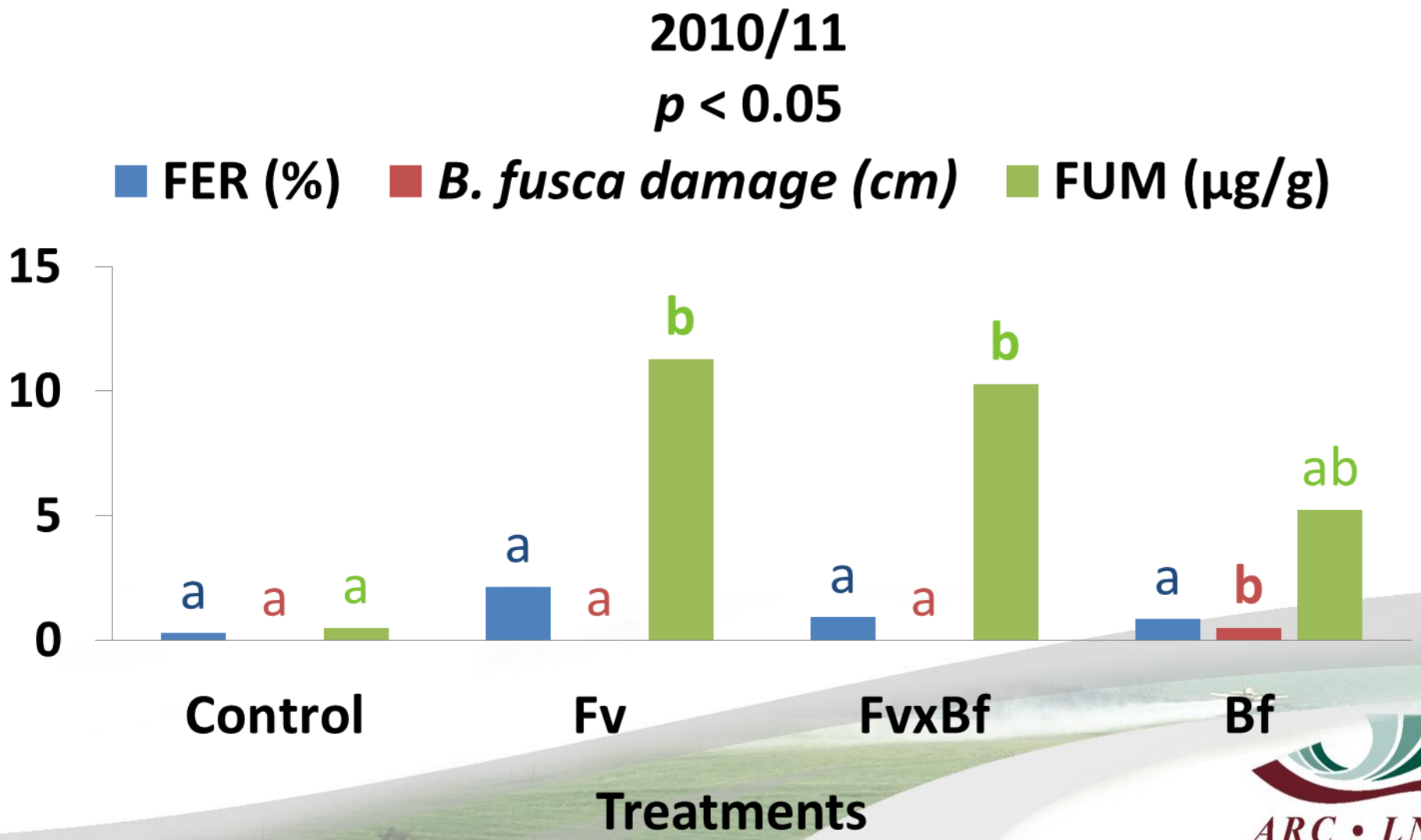

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