

Unravelling **FHB** Epidemics in the Brazilian Subtropics: Lessons Learned and management strategies

Prof. Emerson M. Del Ponte



No-till spring wheat in Brazil

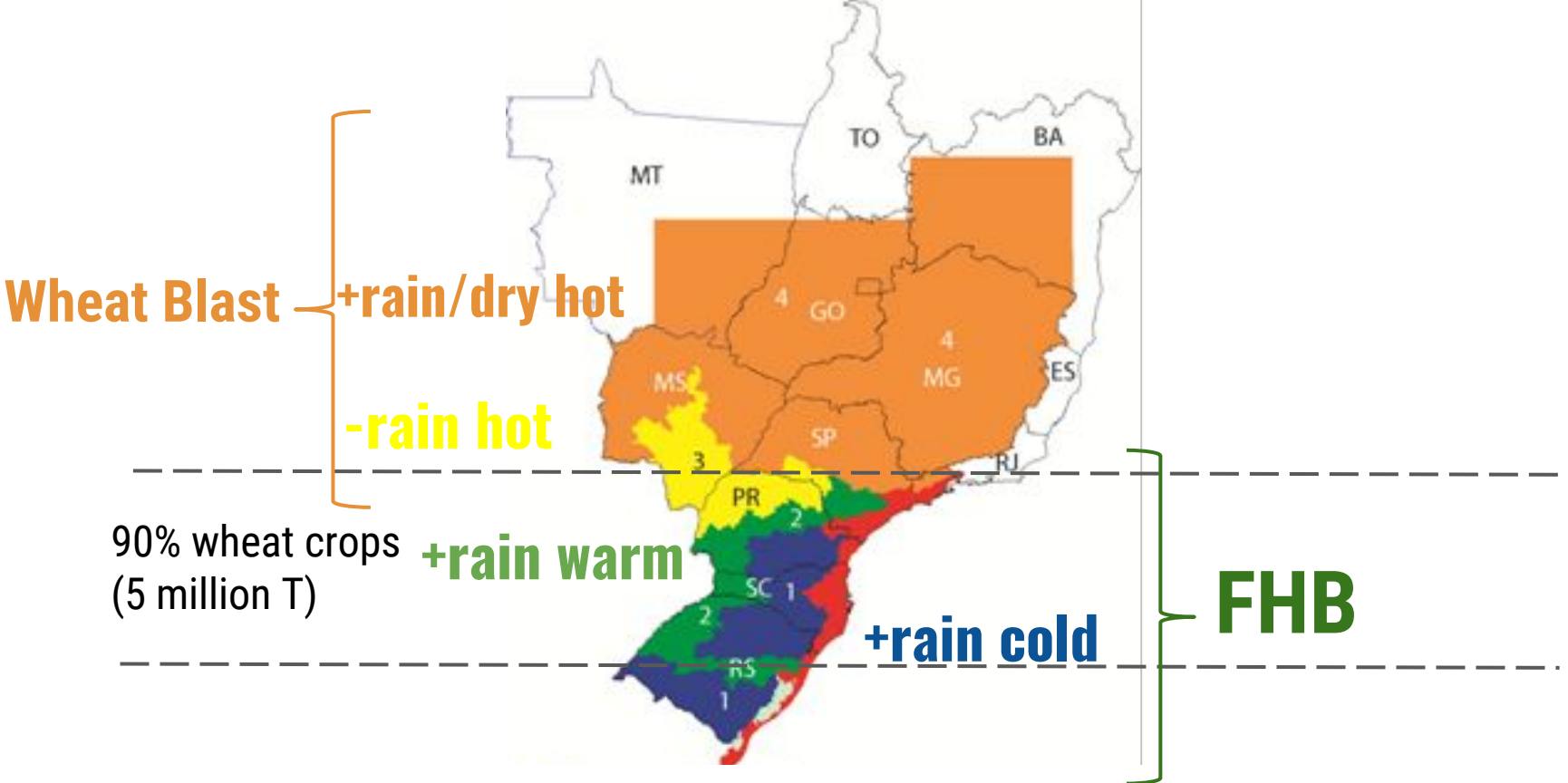




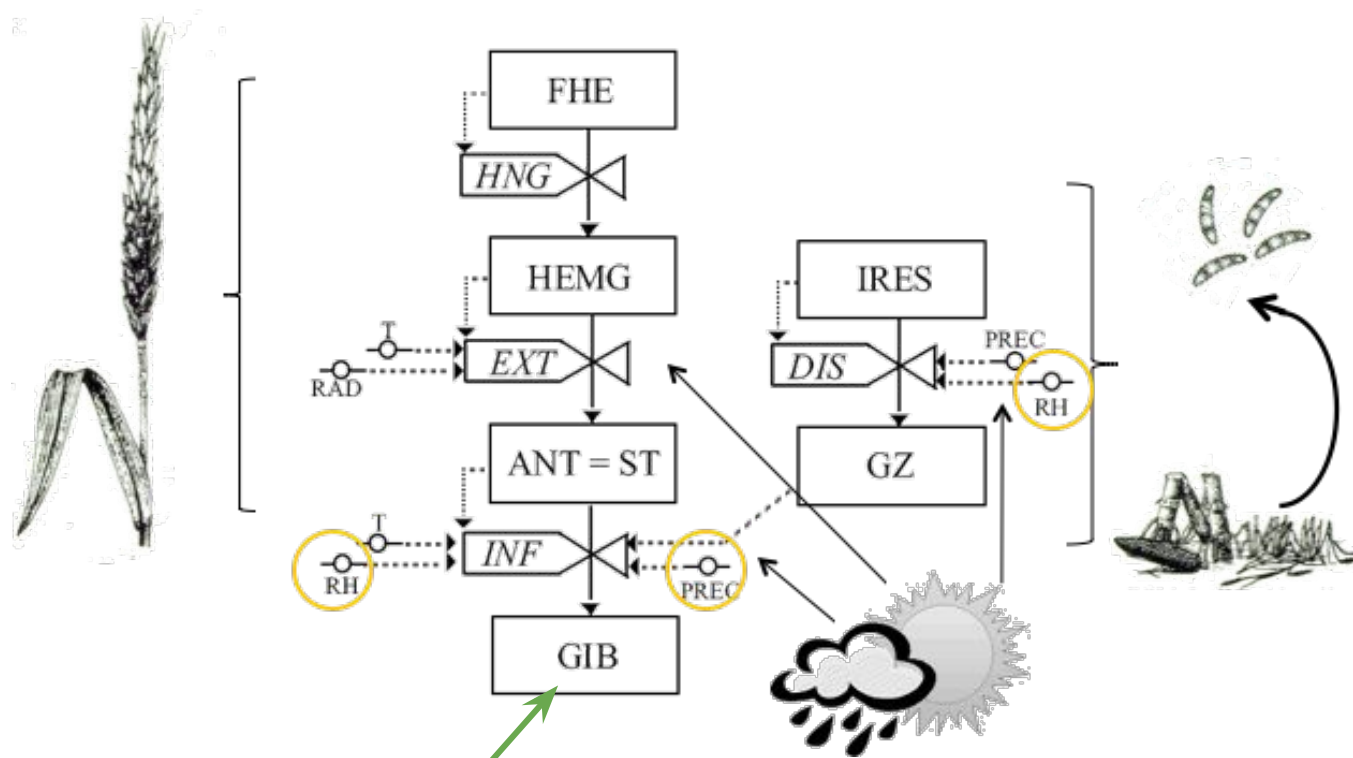
Photo:
Dr. Santana
Embrapa Trigo

Question 1 - Our problem

Why FHB resurged as a concern to Brazilian wheat farmers?



