Effects of diet microbial phytase, vitamin C and copper levels on cadmium retention in slaughtered pigs

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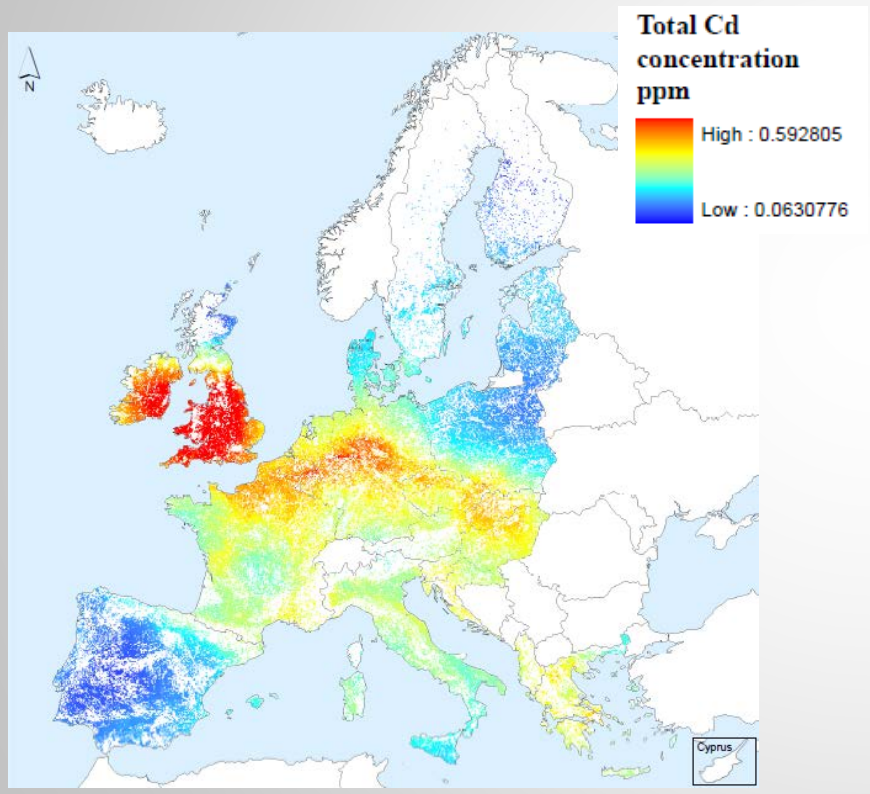
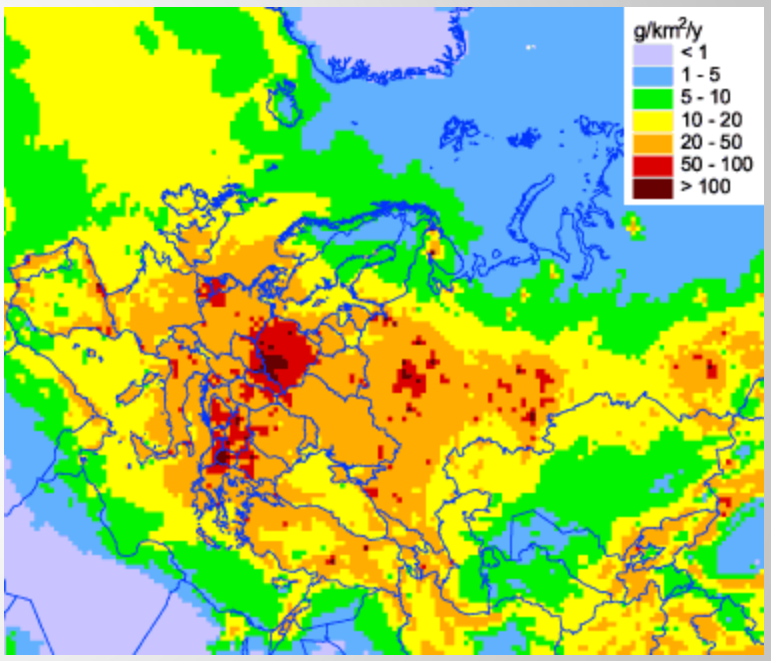
Cadmium in agricultural soils