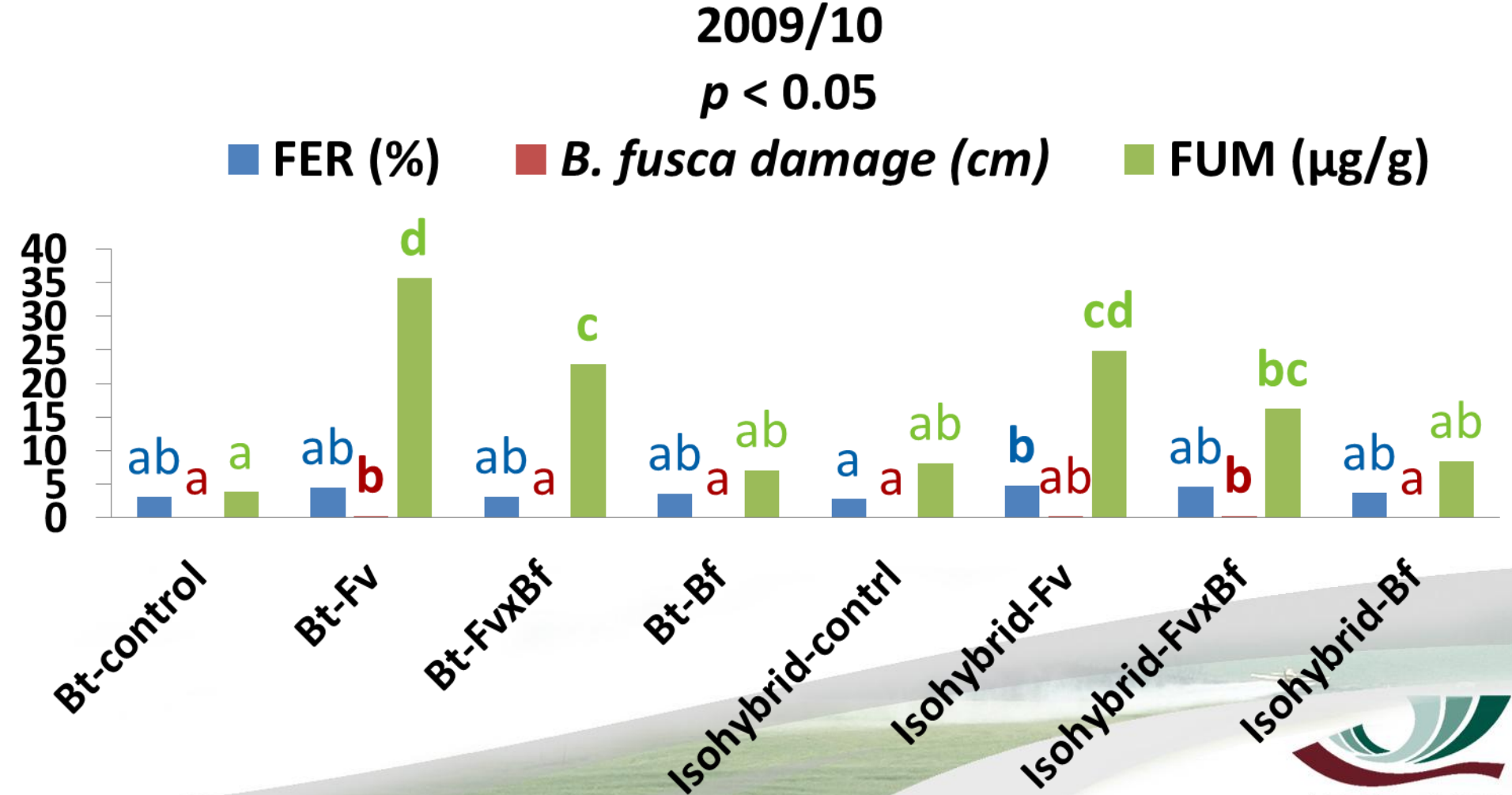
Results (*B. fusca*): Bt-hybrid and isohybrid



