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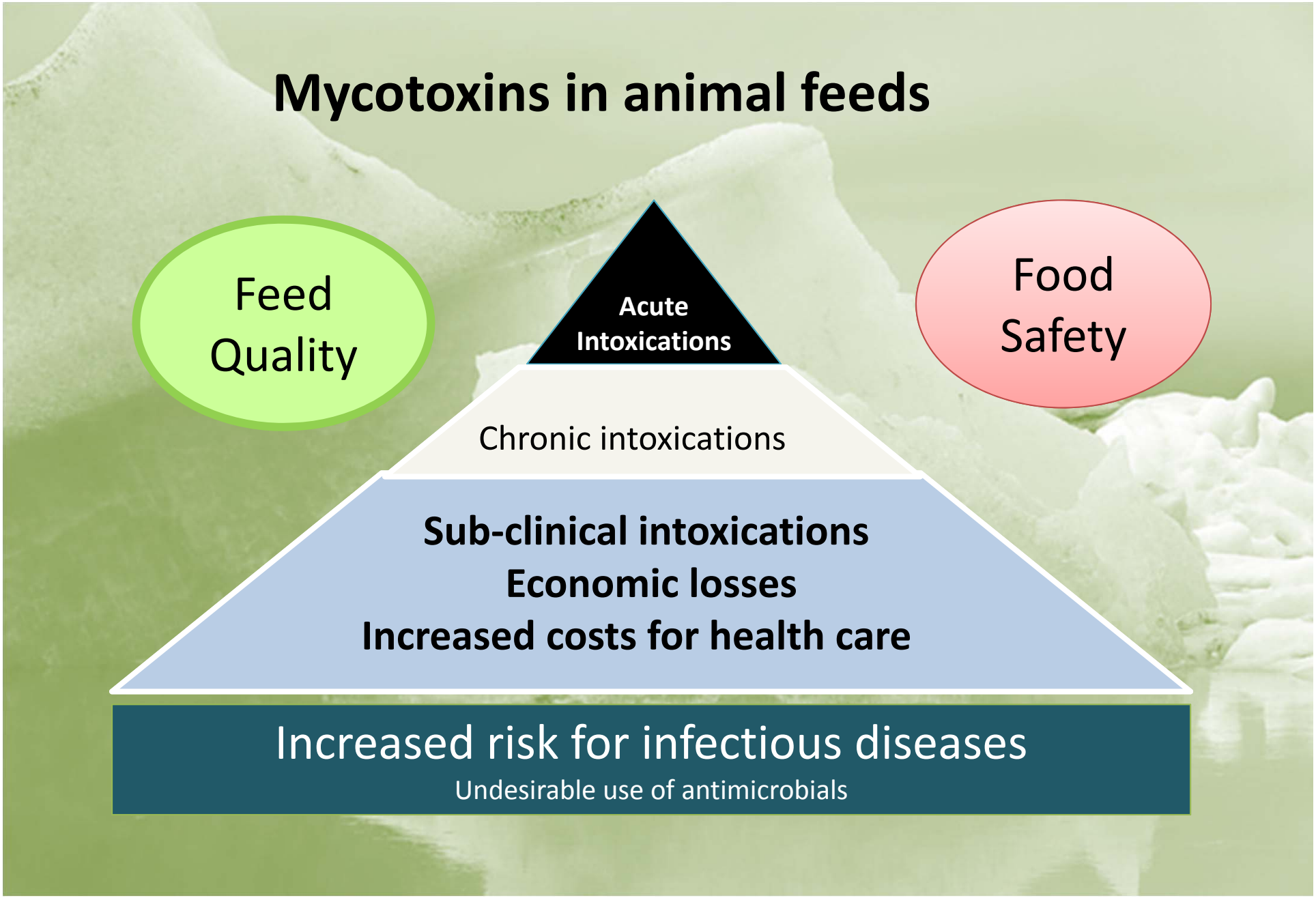
Test results for ergot and mycotoxins in feed – what to do now?

Tom Scott – Research Chair in Feed Processing Technology

January 30, 2014

Mycotoxins in animal feeds



Fink-Gremmels, 2013 – Estimate losses due to mycotoxins in NA = $5B/yr

Toxins of concern - Canada

- Ergot alkaloids
  - Grain (Rye>Triticale>Wheat) / Screenings
  - By-products (Bran, DDGS, Midds)
  - Hay (Fescue hay)
  - Silage (Fescue / Rye or Triticale green feed)
- Pre-harvest mycotoxins
  - DON (>75% of export grain in 2010-12 had measureable levels) Deoxynivalenol / Fusarium
  - Other Fusarium (nivalenol, zearalenone, T-2)
  - Fumonisin B1
- Storage mycotoxins
  - Ochratoxin A (*Penicillium verrucosum*)

