

Moisture & infection timing effects on kernel damage and DON



Christina Cowger

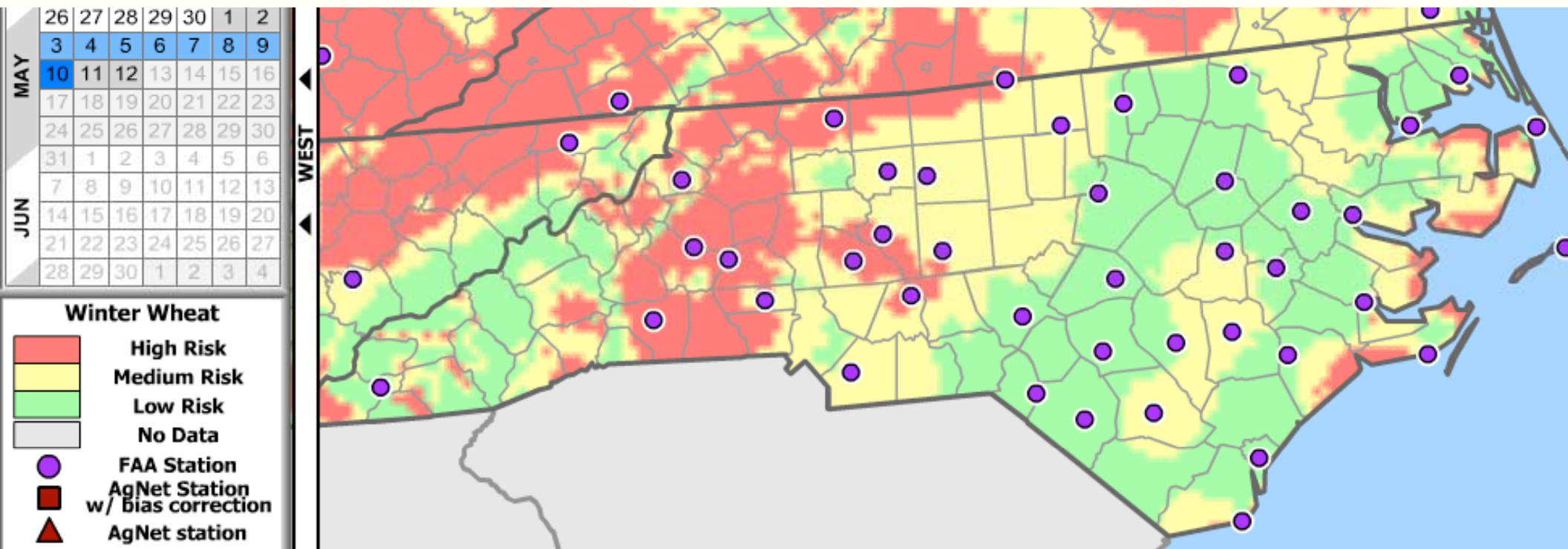
USDA-ARS Small Grains Pathologist

NCSU Department of Plant Pathology

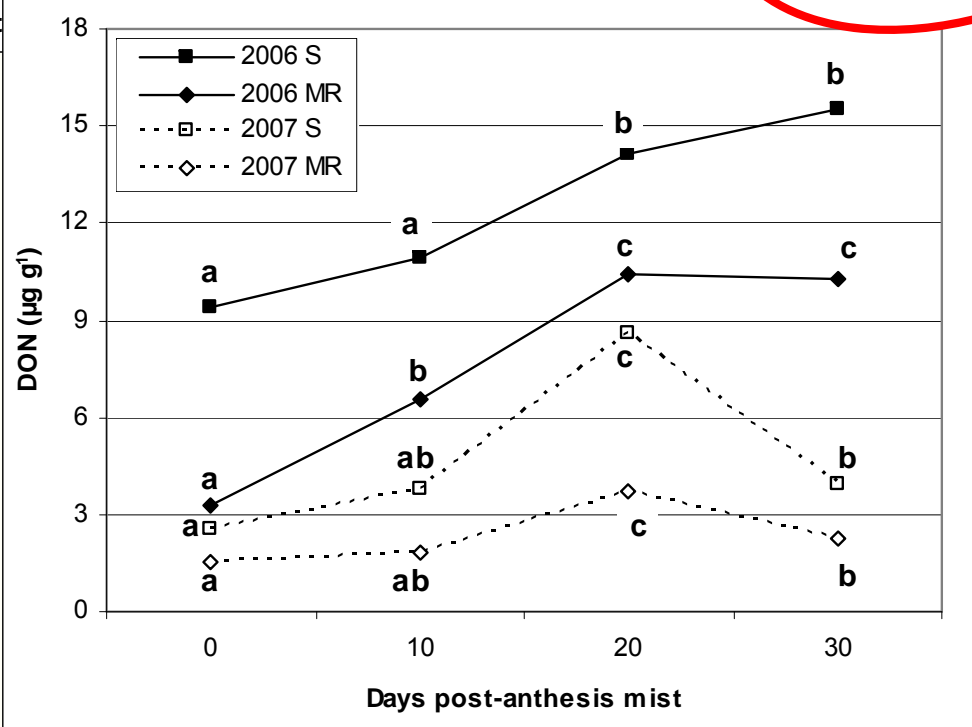
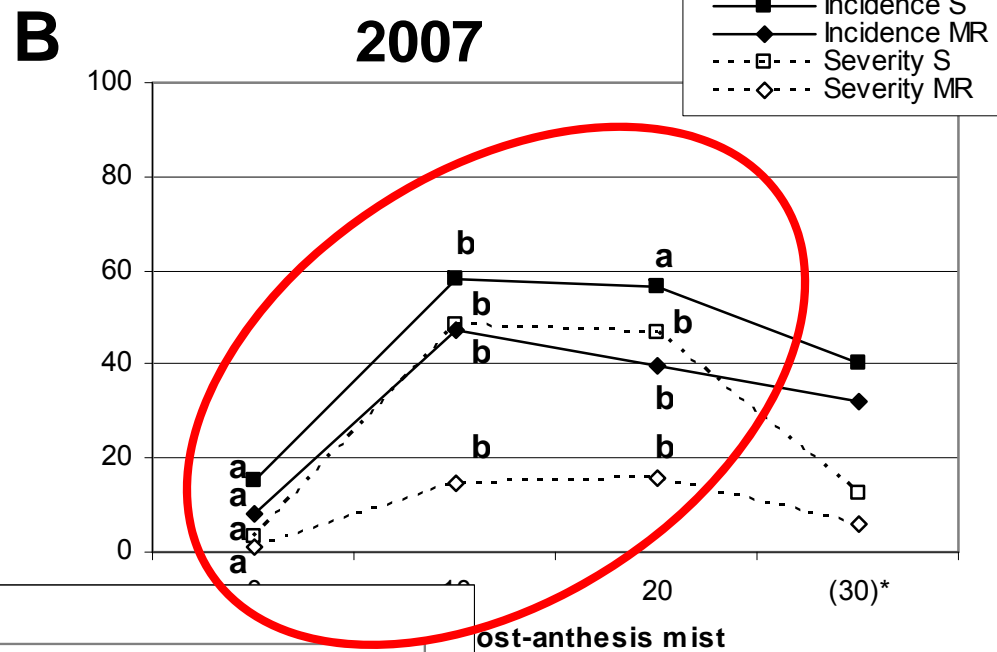
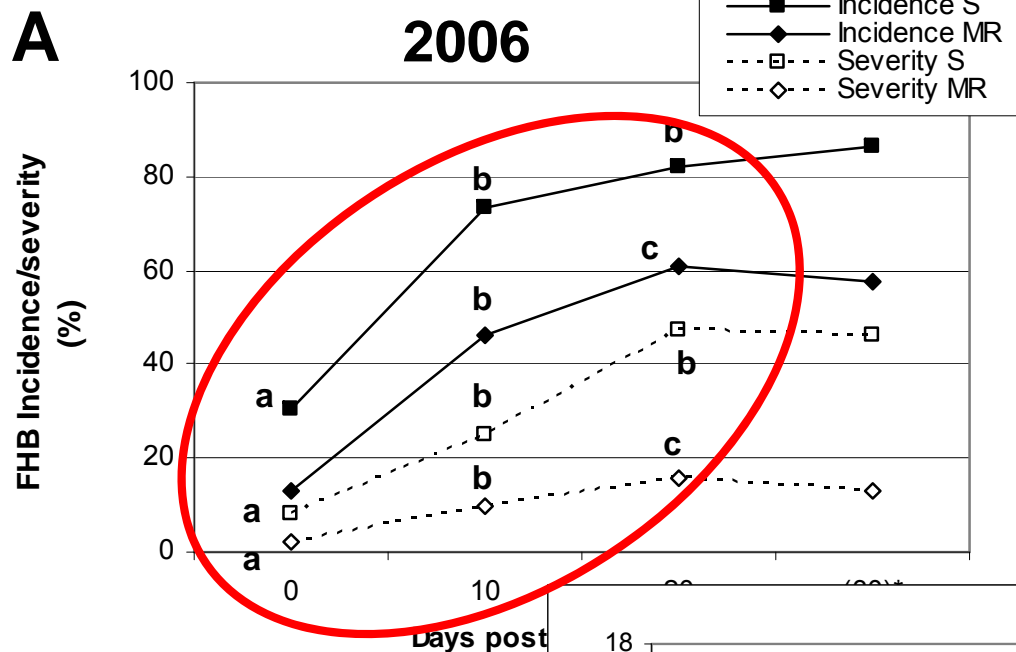
Pre-flowering weather used in national FHB forecasts

- winter wheat -- temperature between 59-86° F and RH >90%
- spring wheat -- variety resistance to FHB, and average RH

De Wolf, E. D., Madden, L. V., and Lipps, P. E. 2003. Risk assessment models for wheat Fusarium head blight epidemics based on within season weather data. *Phytopathology* 93:428-435.