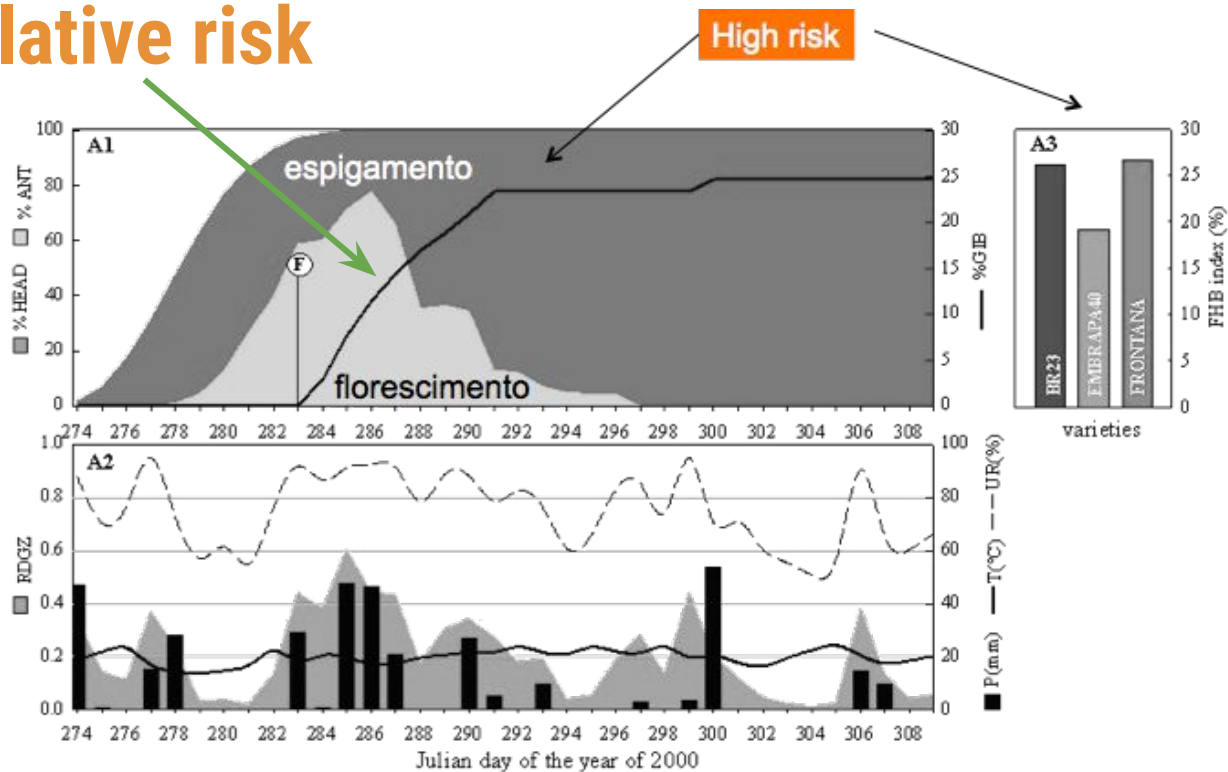
Model development - process-based model



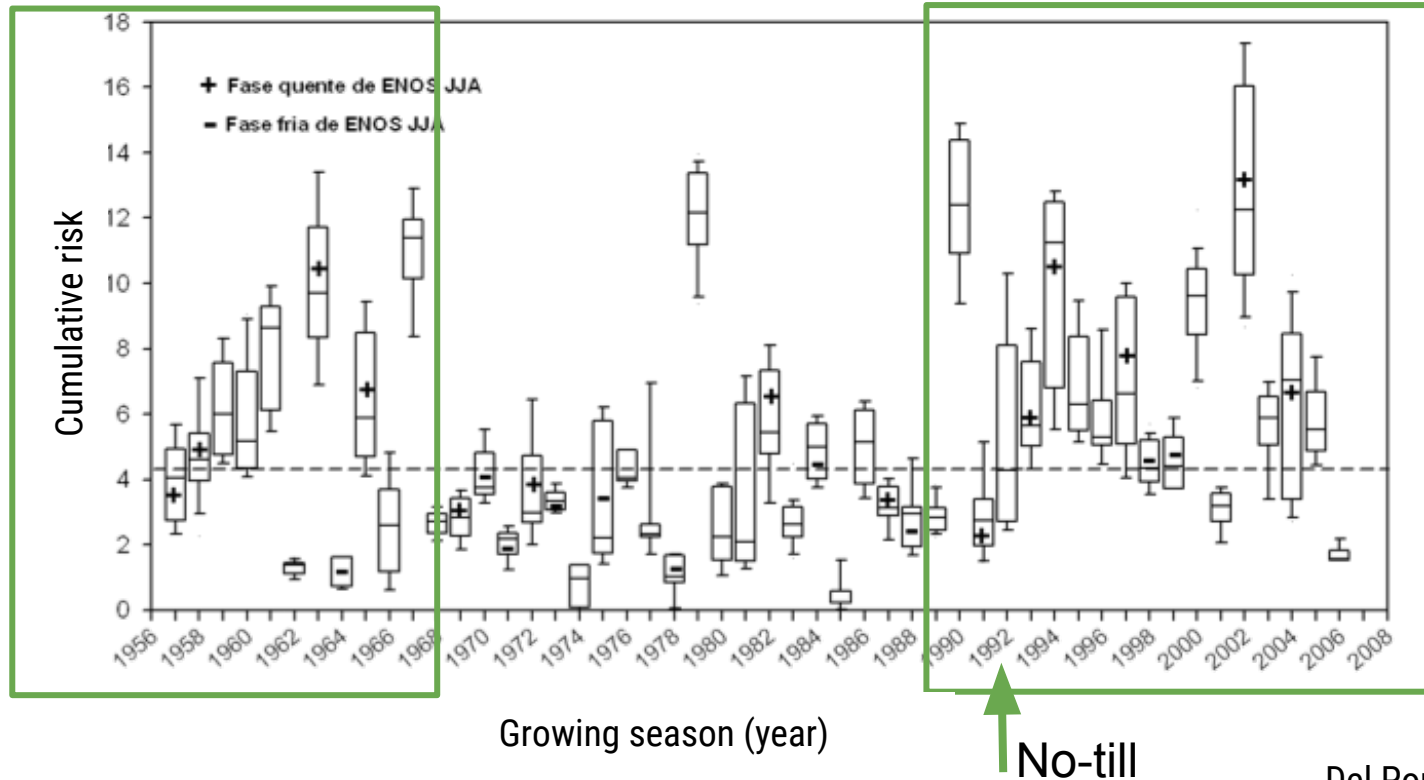
Daily infection risk

Model testing

Cumulative risk



Climate driven boom and bust of FHB?

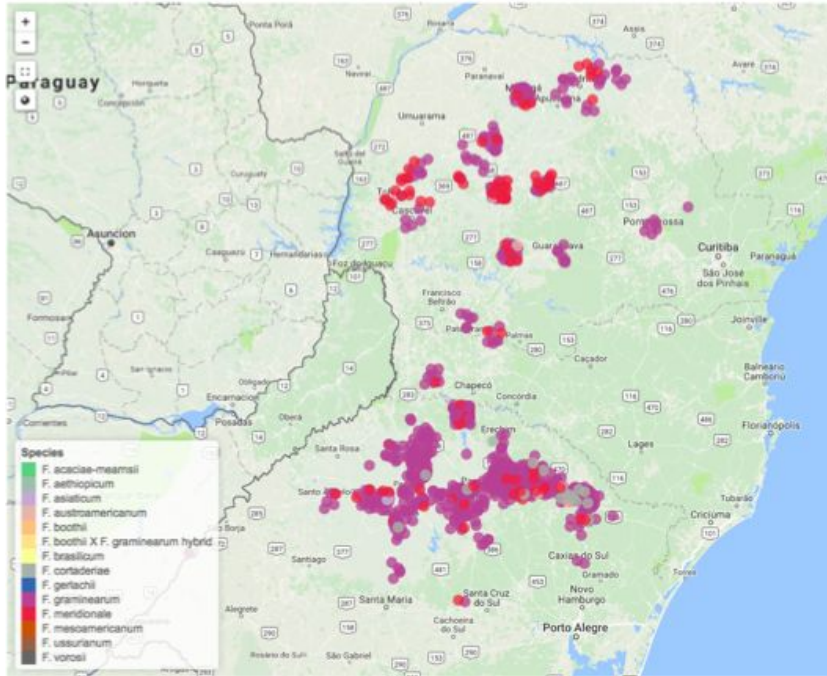


Question 2 - Who is our enemy?

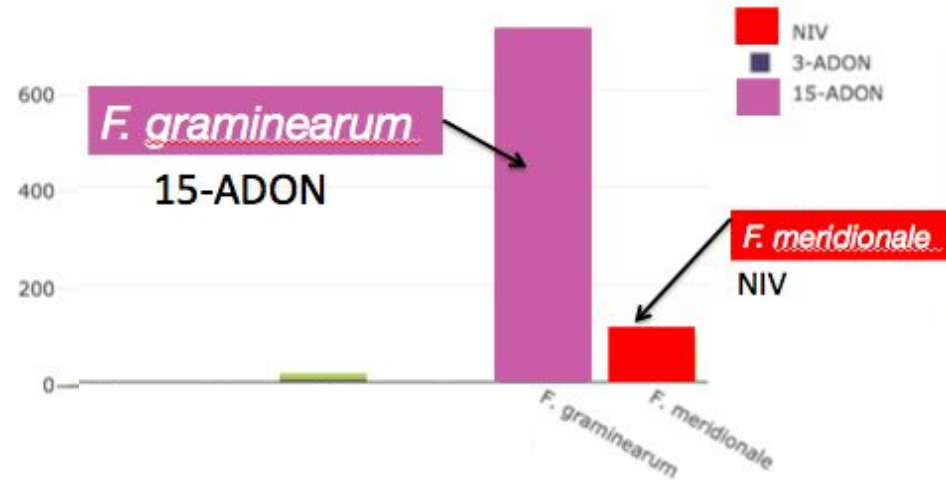
What do we know about FHB pathogen diversity and toxigenic potential?



Diverse and a "complex" population!