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What my test results don't tell me

- Unknowns
  - One fungal species can produce more than one toxin
    - Other toxins that may interact
    - Ergot – 6 toxic alkaloids
  - More than one fungal type
    - Fusarium and/or Ergot during pre-harvest;
    - Ochratoxin A during storage
  - Masked mycotoxins (glycosinolated by plant)
- Duration of exposure or repeated exposure

Sources of mycotoxins

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Ergot – Dairy Cows

- Significant issue based on high intake and potential sources of contamination
- Recommended tolerance in grain used for feed
  - 0.1% by weight of ergot body/grain
    - Has very little relevance to type or level of alkaloids/toxins
  - 2,000 to 3,000 ppb of total alkaloids "recommended tolerable level for beef & dairy"
    - Not enforceable

EU Allowable	Diet (ug/kg; ppb)	Intake (ug/d)	Intake (ug/kg BW)
High Producing Dairy	20-24	164-201	0.25-0.31
Beef – High cereal	44-49	377-420	0.94-1.05
EFSA Journal (2012) 10(7): 2798 – pg 69			

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Recommendations

- Test to know the type and level of alkaloids
  - Need to have good representative sample
- Don't use it!?!
  - What are you going to do with it?
- Dilute it
  - With other grain sources with no ergot
  - With other grain sources with low other mycotoxins / potential for synergistic negative effects
  - Other uncontaminated diet ingredients

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Recommendations

Clean contaminated grain

- Seed cleaners (gravitational bed) and seed sizing
  - Moderate success, may be able to remove ergot bodies larger or smaller than seeds
  - May still be too contaminated to safely use?
- Color sorters
  - Sorting costs $10/MT
  - Loss of ~10% of grain by weight
    - Feed grain $150/MT = further loss of $15/MT
  - If you can successfully sort it, it may be possible to sell it as food grade… may be too expensive to use then!

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BoMill TriQ 30

- NIR Transmittance
  - 18 measurements / seed
  - 30,000 seeds / sec
  - Initially:
    - Establishes variability in seeds
    - Produces 10 fractions of equal area under the distribution curve
    - These are measured and used to set limits for production of 3 fractions

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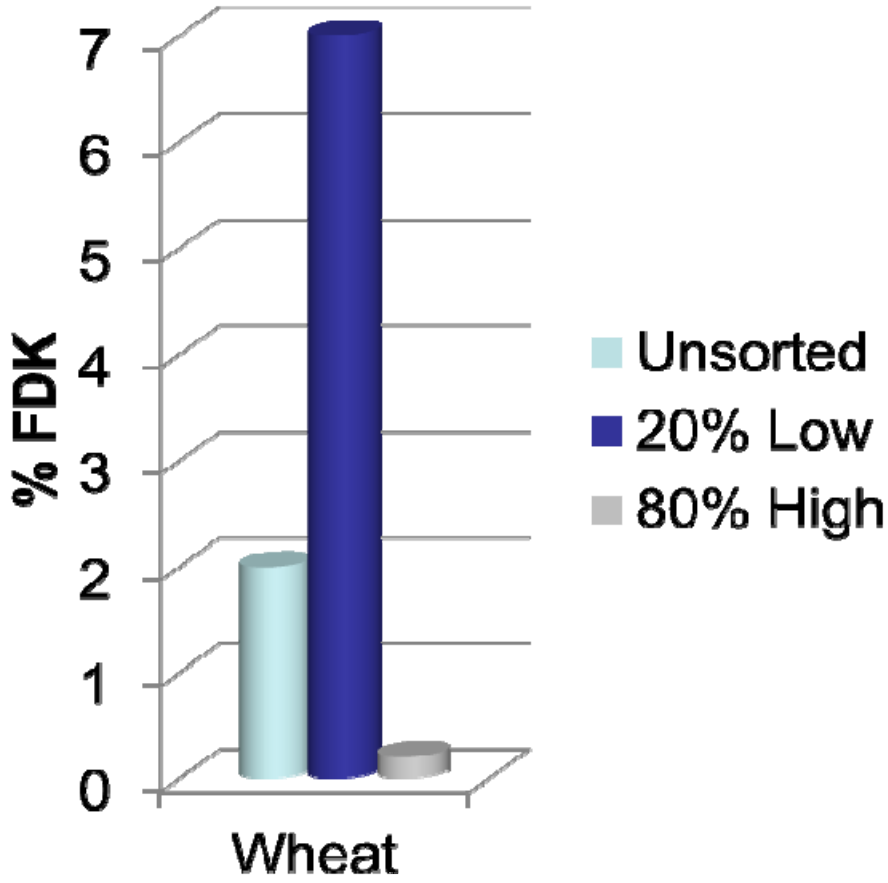
- 1 Source of wheat
  - ~2% FDK graded
- Two fractions
  - Lowest 20% CP
  - Highest 80% CP
- Outliers
  - High levels of outliers can be produced due to malpositioned seeds