Post-flowering moisture increases disease...



Cowger, C., Patton-Özkurt, J., Brown-Guedira, G., and Perugini, L. 2009. Post-anthesis moisture increased Fusarium head blight and deoxynivalenol levels in North Carolina winter wheat. *Phytopathology* 99:320-327.

...and DON

Similar results in Minnesota & North Dakota spring wheats.

What about **infection timing**?

- Schroeder & Christensen (S)
- Del Ponte et al (S)
- Hart et al (W)
- Lacey et al (W)

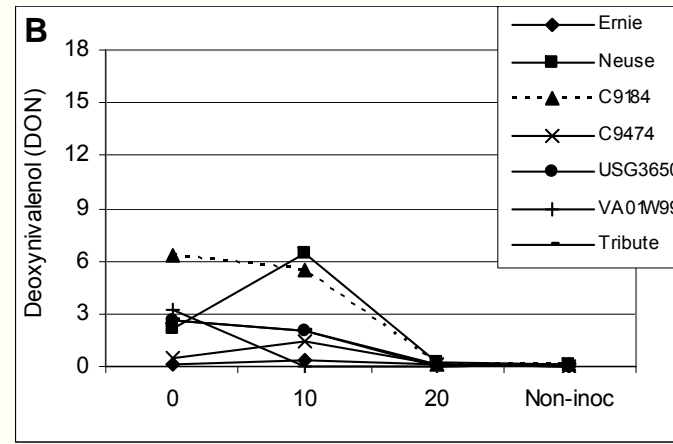
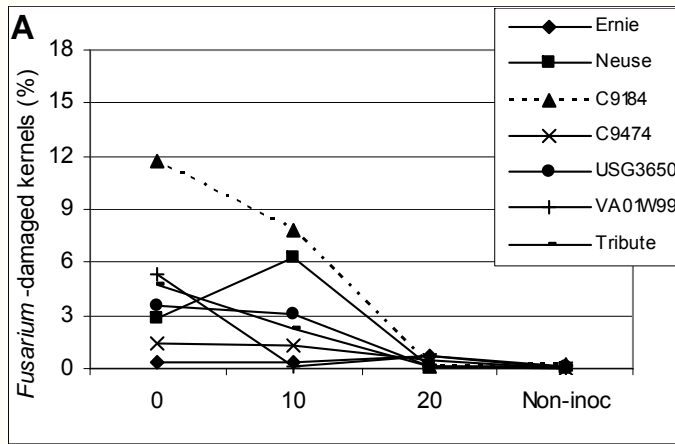


- Mixed results; later infections sometimes produced high DON, sometimes not
- Yield damage less

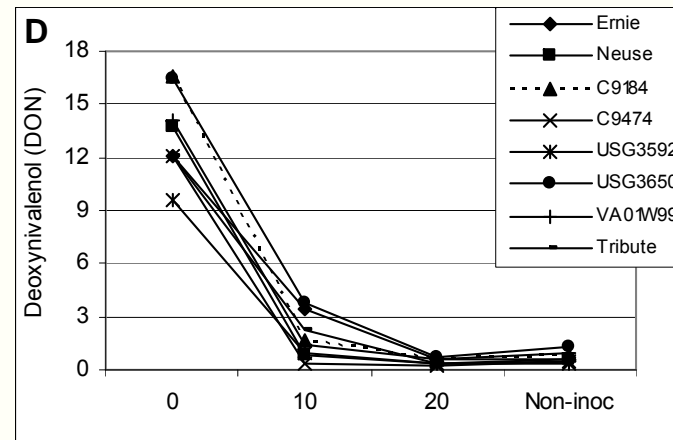
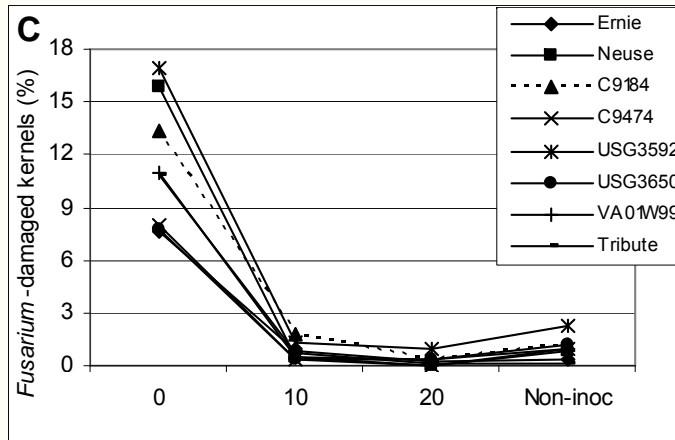
FDK

DON

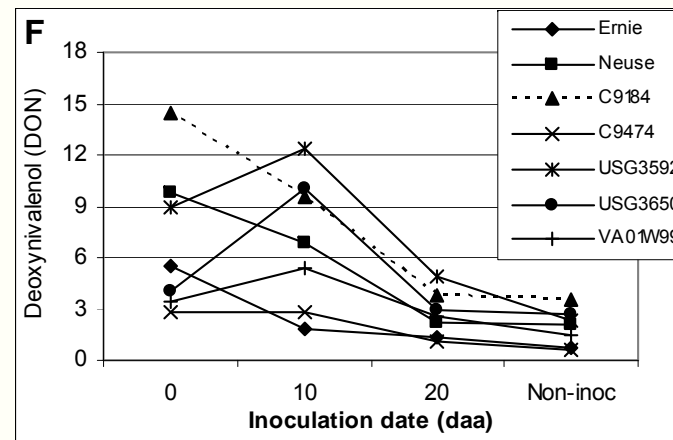
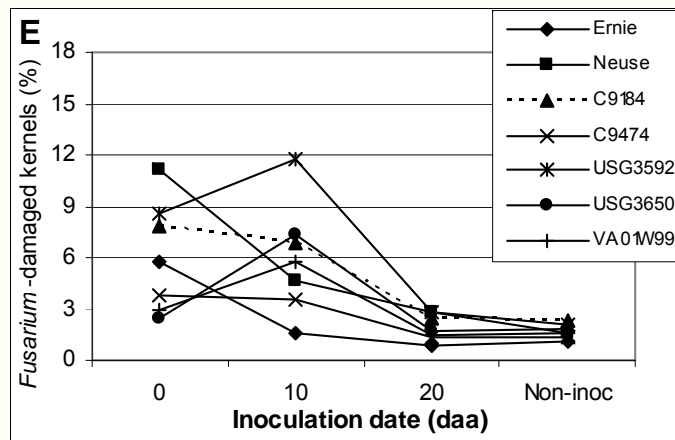
2005