> 850 FGSC strains (5 years)



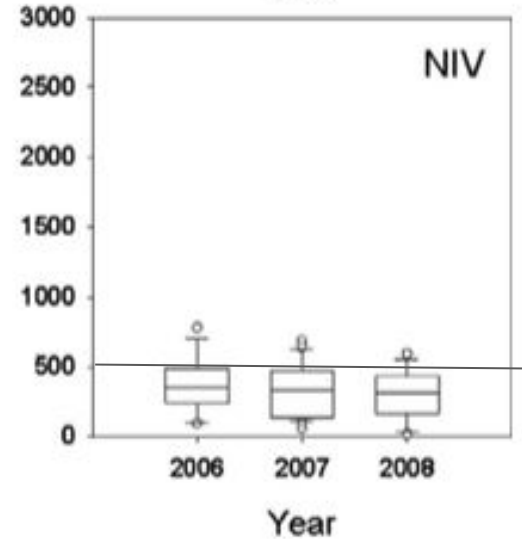
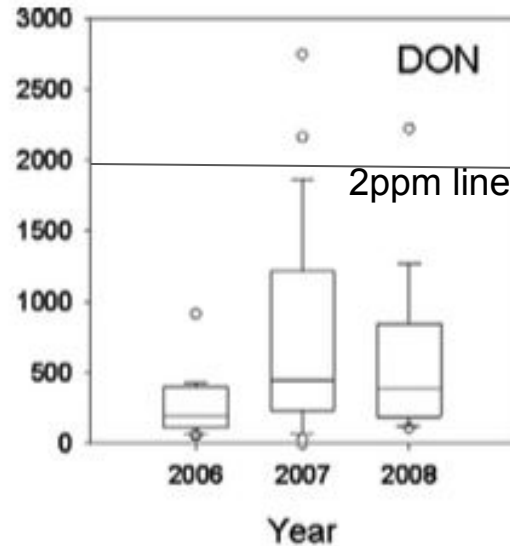
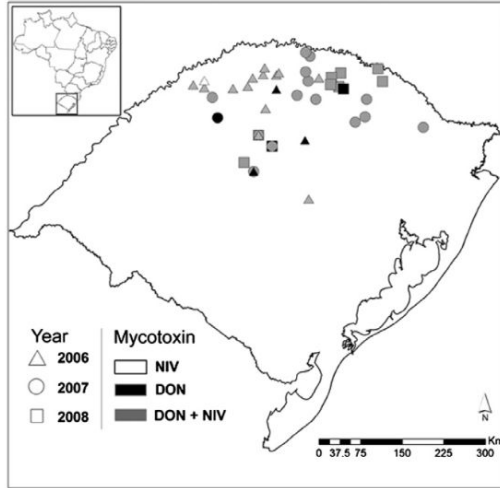
(Scoz et al 2009; Astolfi et al. 2012; Del Ponte et al. 2015)

Question 3 - Enemy's weapons

Should we concern about both **DON** and **NIV** in commercial wheat grain?



Yes! **NIVALENOL** is present in commercial grain



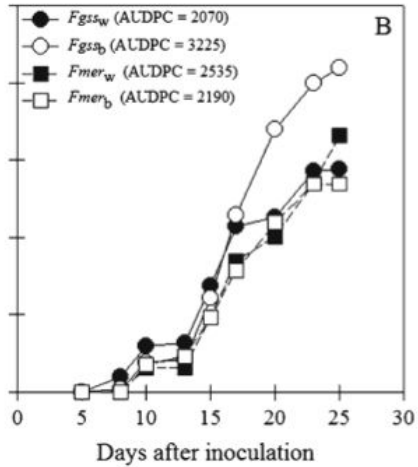
$n = 66$ samples

Question 4 - Understanding the enemy

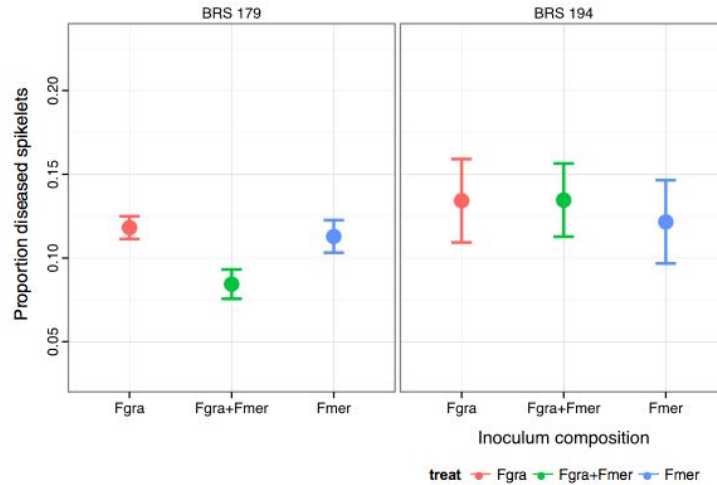
Why is *F. graminearum* (15-ADON) dominant in wheat overall?



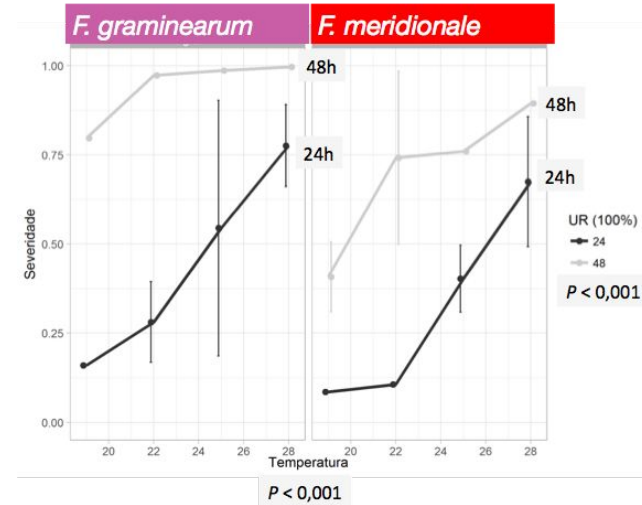
Is *F. graminearum* more aggressive?



Spolti et al. (2012)



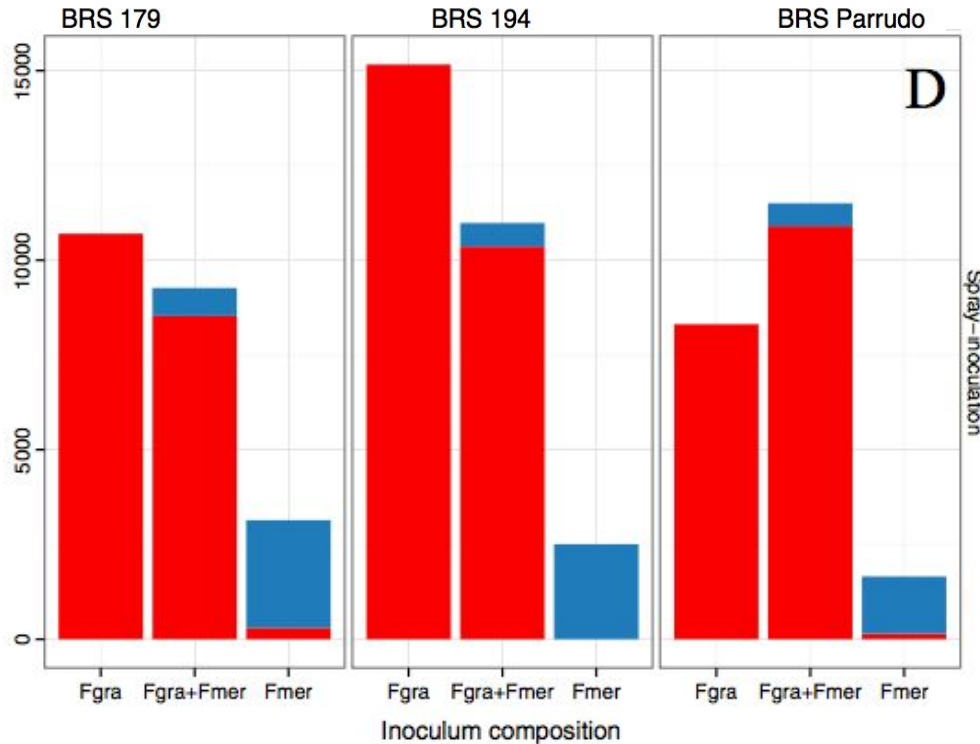
Nicolli et al (2015)



Duffeck et al (*unpublished*)

Genotype -> chemotype

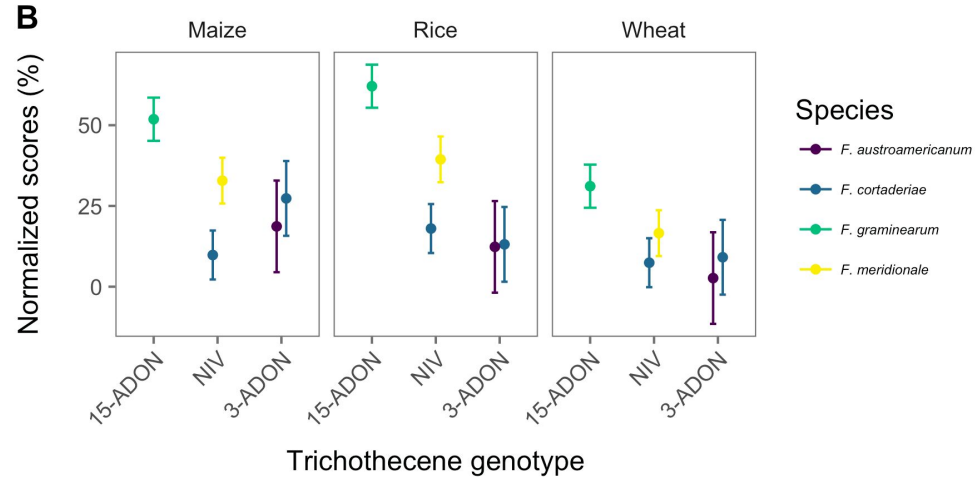
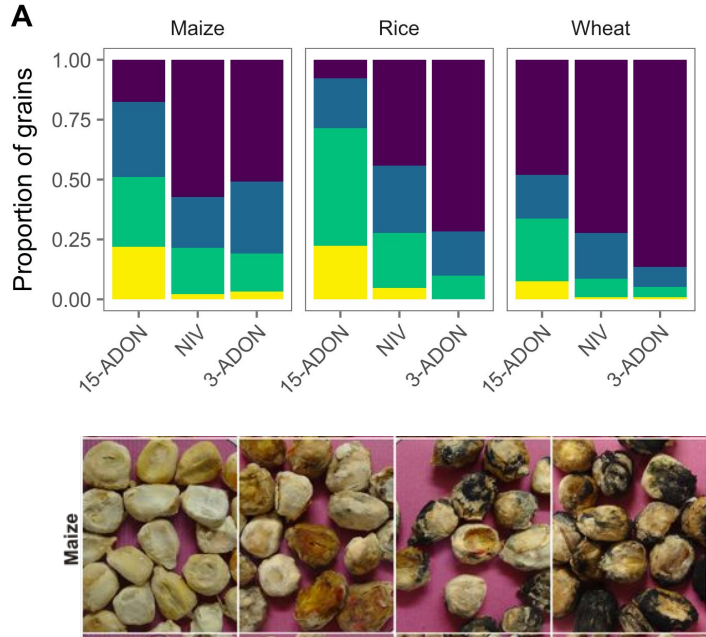
What about trichothecene production?