Agricultural soil concentration



Report 'Sustainable Agriculture and Soil Conservation'
eusoils.jrc.ec.europa.eu

Total deposition in 2009



EMEP data
www.msceast.org

Background and aims of the study

Regulation and its evolution

- maximum levels in feed- and foodstuffs
  - animal feeding (Directive 2002/32 of Parliament & Council)
  - food (Regulation 1881/2006 of Commission)
- EFSA Scientific report (2012) : average Cd dietary exposure too high
- Commission's review of Cd maximum levels : reducing Cd in foods

Respecting pig feed limits ` compliance of pork offals

- continuous exposure < max $[Cd]_{diets}$ $\rightarrow$ $[Cd]_{kidney}$ > tolerance (Royer and Lebas, 2010a,b).
- EU pig tissue controls : 0.6 % in 2009 & 1.2 % in 2010 non compliants

How to limit Cd accumulation in pig kidneys ?

- effects of microbial phytase, vitamin C and copper in diets

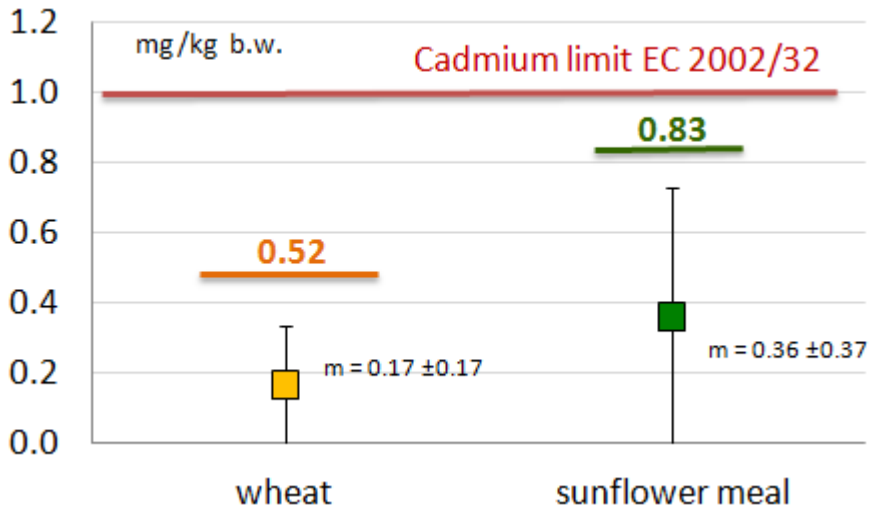
Material and methods : 4 diets

- Non contaminated (control) vs contaminated diets

  (œ0.5 mg Cd/kg = maximal limit in feeds)

  - PHYT : with phytase (1000 FTU),
  - PHOS : without phytase (+ 0.6 g P),
  - CuVitC : with phytase, vitamin C (1000 then 700 mg/kg) and lower Cu content (44 mg/kg in phase 2 diet).