2006



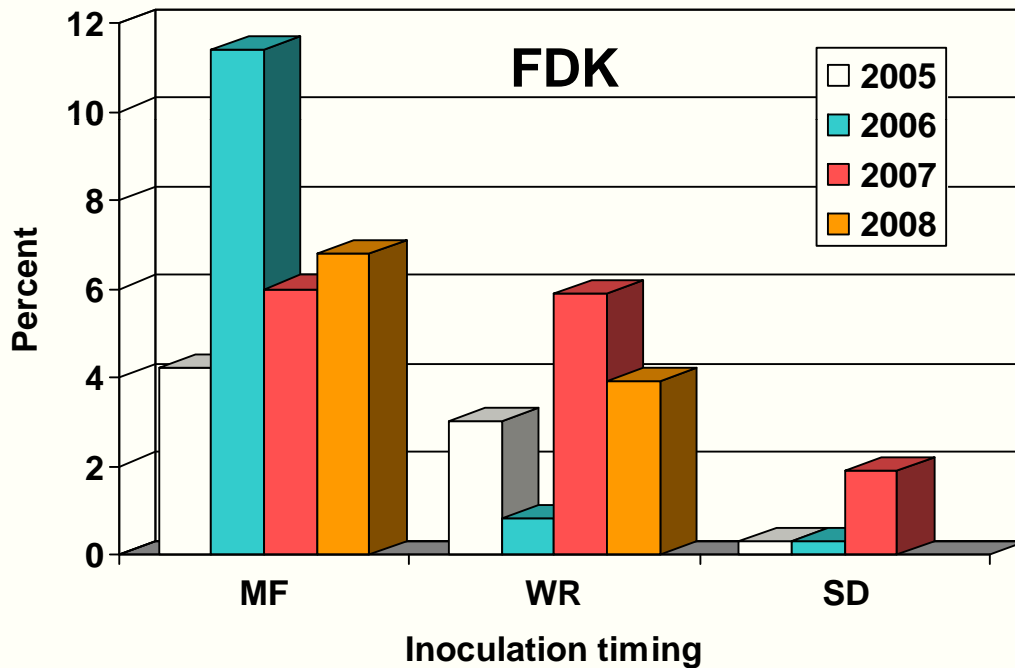
2007



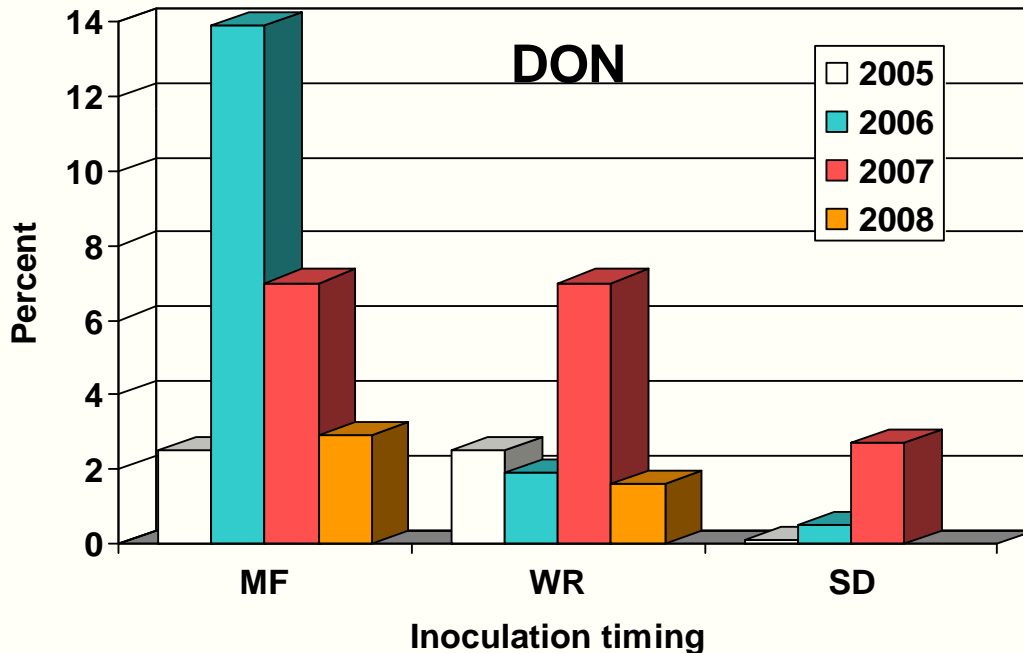
MF WR SD

MF WR SD

Averaged
across 4
mist
durations



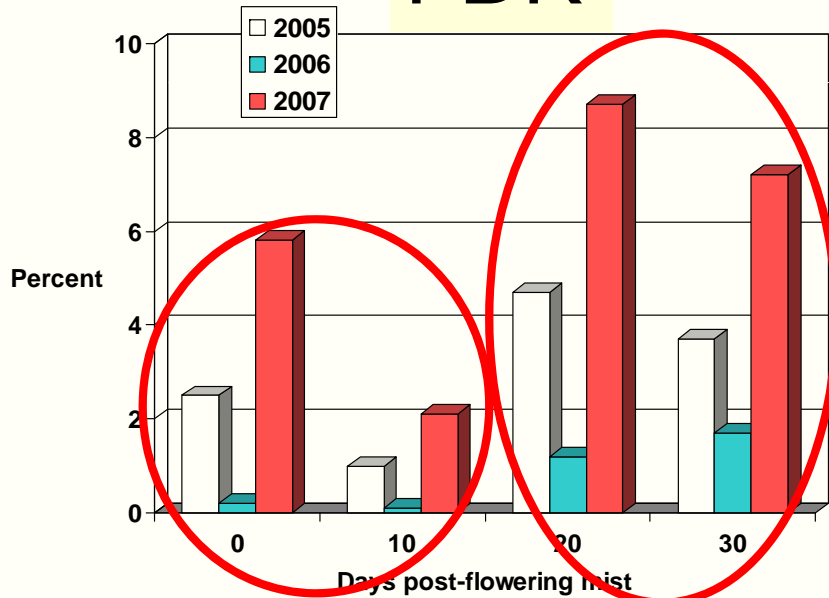
- **FDK**
 - WR: down in 3 of 4 yrs
 - SD: same as background in 2 of 3 yrs



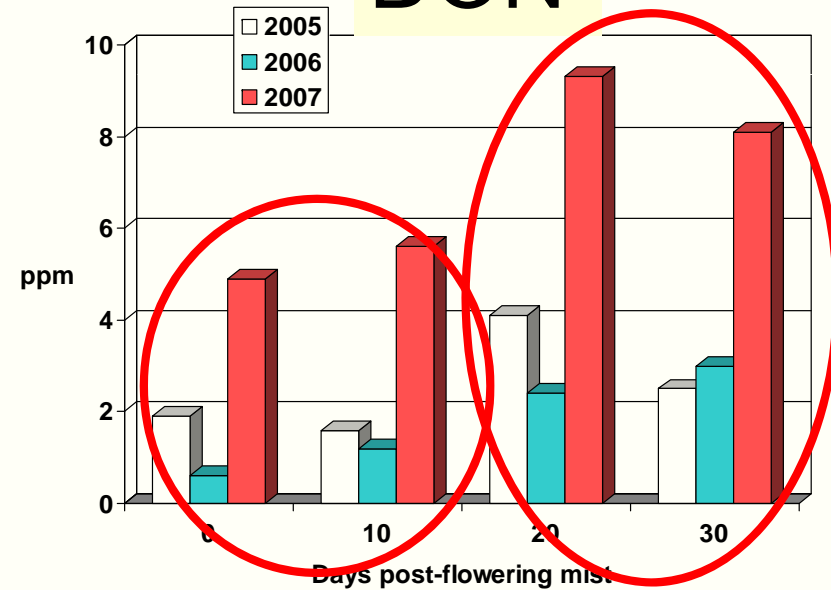
- **DON**
 - WR: down in 2 of 4 yrs
 - SD: same as background in 2 of 3 yrs

Moisture makes watery-ripe infections worse

FDK



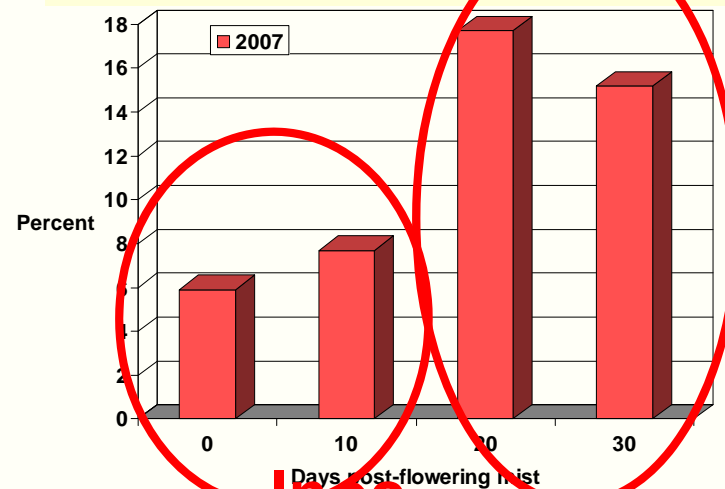
DON



Inoc

Inoc

% infected kernels



Inoc

Maximum vulnerability to infection Winter wheat (NC)



Spring wheat (ND)–
cultivar-dependent?

Mid-flowering



Barley
(ND)