Chemical analysis

mycotoxin ■ DON ■ NIV

Is *F. graminearum* more fertile (perithecia production)?

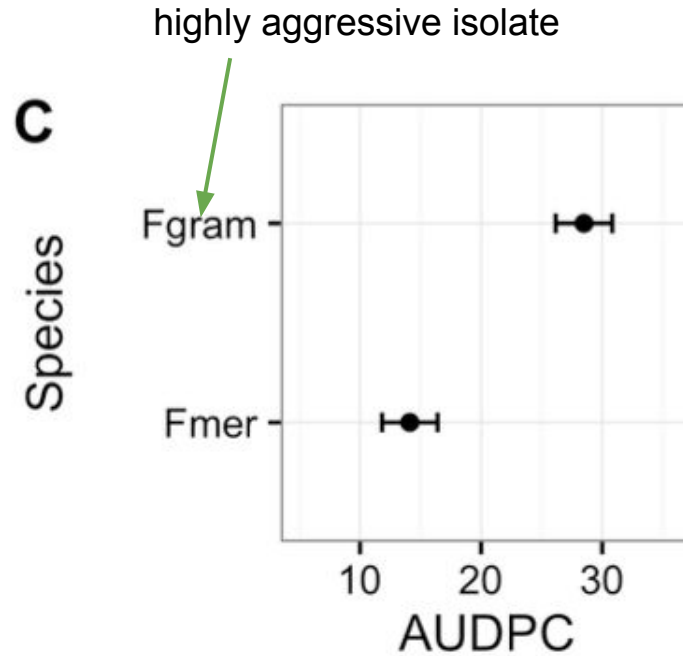
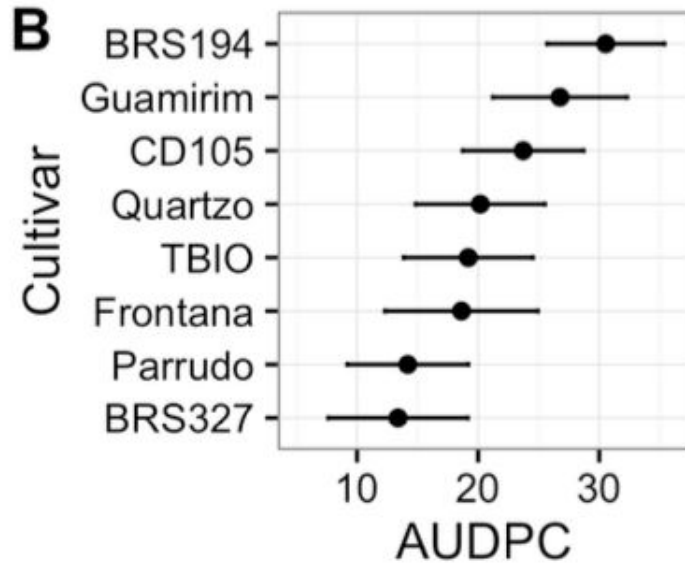


Question 5 - How to prepare for it?

Should breeders concern about *F. meridionale*?



Species x Cultivar = $P > 0.05$



Question 6 - How to best combat it?

Do fungicides control FHB and increase yield?

Which one is better?

Are 2 sprays better than 1 spray?



Quantitative Review of the Effects of Triazole and Benzimidazole Fungicides on Fusarium Head Blight and Wheat Yield in Brazil

Franklin Jackson Machado, Departamento de Fitopatologia, Universidade Federal de Viçosa, 36570-000, MG, Brazil; Flávio Martins Santana and Douglas Lau, Embrapa Trigo, Passo Fundo, 70770-901 RS, Brazil; and Emerson Medeiros Del Ponte,[†] Departamento de Fitopatologia, Universidade Federal de Viçosa, 36570-000 MG, Brazil

Meta-analysis

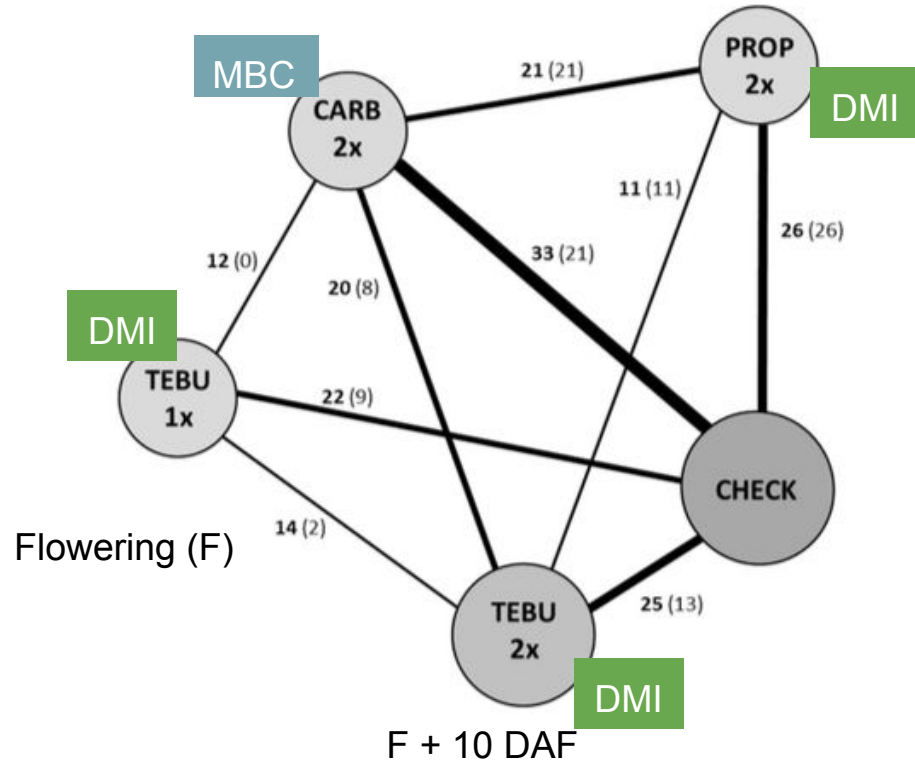
46 studies (yield)

38 studies (FHB index)

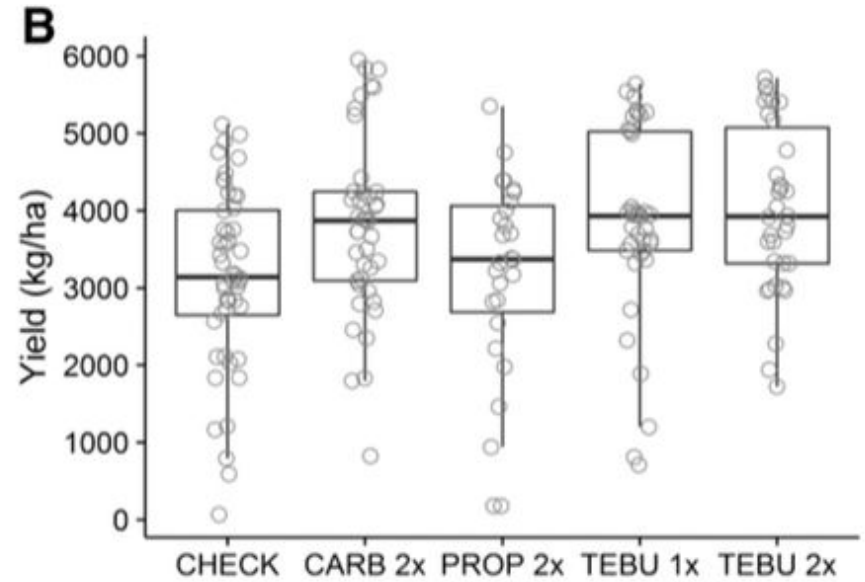
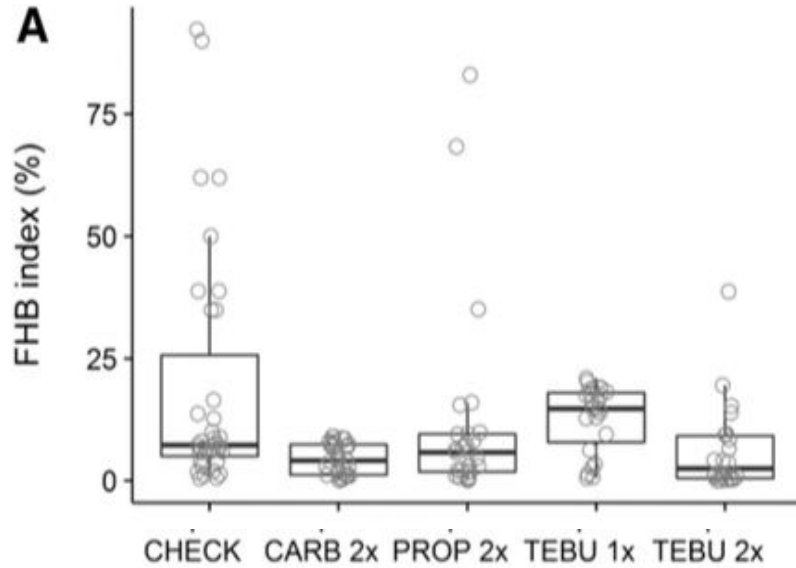
15 years of studies

- Tebuconazole
- Propiconazole
- Carbendazim

Machado et al. (2017)



Fungicides do work!