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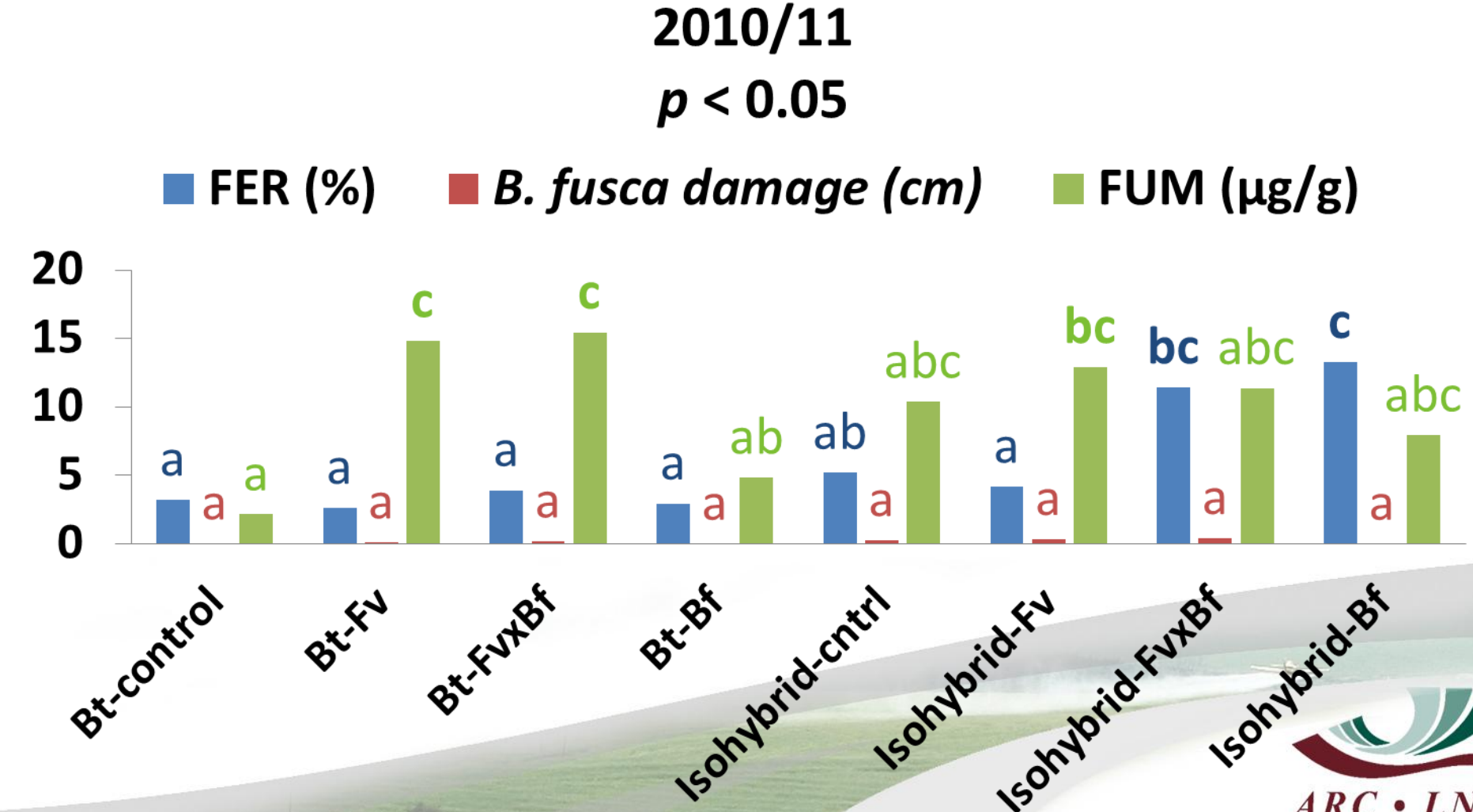
Results (*B. fusca*): Bt-hybrid and isohybrid



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Materials and methods

Mechanical damage

- Trial planted at Potchefstroom, (RCB) design
- Non-Bt (PAN6723) hybrid
- Cork borers (1.59, 1.75, 2.23 & 2.39 cm internal diameter) were used to damage ears at the blister stage with and without *F. verticillioides* inoculation