Watery ripe

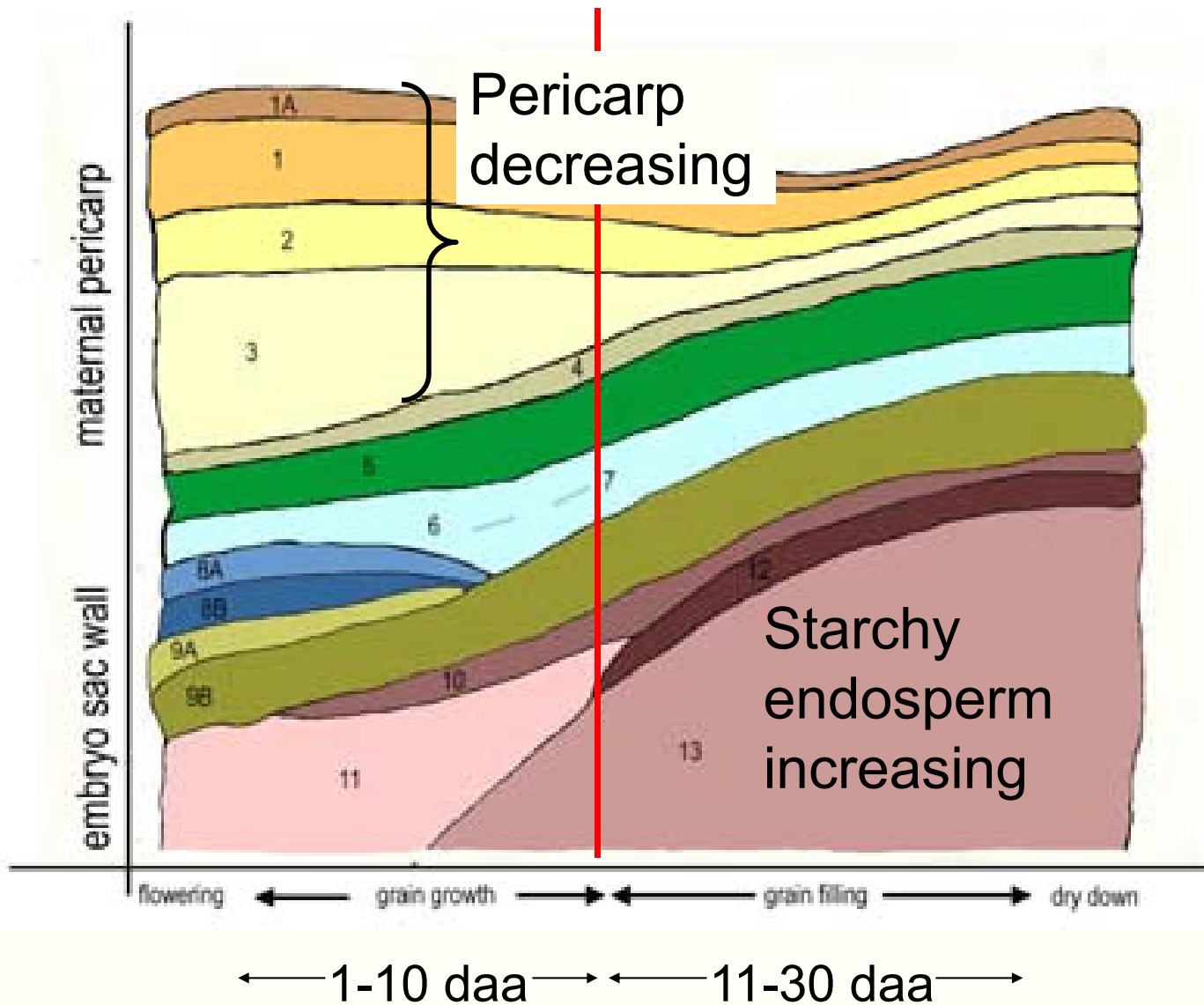


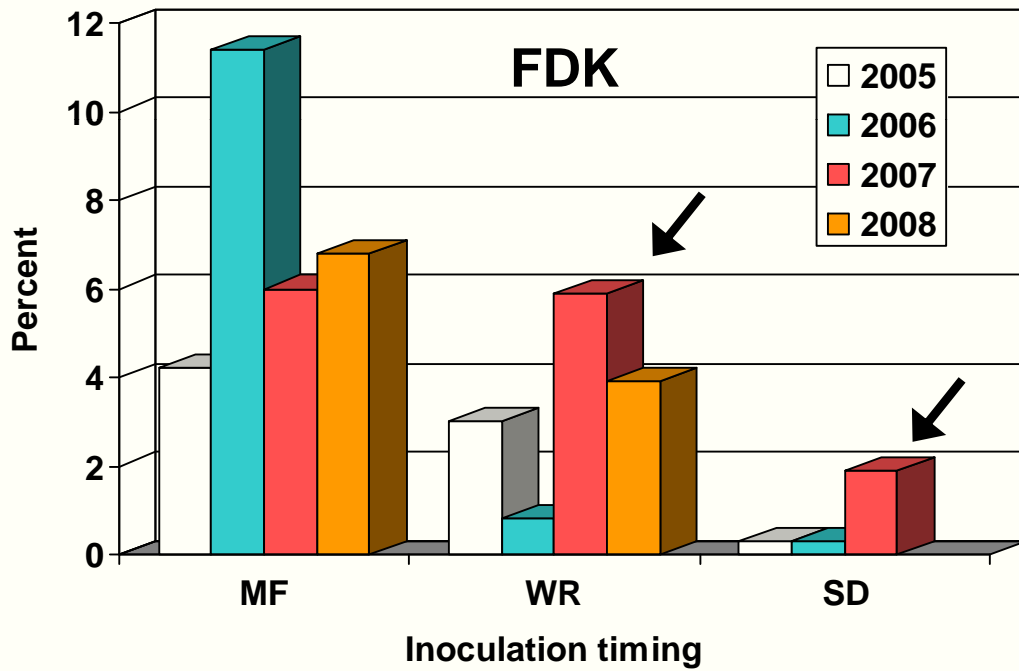
Ventral
groove

Soft dough

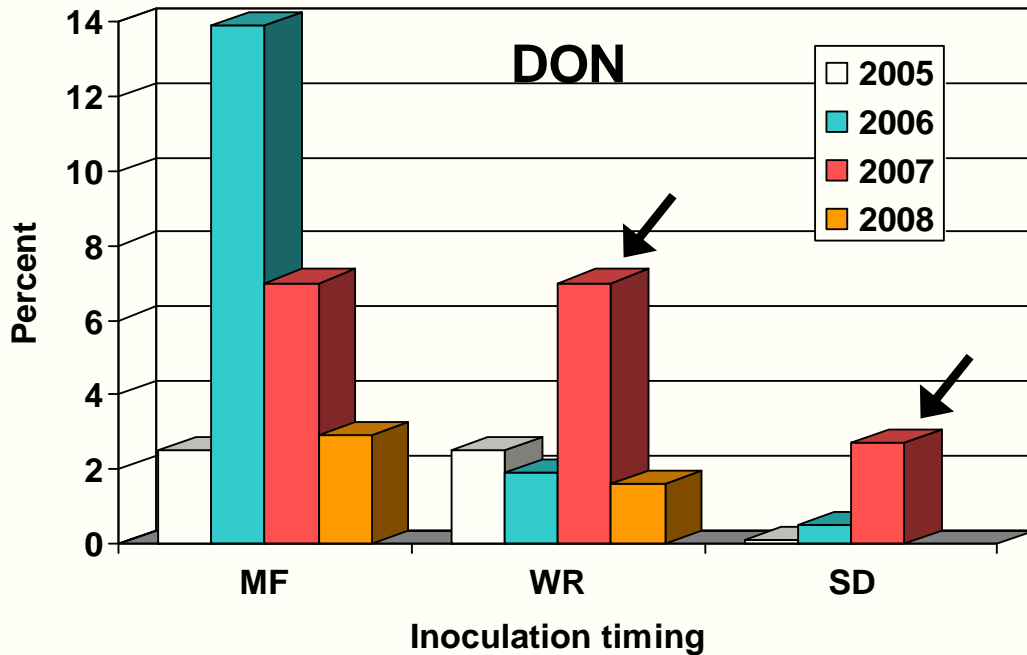
Durum (ND)