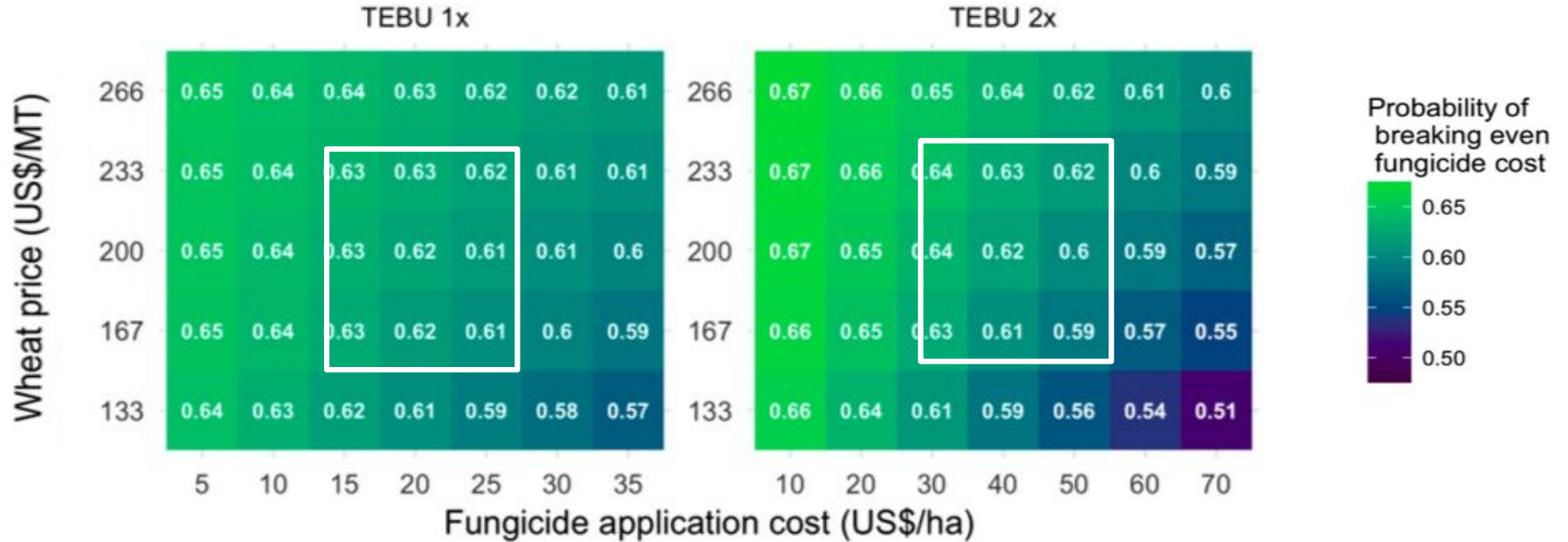
How well?

| Fungicide ^a | <i>n</i> ^b | <i>k</i> ^c | Yield gain (kg/ha) | Efficacy (%) |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------|
| CARB _{2x} | 41 | 33 | 455.8 | 55.1 |
| PROP _{2x} | 27 | 26 | 497.4 | 46.9 |
| TEBU _{1x} | 38 | 22 | 456.7 | 58.5 |
| TEBU _{2x} | 34 | 25 | 558.3 | 53.2 |