- Contamination resulting from raw materials

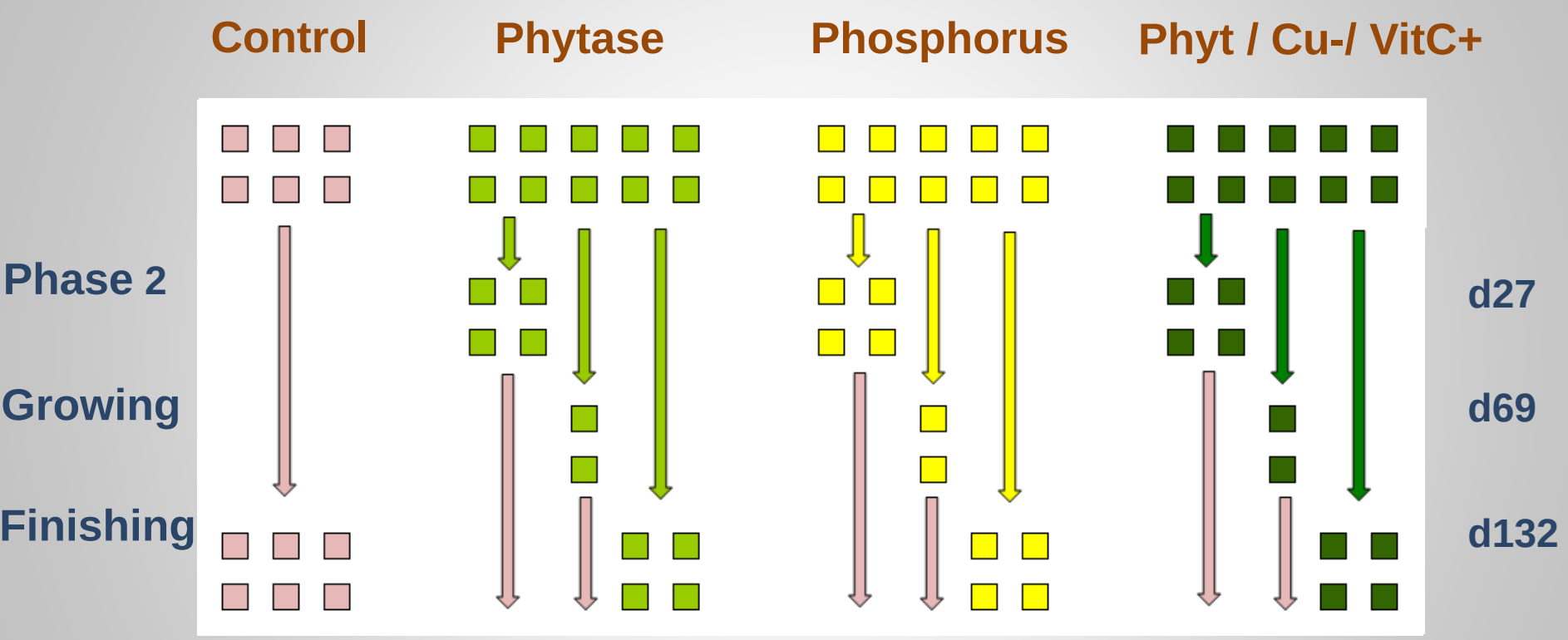


Limit for feed materials

Experimental feedingstuffs

mean [Cd] œSD , EFSA 2004

Experimental design : 36 female pigs

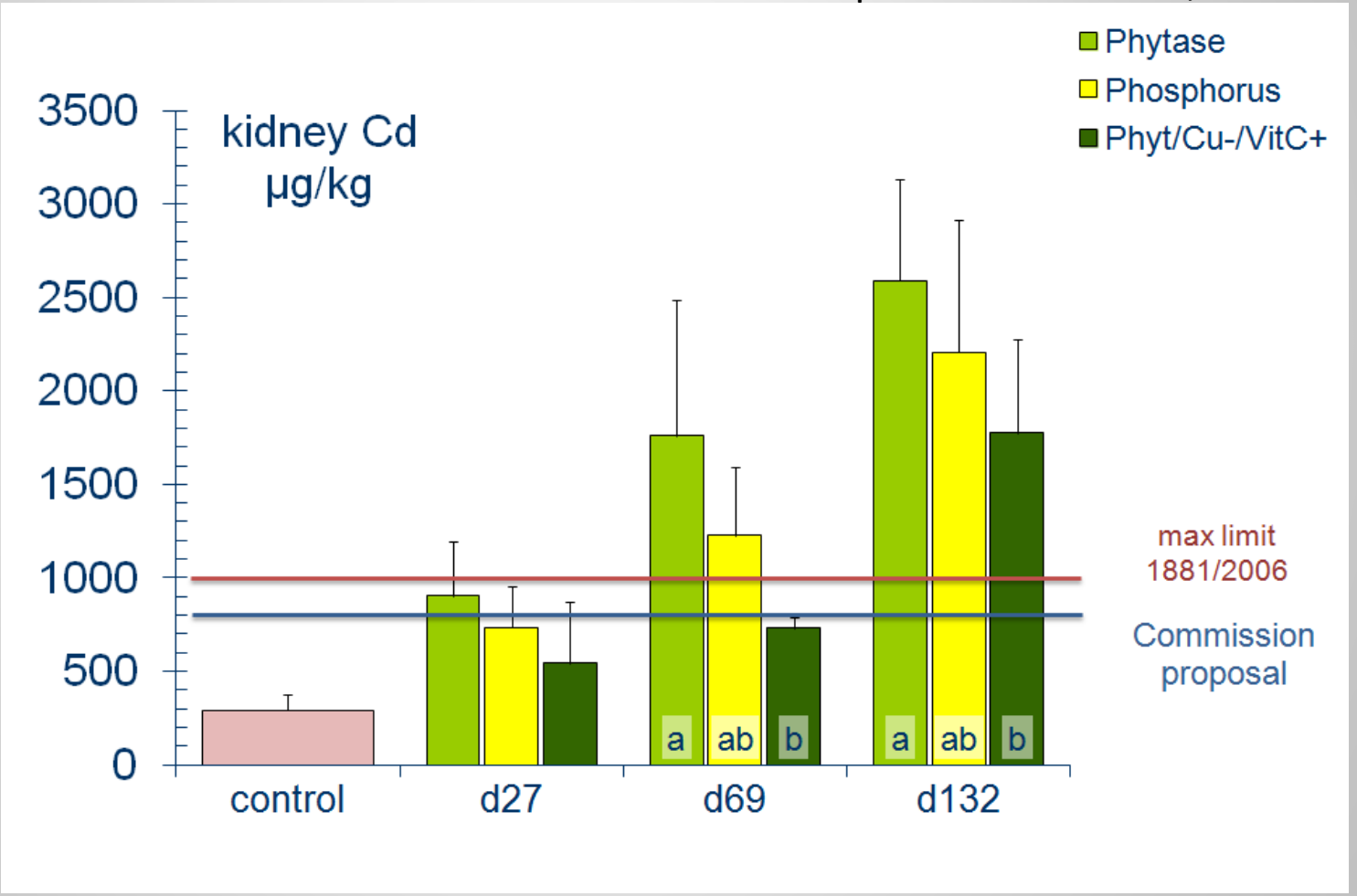


13.5 kg → 113 kg

Results : effect of diets on kidney Cd concentration

Feed : P < 0,001

Exposure time : P < 0,001



Discussion

- Effect of phytase
  - phytase ↗ renal Cd of pigs fed 0.78 mg Cd /kg (Zacharias et al., 2001)
  - Microbial phytase ↗ liberation of Cd phytate

- Effect of copper
  - $[Cd]_{kidney}$ x 2 • $[Cu]_{fattening\ feeds}$ ↗ 175 - 200 mg/kg (Rambeck et al, 1991. Rothe et al, 1994.)
  - $[Cu]_{fattening\ feeds}$ now limited 25 mg/kg, reducing $[Cu]_{phase\ 2}$?
  - Cu →MT's synthesis. Displacement of Cu from MTs by Cd ??

- Effect of vitamin C
  - Influence shown in rats (Grosicki, 2004) and pigs (Rothe et al., 1994)
  - Supplemental vitC ↘ Cd distribution and ↗ Fe absorption..

Conclusions

- Feed and food safety issues
  - Lower maximum limits for kidneys under discussion
  - Role of feeding practices : information of feed manufacturers about quality of mineral feedstuffs
- Adjusting the diet parameters
  - Phosphorus and calcium levels, supplemental phytase
  - Copper content
  - Vitamin C addition

Thank you for your attention

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