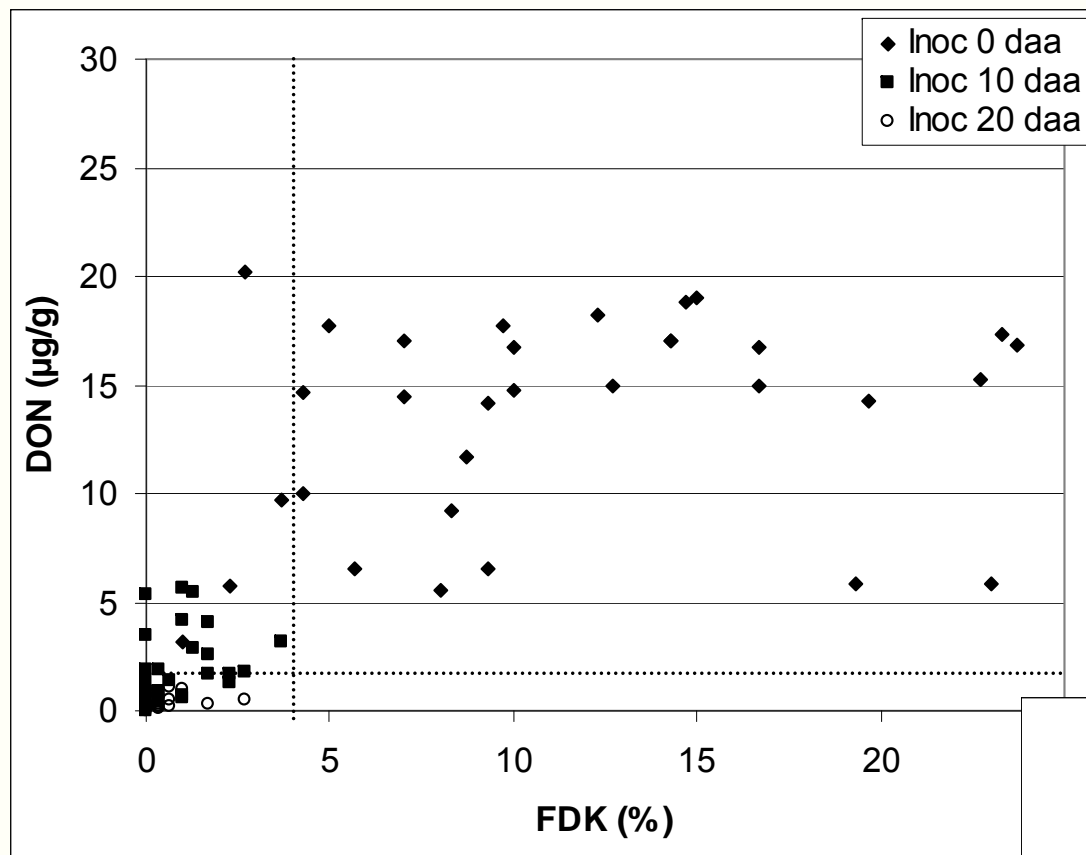
Cell layers inside a grain





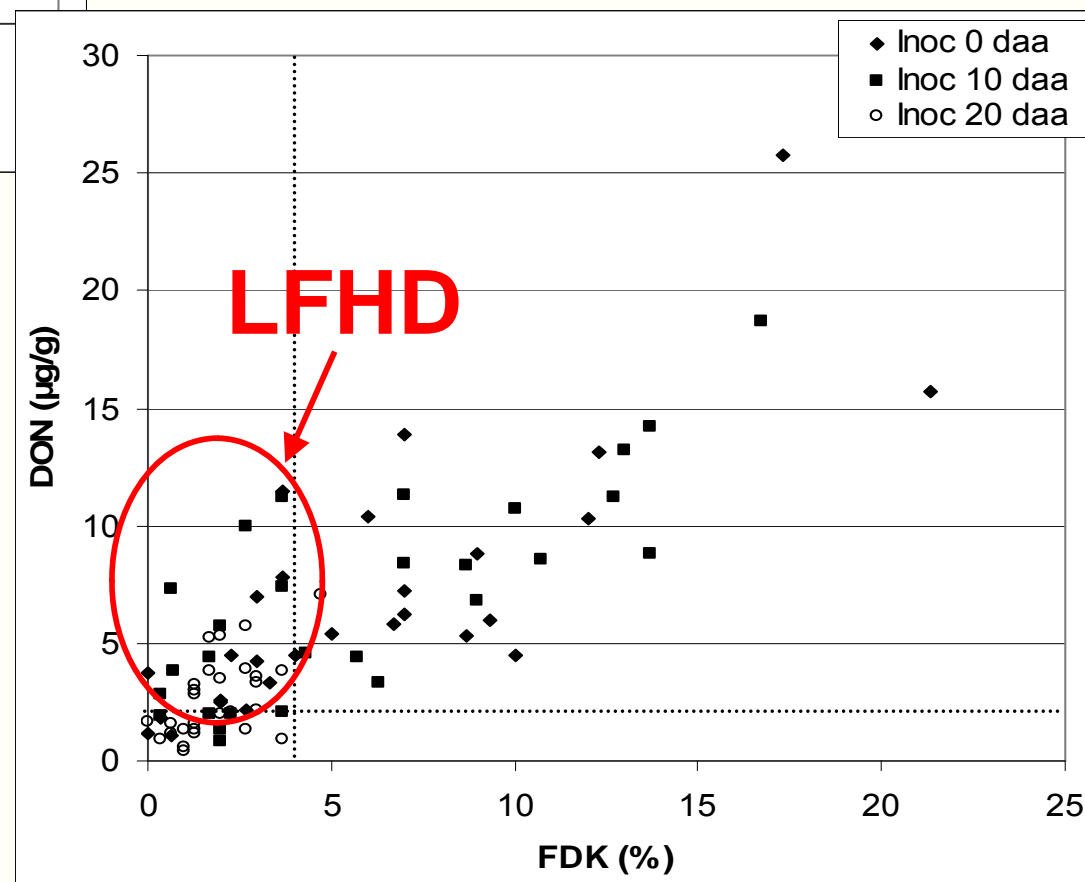
What about this weird year?





Data points: means of 3 reps of cv*inoc*moisture

2007 – atypical year



2006 – typical year

- **Low-FDK, high-DON (LFHD)**

- 2005: 14%
- 2006: 18%
- 2007: 41%

So what?

- Surprises for growers at the elevator
- Affects our ability to forecast DON levels and problems from grading grain

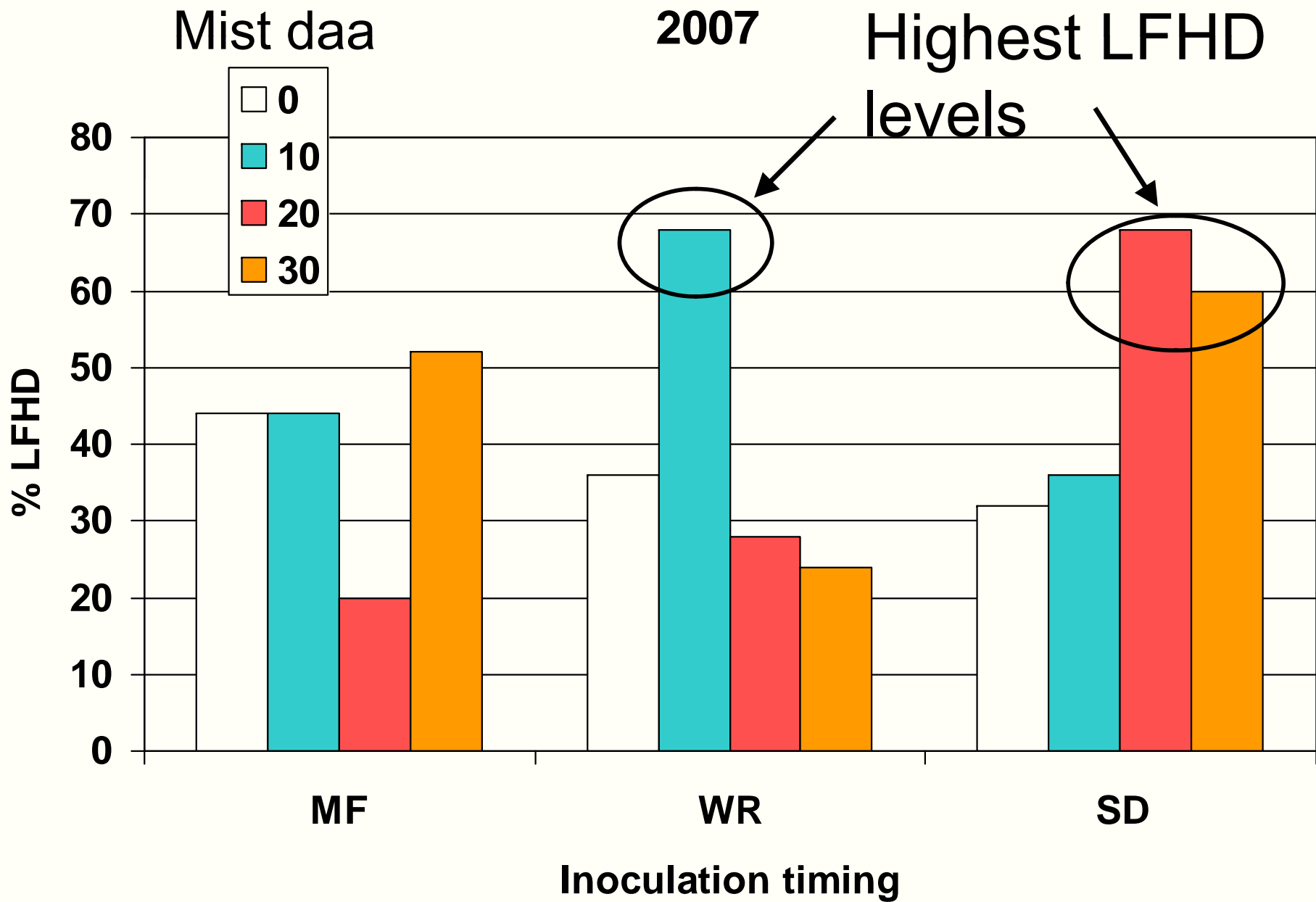


FDK-DON correlation (R)

- **In “normal” years,**
 - **Infection timing: 0-10 daa > 20 daa**
 - **Post-flowering mist: 0-20 daa > 30 daa**
- **In high-LFHD year: no clear correlation pattern**

What factors maximized LFHD?

- Only significant factor = **interaction** of **moisture** and **infection timing**
 - **Infection timing** was important IF **mist** applied
 - **Mist duration** was important IF **inoculation** was **post-anthesis**
- LFHD maximized by marginal but not non-conducive conditions