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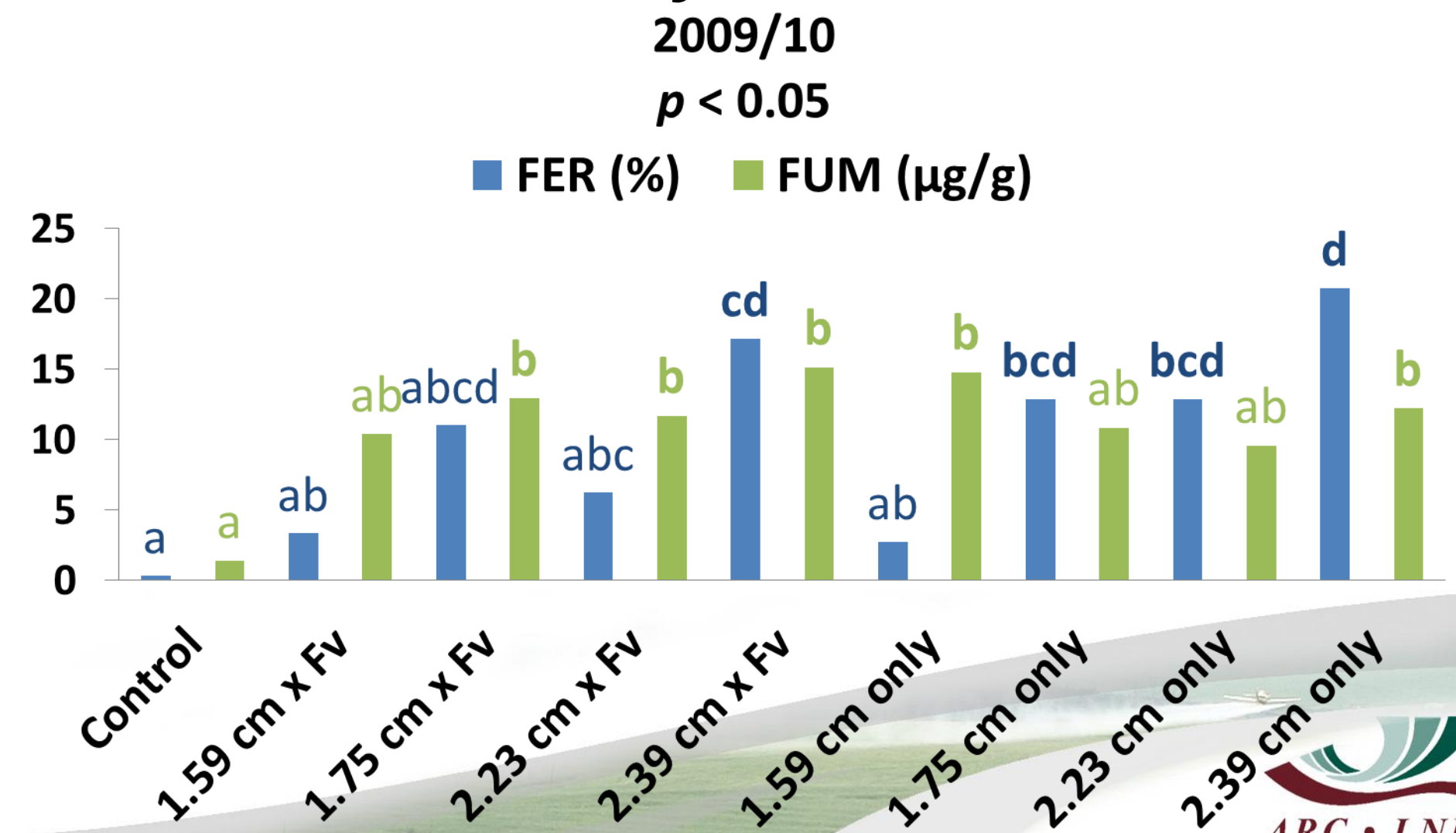
Results (mechanical): non-Bt hybrid