+ 102 kg/ha



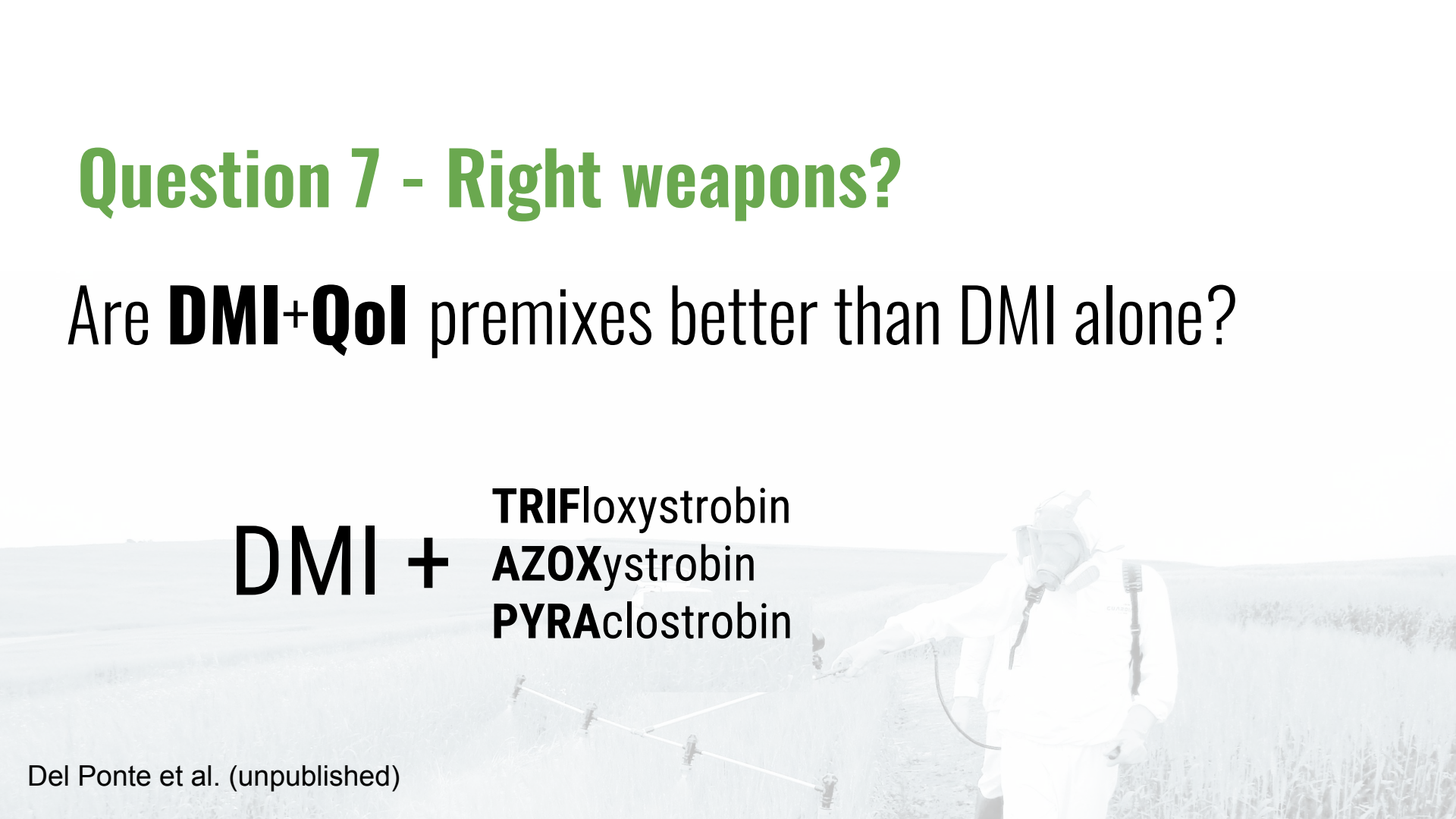
Show me the money! risk



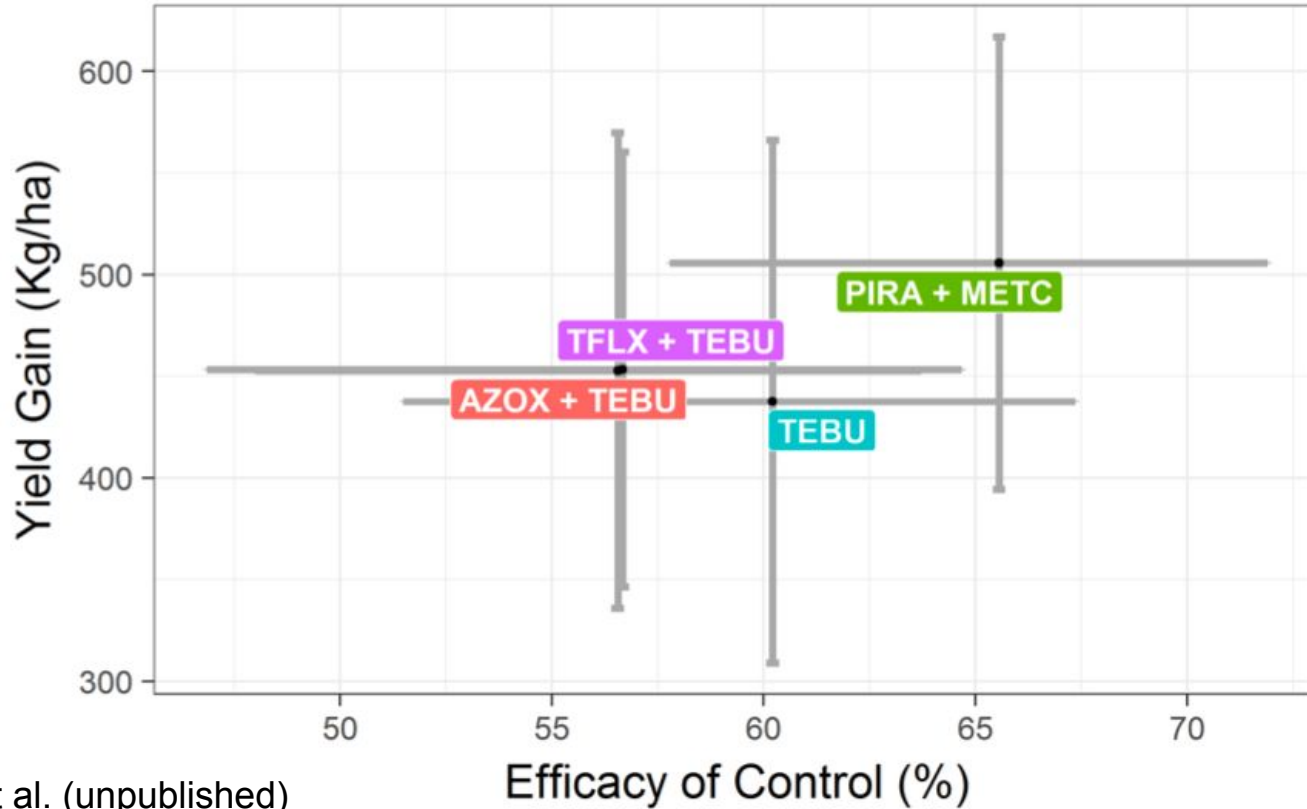
Question 7 - Right weapons?

Are **DMI+QoI** premixes better than DMI alone?

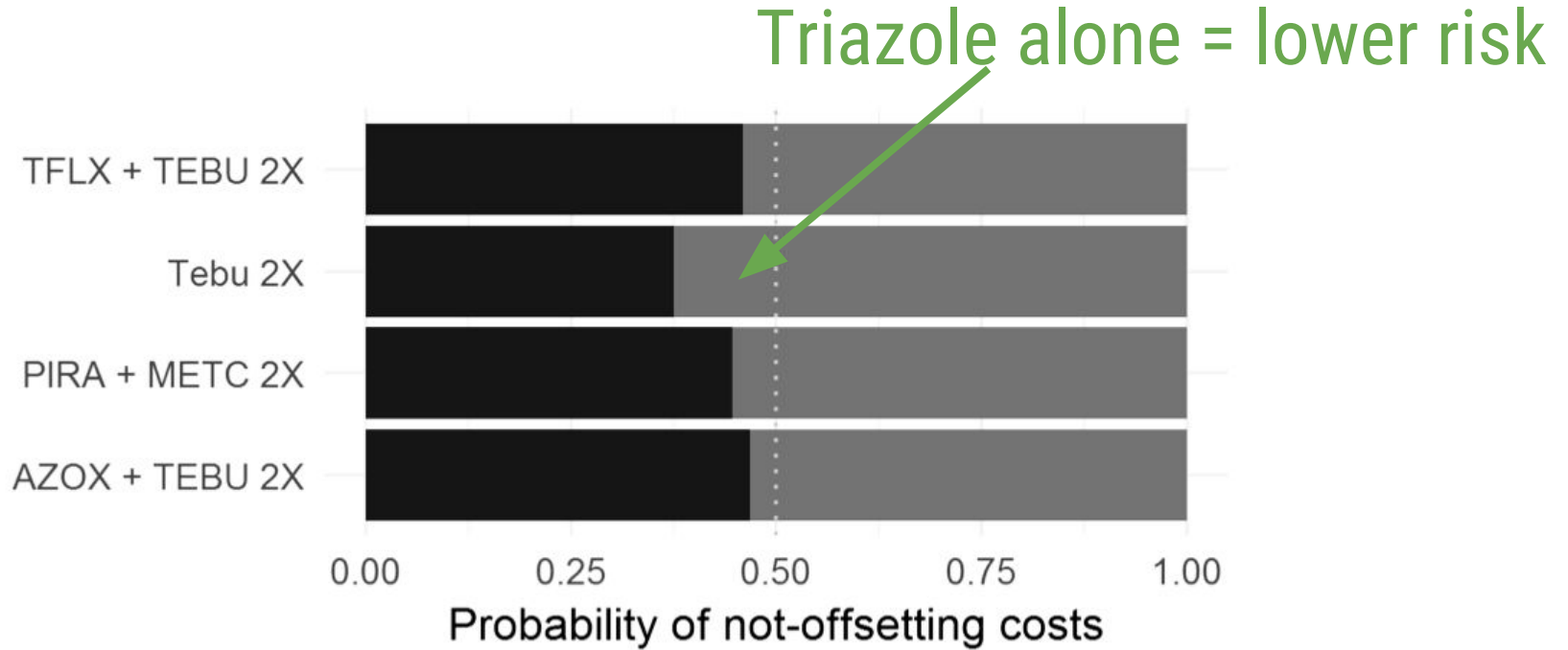
DMI + **TRIFloxy**strobilin
AZOXystrobilin
PYRAclostrobilin



Two sprays (F + 10 DAF)



Show me the money 2



Question 8 - The right target!

Are all fungicides (alone or premix) reducing DON?



Location: Guarapuava

4-year experiments (2011 - 2014)

9 fungicides treatments

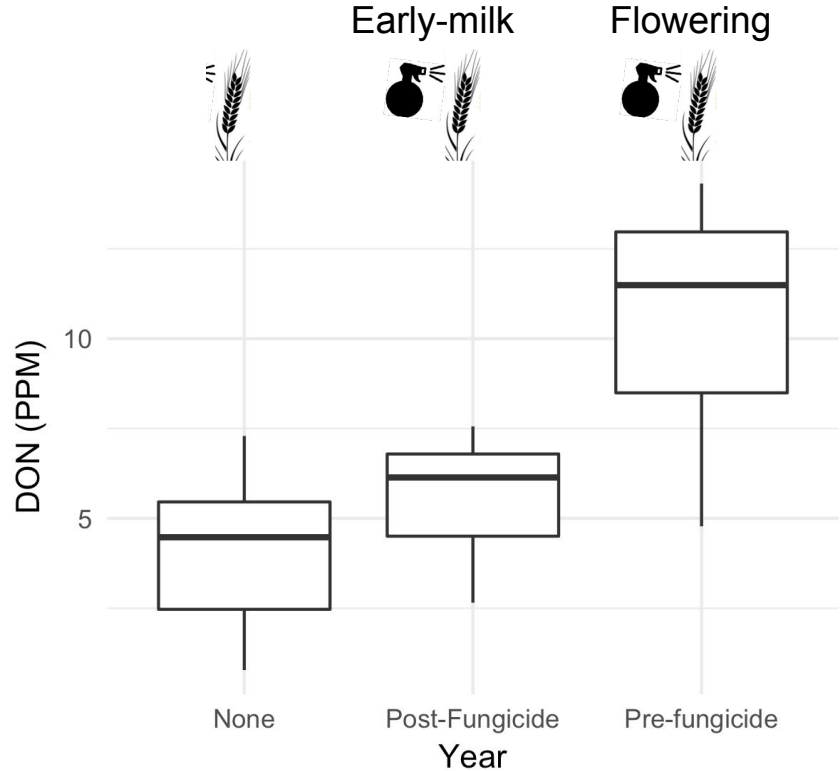
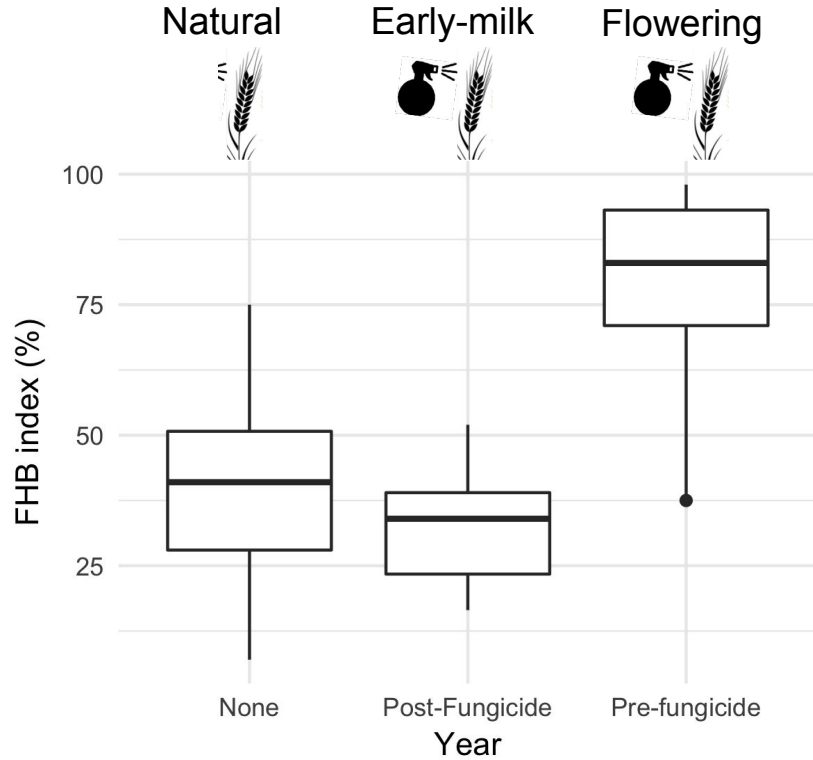
3 inoculations (none, flowering, late milk)