DON changes over time

•7 cvs

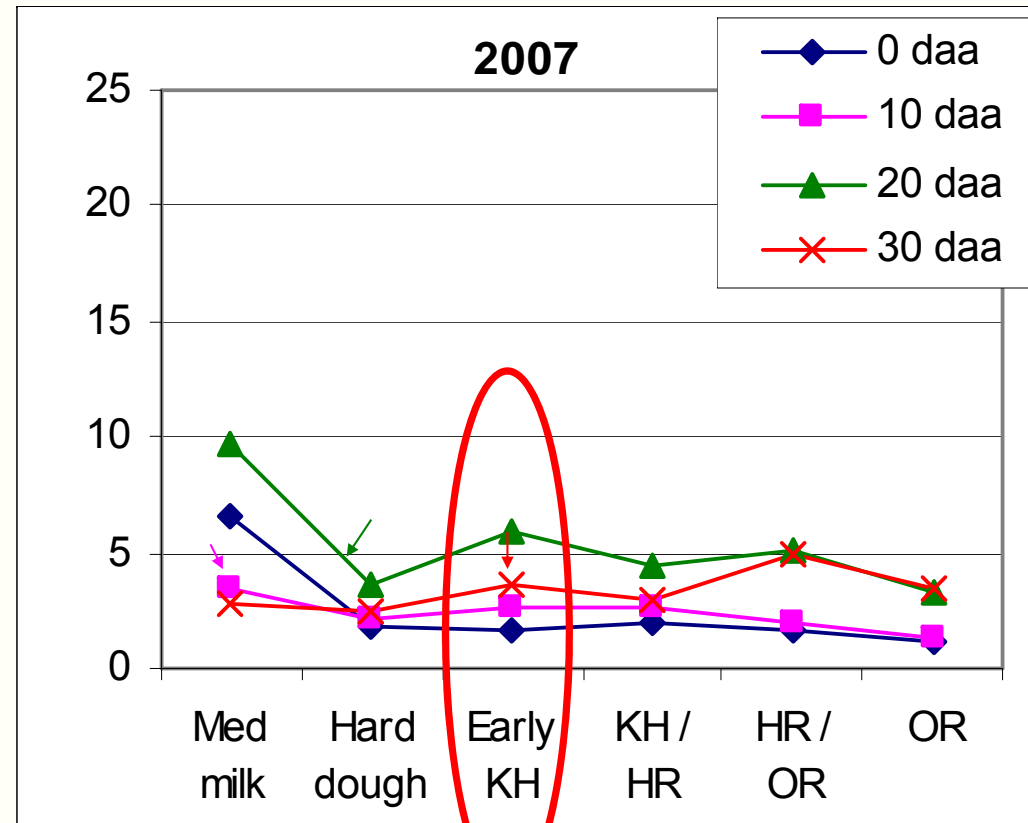
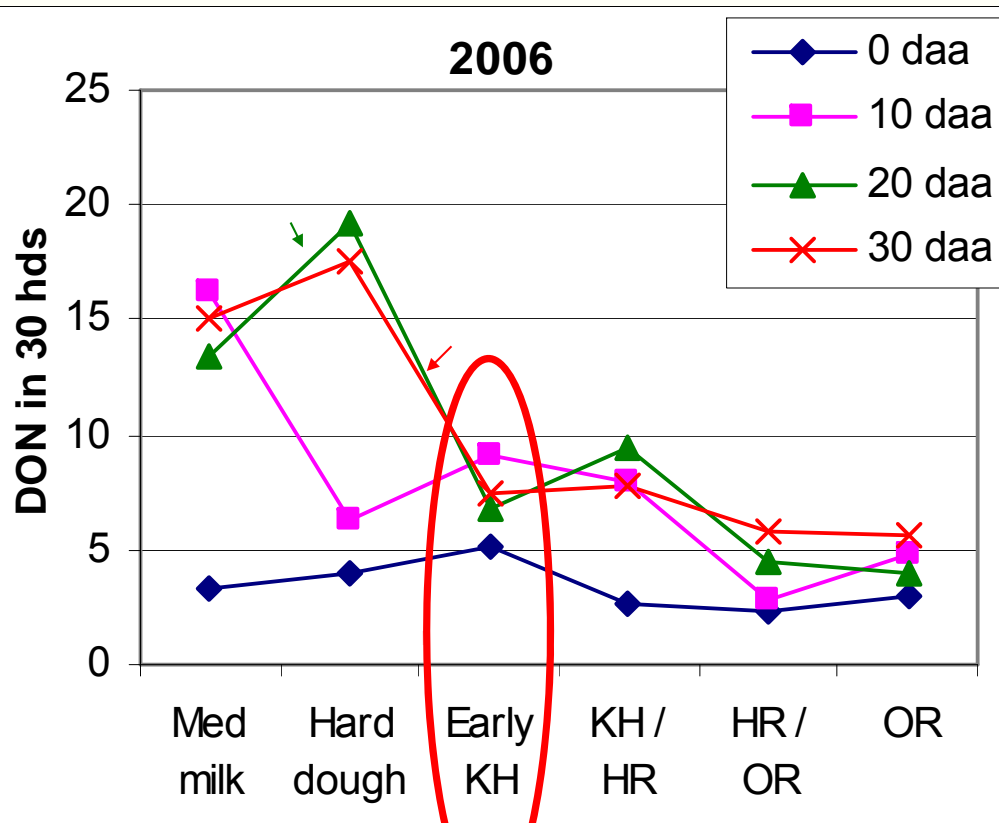
•Spray-inoculated at MF

Mist

Mist

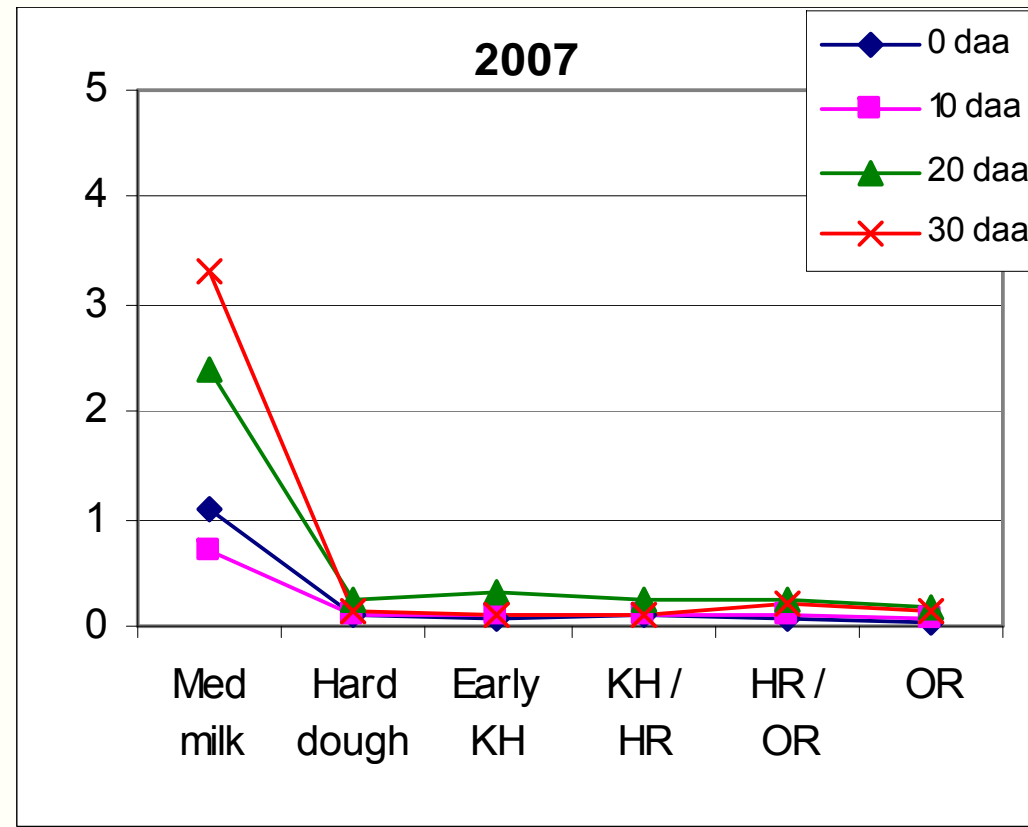
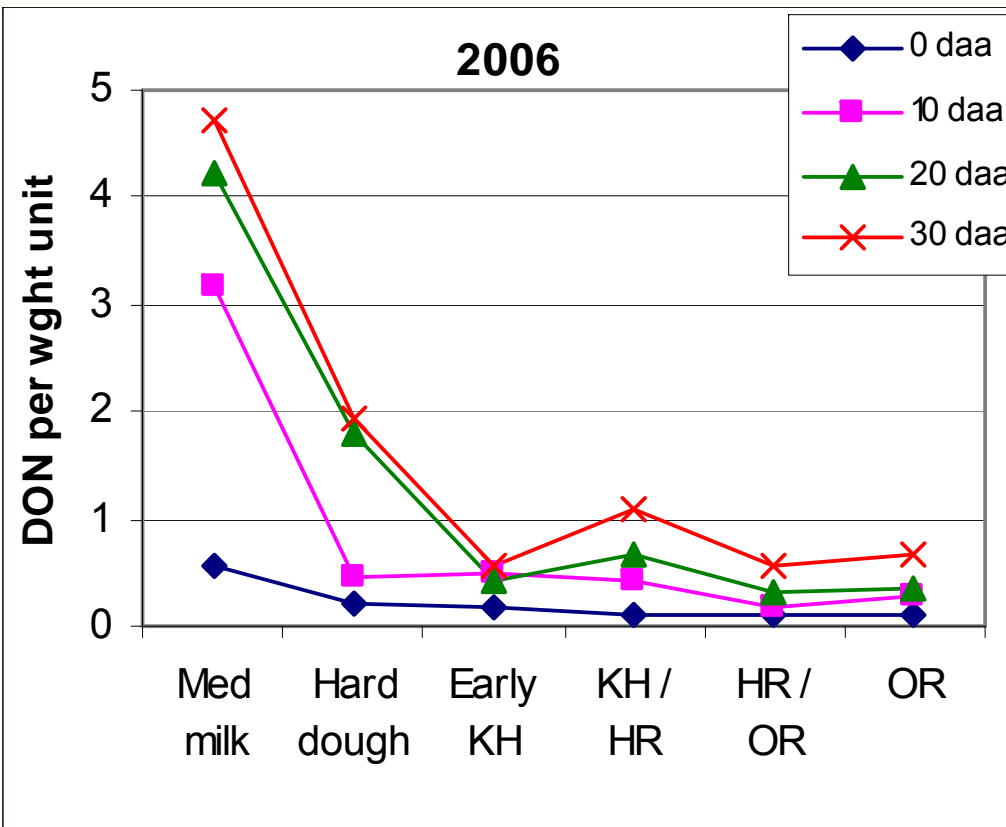
2006