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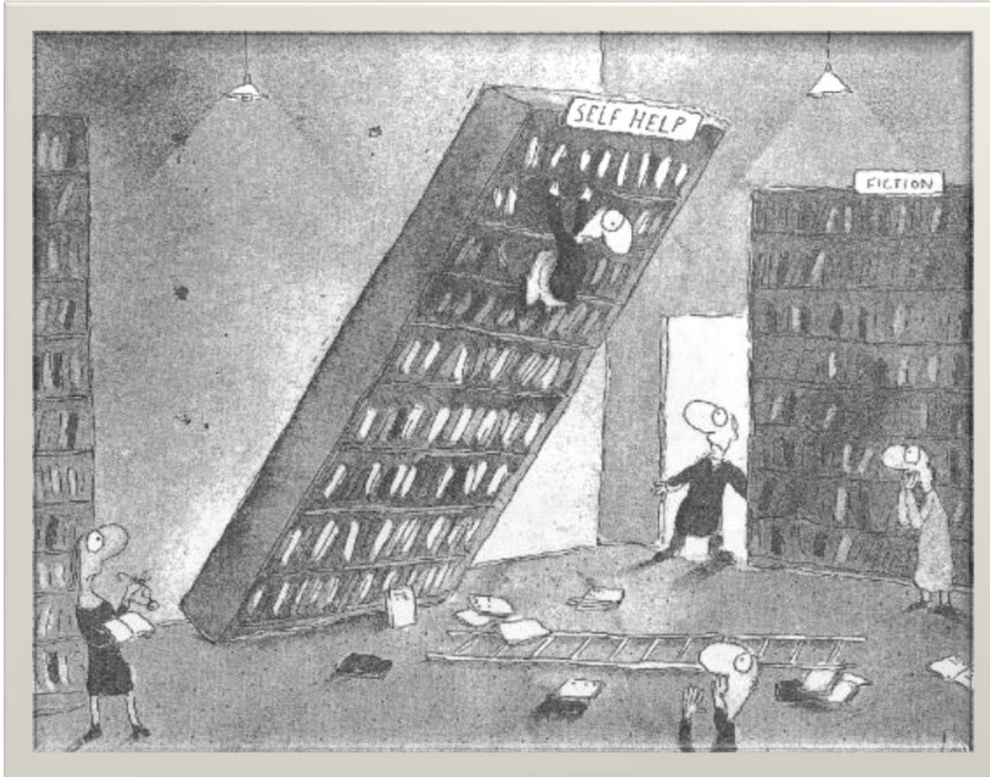
Chemical detoxification

- Detoxify or inactivate mycotoxins
  - Ozone
  - Ammonia, ammonia hydroxide
  - Sodium bisulfite
  - Peroxide acids
  - Formaldehyde
  - Bases, calcium hydroxide
- Issues with
  - Safety
  - Palatability
  - Efficacy
  - REGULATORY



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Recommendations

Decrease level of absorption

- Reduce internal exposure
  - Binders to tie up toxins so they are excreted
    - See next two slides
  - Toxin transport competition or inhibition
    - Chlorophyll; alfalfa meal; soybean metabolites; green tea polyphenols

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Adsorbents: Mineral clays

- Many products available
  - Bentonites (used as a pellet binder, but require >4%)
  - Zeolites
  - Aluminosilicates
  - Hydrated sodium calcium aluminosilicate (HSCAS)
- Adsorption depends on the chemical structure
  - Capacity can vary from 0 to 87% (Devegowda & Murthy, 2005)
  - Most claims are based on in vitro data and difficult to show efficacy in live animal trials using purified toxins not naturally occurring
- Mostly effective for aflatoxins, but little efficacy for:
  - DON
  - Zearlenone
  - T-2 toxin
  - Ochratoxin A
  - Diacetoxyscirpenol
  - Fescue Toxin
- Mineral clays reduce the utilization of Mn, Zn, Mg, Cl, Cu and Na

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Adsorbents: Yeast cell wall

- Yeast cell wall derived and/or modified glucomannan (Mycosorb / Alltech Inc)
- Biorgin (Brazil)
- Pros and Cons
  - Lower inclusion levels than clays (1 vs 40kg / MT)
    - Costs/MT similar, but less dilution of diet
  - Broader claims for different types of mycotoxins
- Research has promoted this for countering ergot toxicity on pasture and/or from ensiled contaminated green feed