DMI, MBC or DMI+QoI

Feksa et al. unpublished doctoral studies

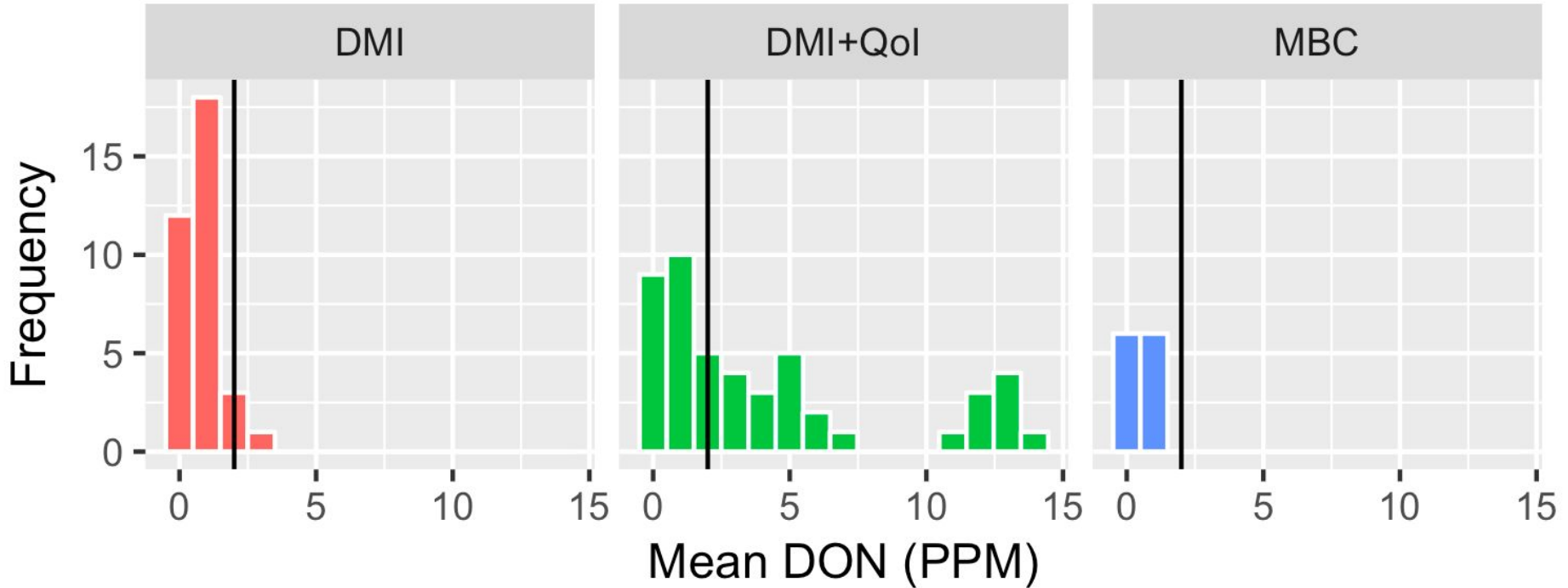
Source: Dr. Dauri Tessmann (UEM)

Three non-fungicide treated check (inoculations) treatments

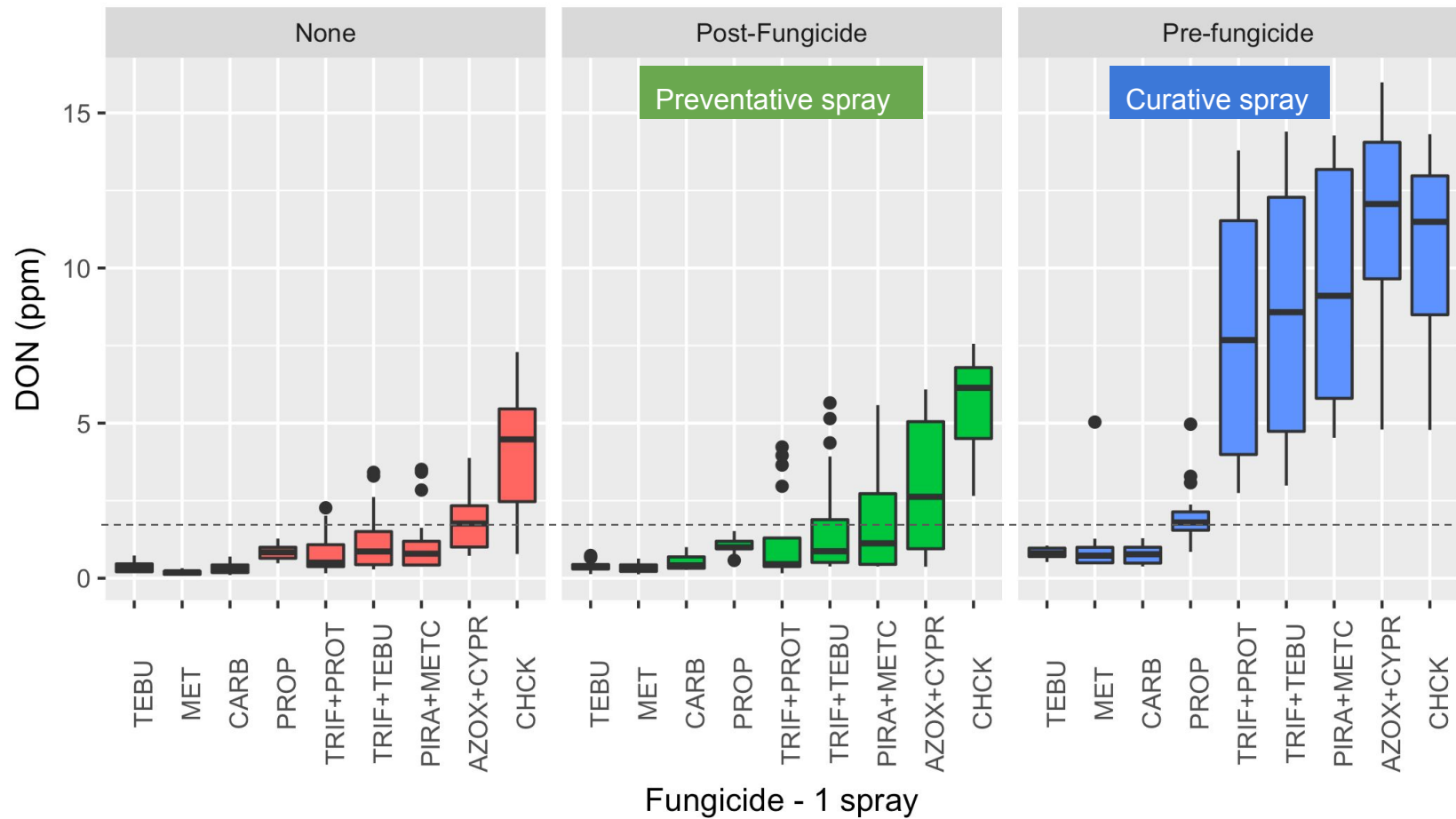


Feksa et al. unpublished data from doctoral studies
Source: Dr. Dauri Tessmann (UEM)

Fungicide groups and DON levels



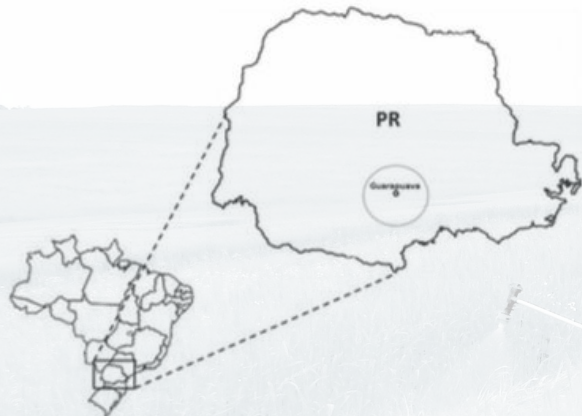
Feksa et al. unpublished data from doctoral studies
Source: Dr. Dauri Tessmann (UEM)



Feksa et al. unpublished data from doctoral studies
 Source: Dr. Dauri Tessmann (UEM)