2007



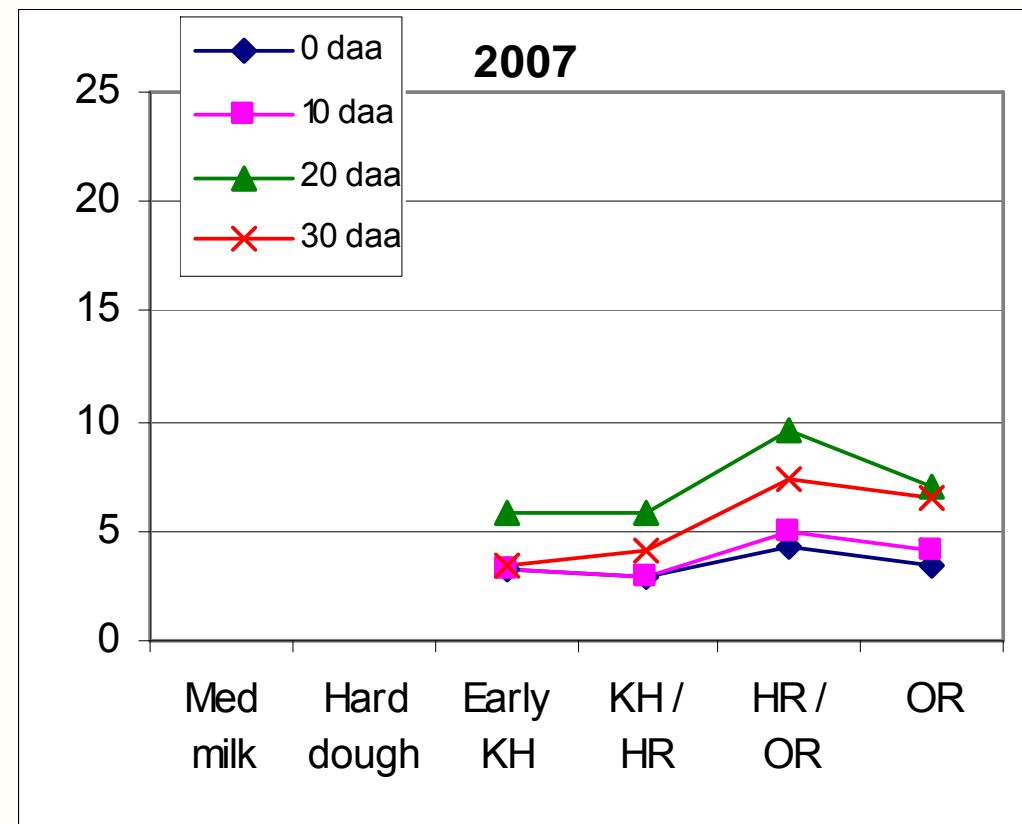
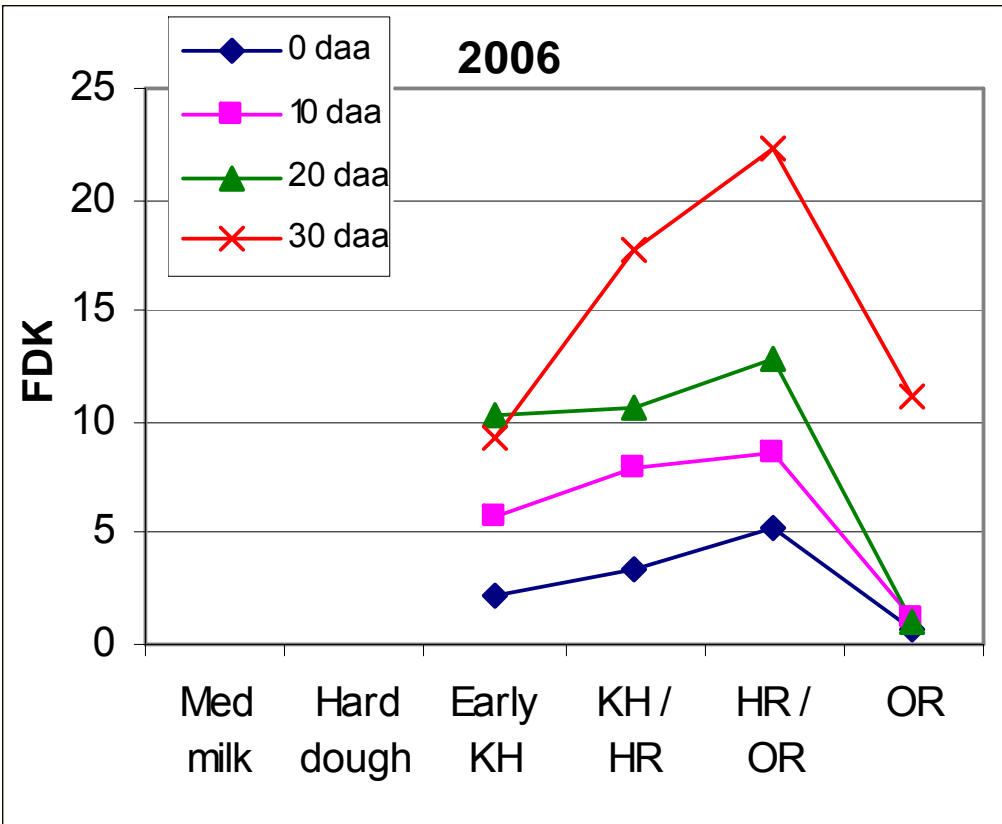
DON per 30-head sample

DON changes over time



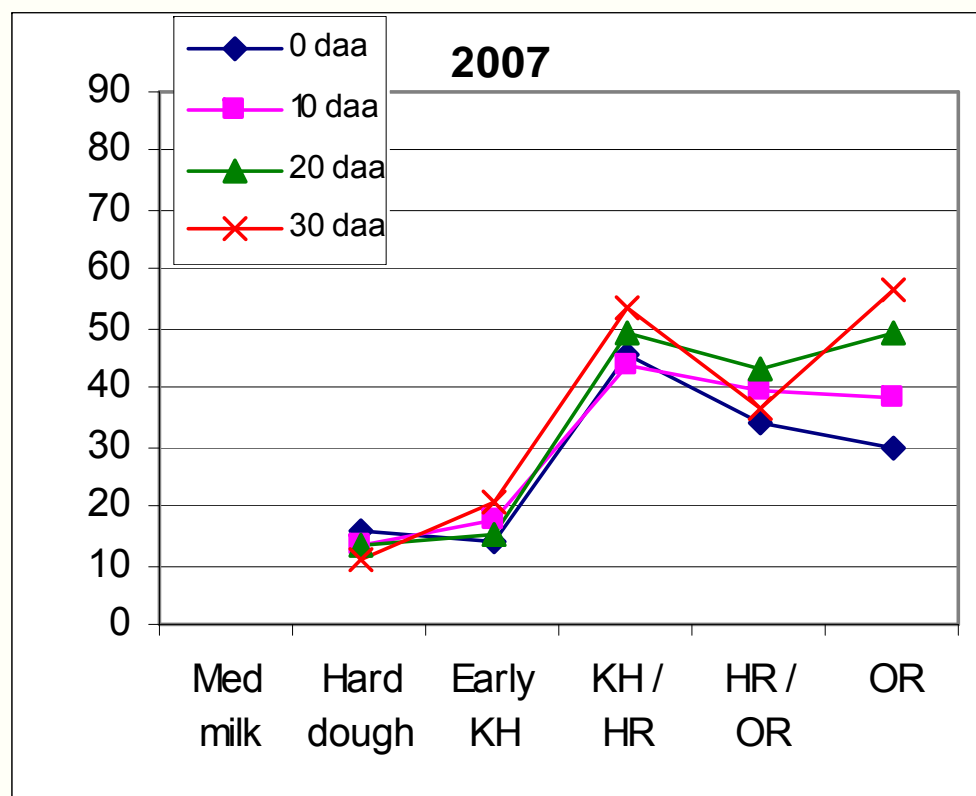
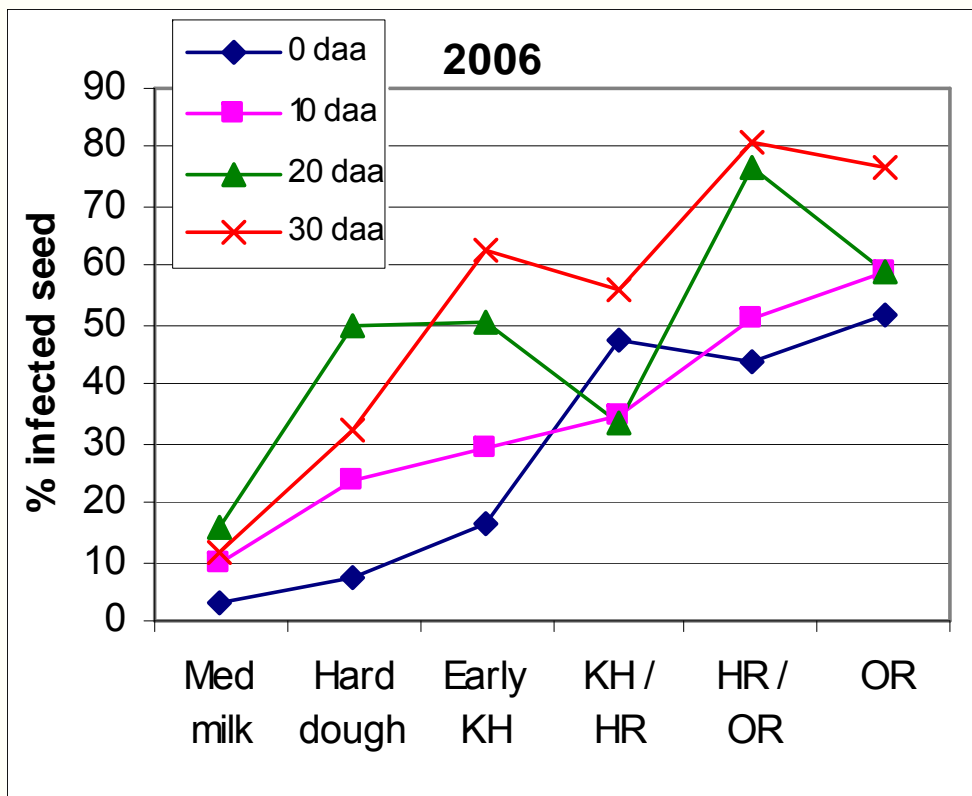
DON per wght unit

FDK increases during grain fill but mainly if it's very wet....