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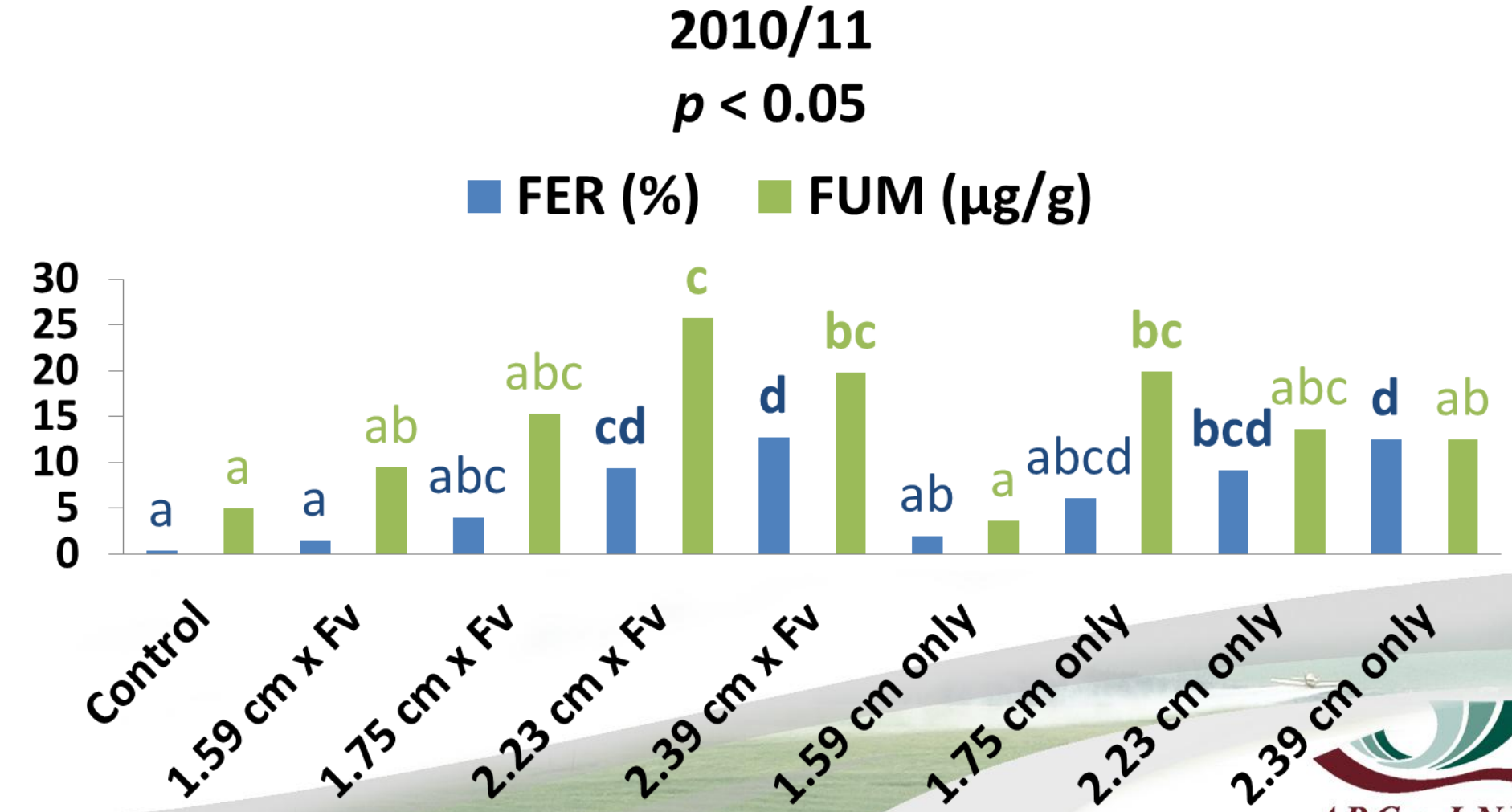
Results (mechanical): non-Bt hybrid



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Discussion

- Both *B. fusca* and mechanical damage significantly increase FER
- Fumonisin production appears to be independent of *B. fusca* infestation/damage

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Conclusion

- The Bt hybrid had less FER when compared to non-Bt hybrids implying that *B. fusca* increases FER
- *B. fusca* appears to play a significant role as a vector
- The role of *B. fusca* in vectoring *Fusarium verticillioides* is being studied further as per project aims laid out earlier
- Fumonisin contamination remain problematic in both Bt and non-Bt maize

Progress made

- Popular articles - 3
- Congress oral/talk presentations - 2
- Congress poster presentations - 3
- Expected scientific publications - >3

Acknowledgements

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Thank you!

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