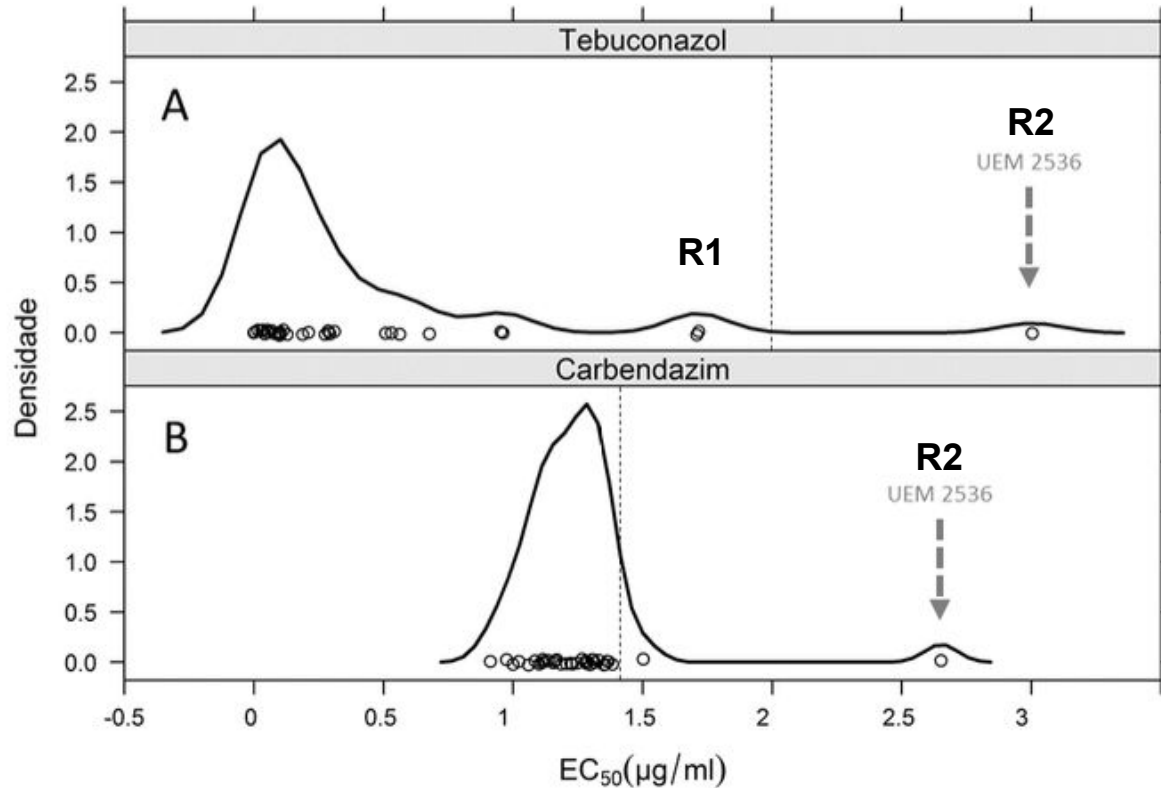
Question 9 - Is the enemy adapting?

Should we concern about fungicide resistance?

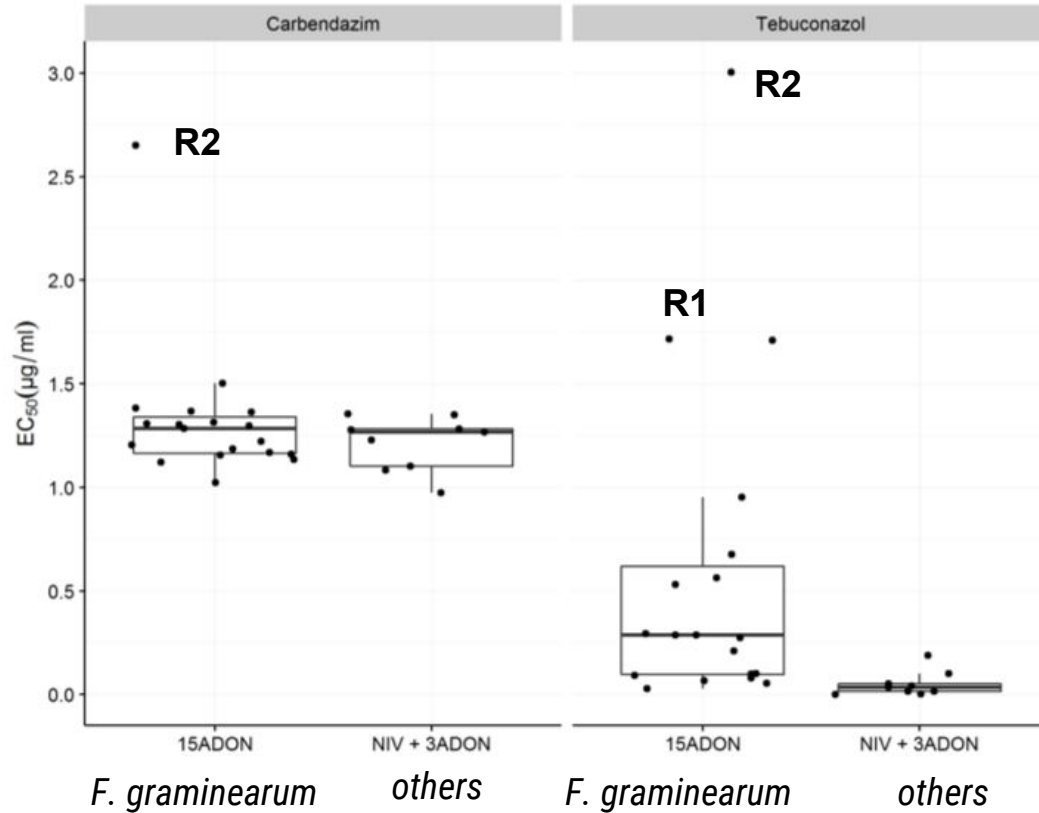


Region: Guarapuava
4-year sampling
35 isolates all location-years
EC-50 calculation

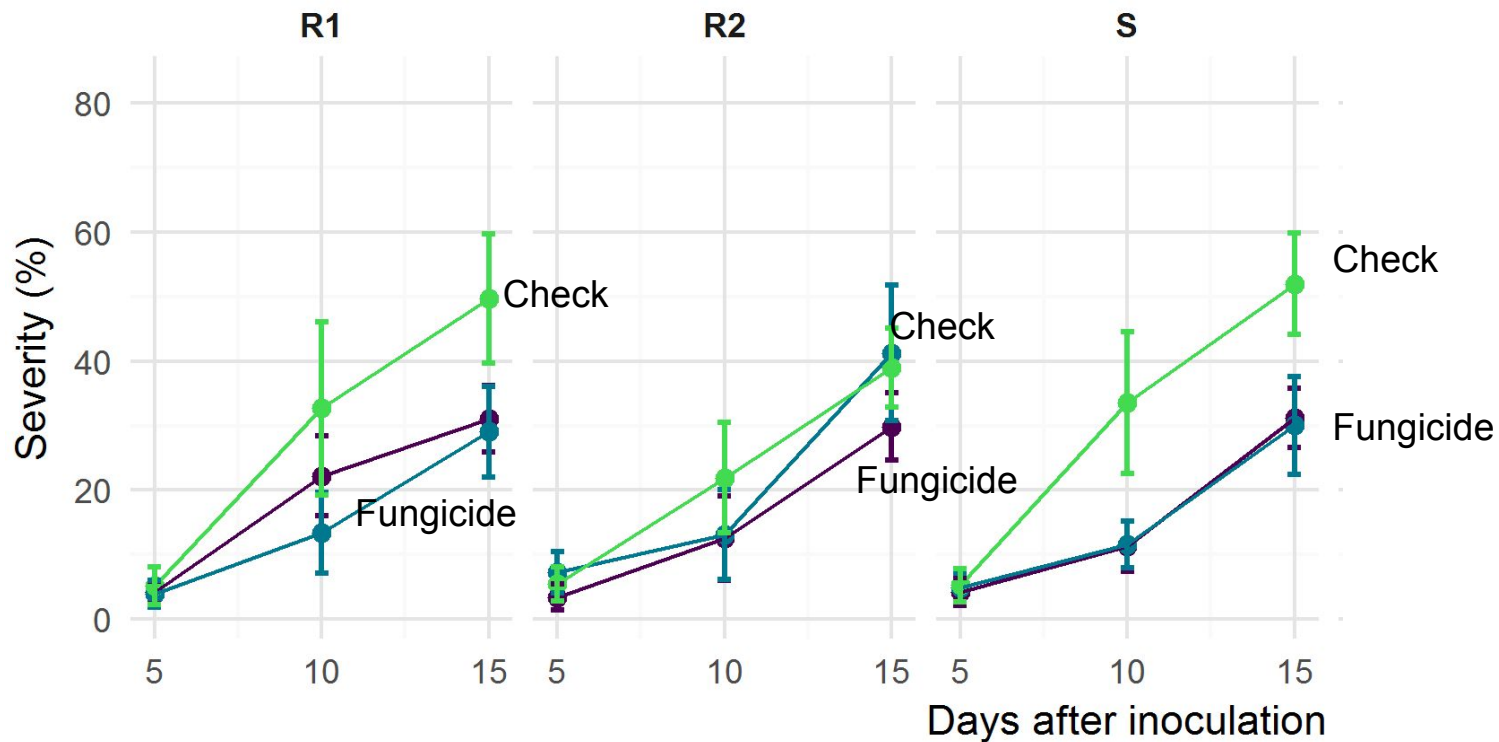
EC50 levels for 35 strains



F. graminearum less sensitive to TEBU



Control efficacy TEBU in the field



9 Lessons Learned

1. Previous crop not important risk factor in the sub-tropics (no-till)
2. At least two important species/chemotypes to target
3. DON and NIV should be a target in surveys (only DON now)
4. One seems more adapted to wheat environments (*F. graminearum*)
5. Breeders should use the most aggressive strains
6. One spray of tebuconazole is a cost-effective choice (yield)
7. Premixes (DMI+QoI) likely do not break even on costs
8. Premixes (DMI+QoI) do not reduce DON as single DMIs
9. The pathogen may be adapting to fungicides - future concern

Acknowledgements



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Gabriela Mendes
Franklin Machado
Maíra Duffeck



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2017 40 anos
Fitopatologia - UFV

UFV

Thank you!