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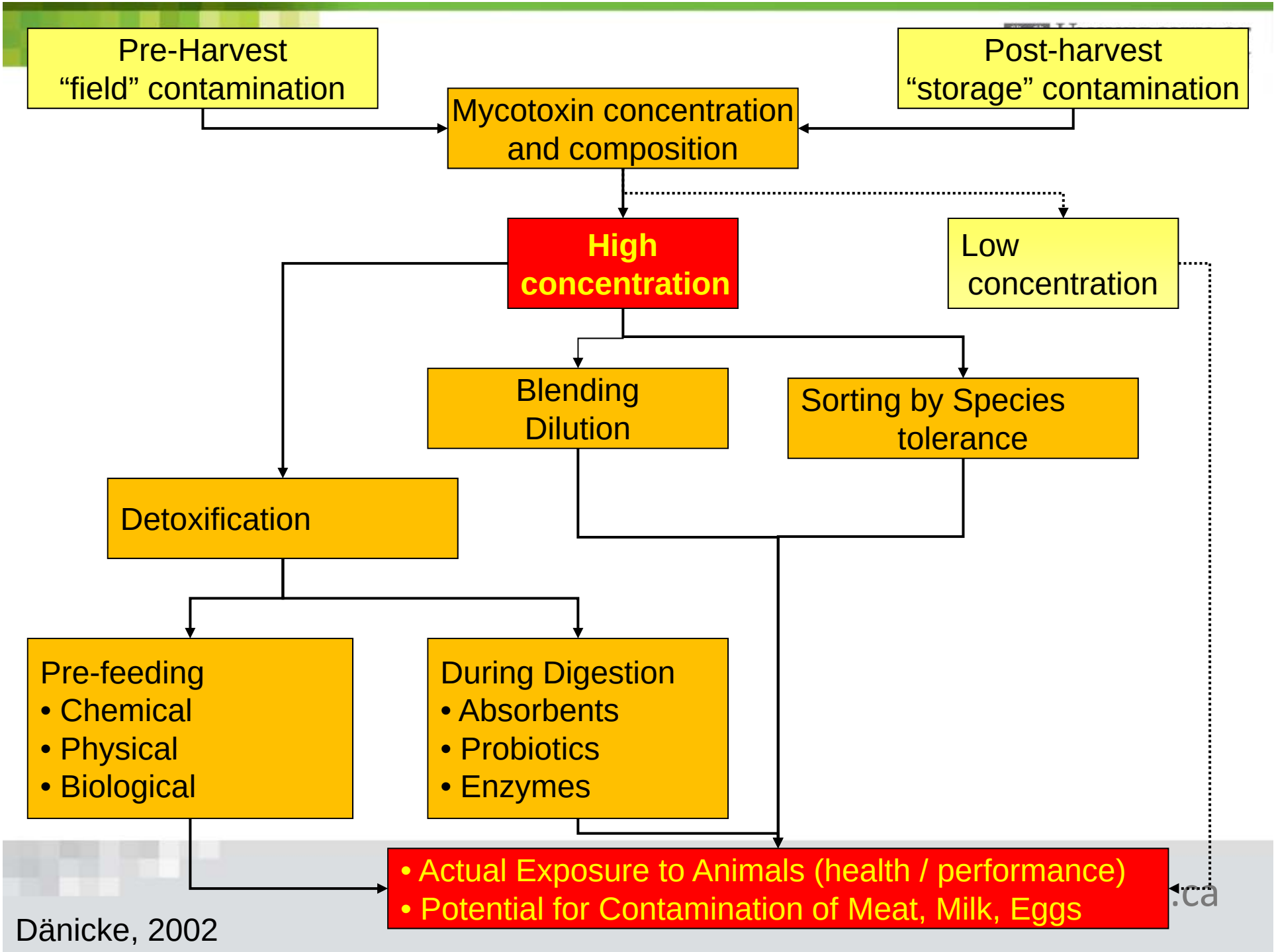
Recommendations

Minimize adverse effects on animal

- Biotransform the toxin into less or none toxic forms
  - Enzymes / not specific
  - Probiotics? = Ruminants?
- Reduce negative effects of toxins
  - Reduce damage to tissue
  - Reduce oxidative stress caused by mycotoxins
    - Fortify diets with Methionine, Selenium, Vitamins
    - Antioxidant supplements (polyphenols / peptides)


Pre-Harvest
“field” contamination
Post-harvest
“storage” contamination
Mycotoxin concentration
and composition
High
concentration
Low
concentration
Blending
Dilution
Sorting by Species
tolerance
Detoxification
Pre-feeding
• Chemical
• Physical
• Biological
During Digestion
• Absorbents
• Probiotics
• Enzymes
• Actual Exposure to Animals (health / performance)
• Potential for Contamination of Meat, Milk, Eggs
Dänicke, 2002


Thank You – Questions?
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