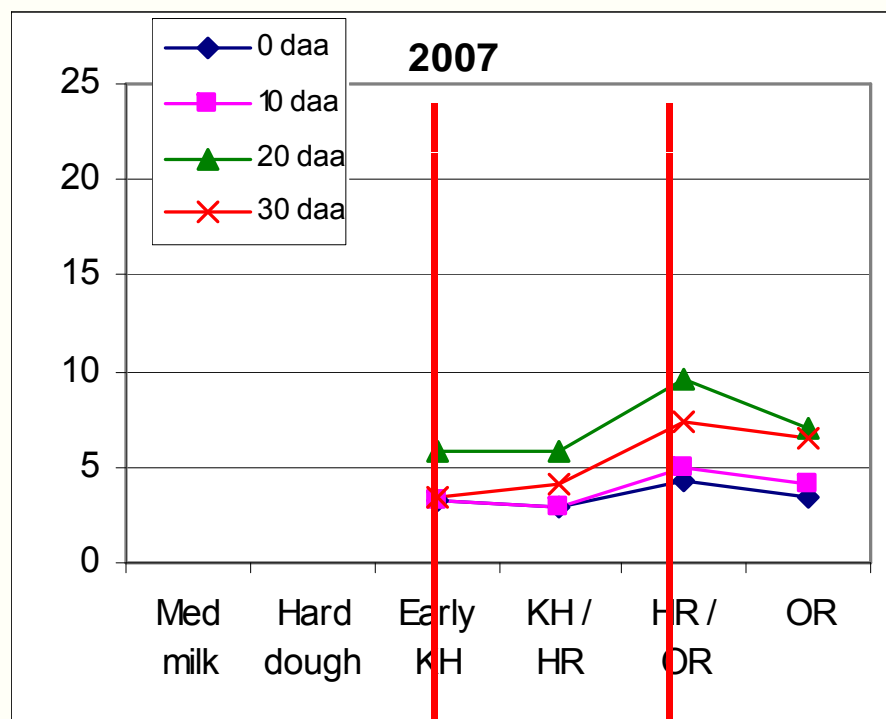
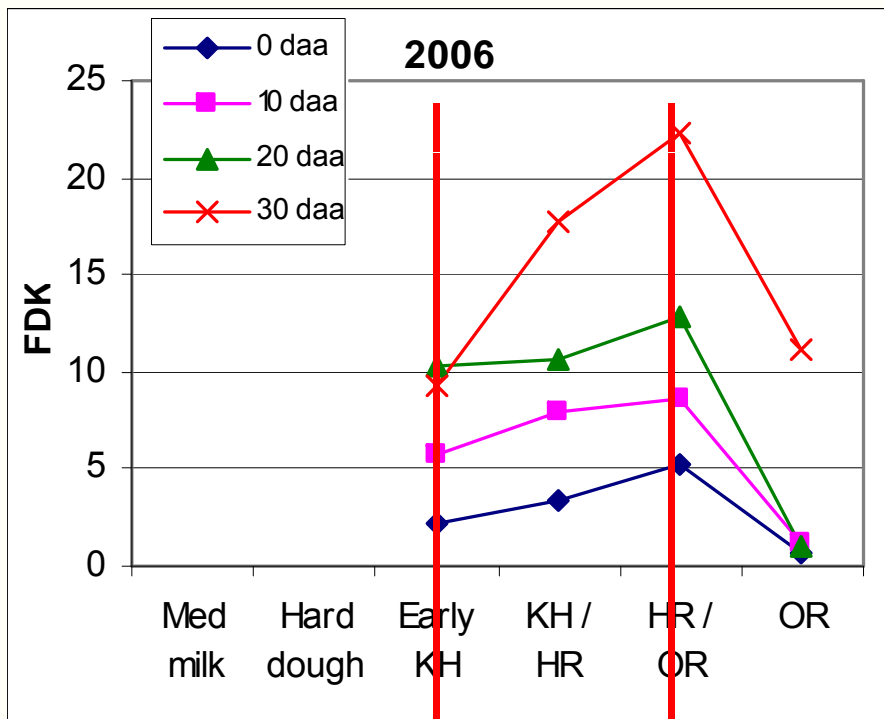
FDK %

Infections spread through heads over time

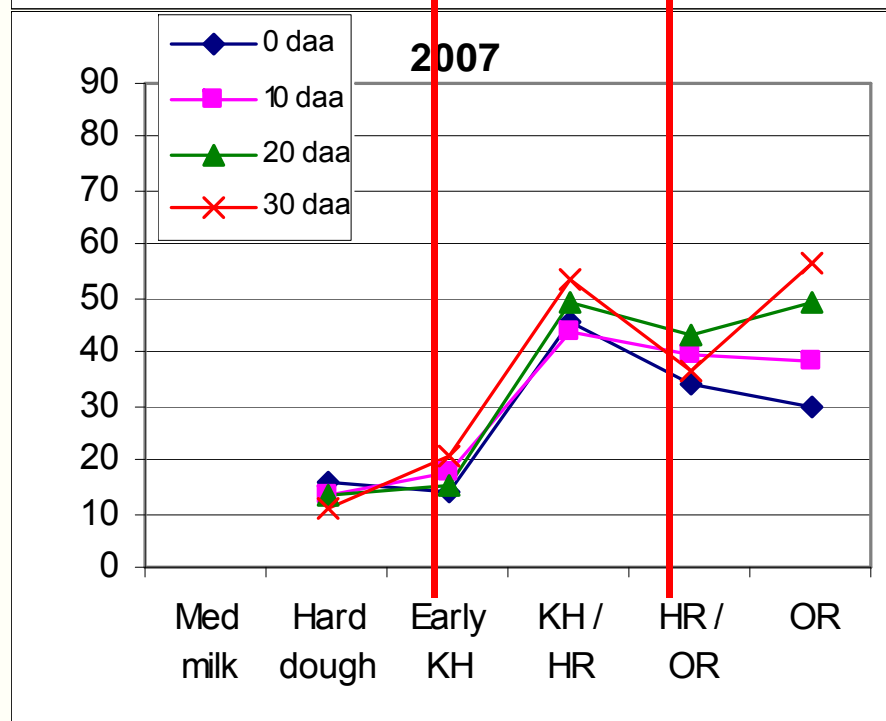
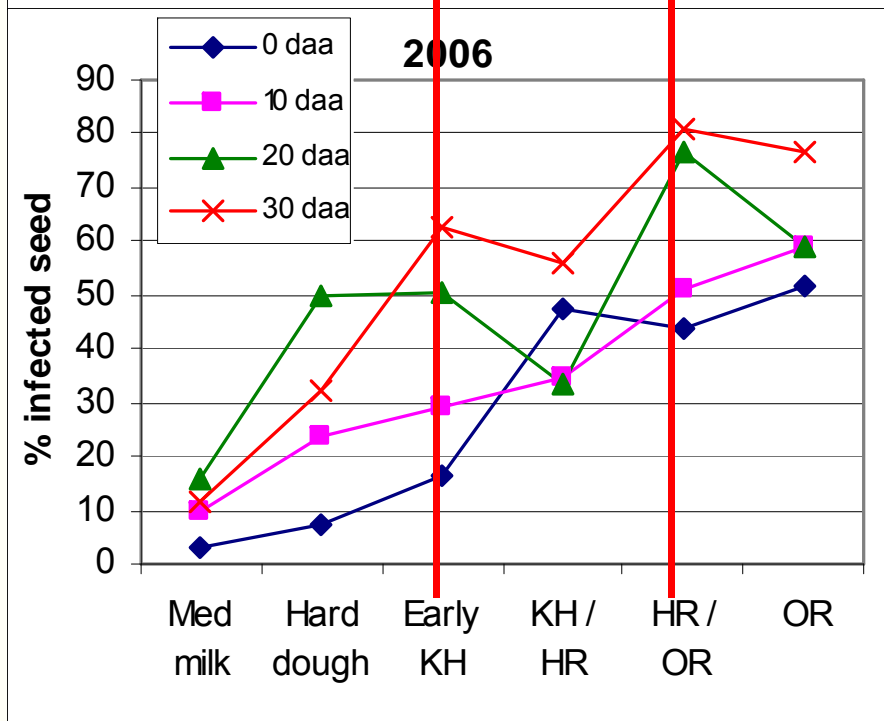


% infected kernels

FDK



% Inf Seed



	Washington Co.		Beaufort Co.		Pasquotank Co.	
	Plymouth USG 3592 S	Wenona P26R12 S	Pinetown P26R12 S	Belhaven SS 8308 S	Field 1 Panola S	Field 2 P26R12 S
Date	----- DON (ppm) -----					
HR	1.42	3.63	4.17	3.62	6.01	15.24
HR+7	1.43	3.51	3.00	4.45	3.55	5.61
HR+14	1.19	2.60	--	2.88	4.22	4.52

(hand-harvested)

“Early harvesting will stop additional DON accumulation in grain, can help to prevent field sprouting, boost test weight and, perhaps most importantly, increase soybean yield when double-cropping.”

-- advice to growers, eastern U.S., May 28, 2009

Findings & implications

Winter wheat maximally susceptible for ~10 days (in NC)

→ **Protection strategies need to take into account**



Mid-flowering



Watery ripe

- **LFHD scenario**
 - Rain post- rather than pre-flowering
 - Greater variability in flowering timing(?)
 - If dry pre-flowering, wet post-flowering, be alert for LFHD
- **Extended post-flowering rain can elevate FDK and DON even in late-infected crops**
 - DON forecasts include post-flowering weather
- **DON declines during grain-fill**
 - With bad scab, measured DON may be lower with later harvest

Thanks!

- USWBSI funding
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- Consuelo Arellano, NCSU Statistics
- Cunningham Research & Extension Center

