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► **To cite this version:**

Christophe Nguyen, Emmanuelle Gourdain, Gu  no   Grignon, Bruno Barrier-Guillot, Benoit Meleard. Contamination of durum wheat by cadmium: lessons from the field. ICOBTE 2017, Jul 2017, Zurich, Switzerland. 1 p. hal-01605302

HAL Id: hal-01605302

<https://hal.science/hal-01605302>

Submitted on 5 Jun 2020

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Contamination of Durum Wheat by Cadmium : Lessons from the Field



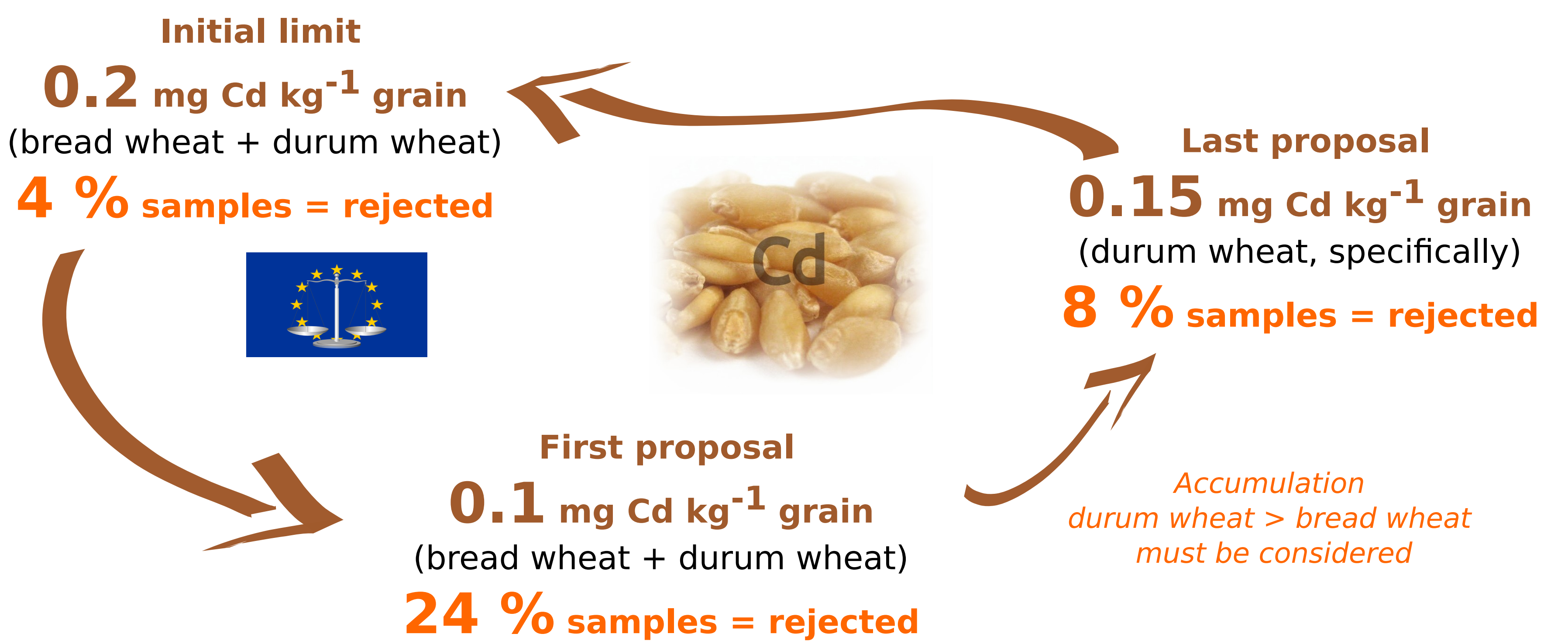
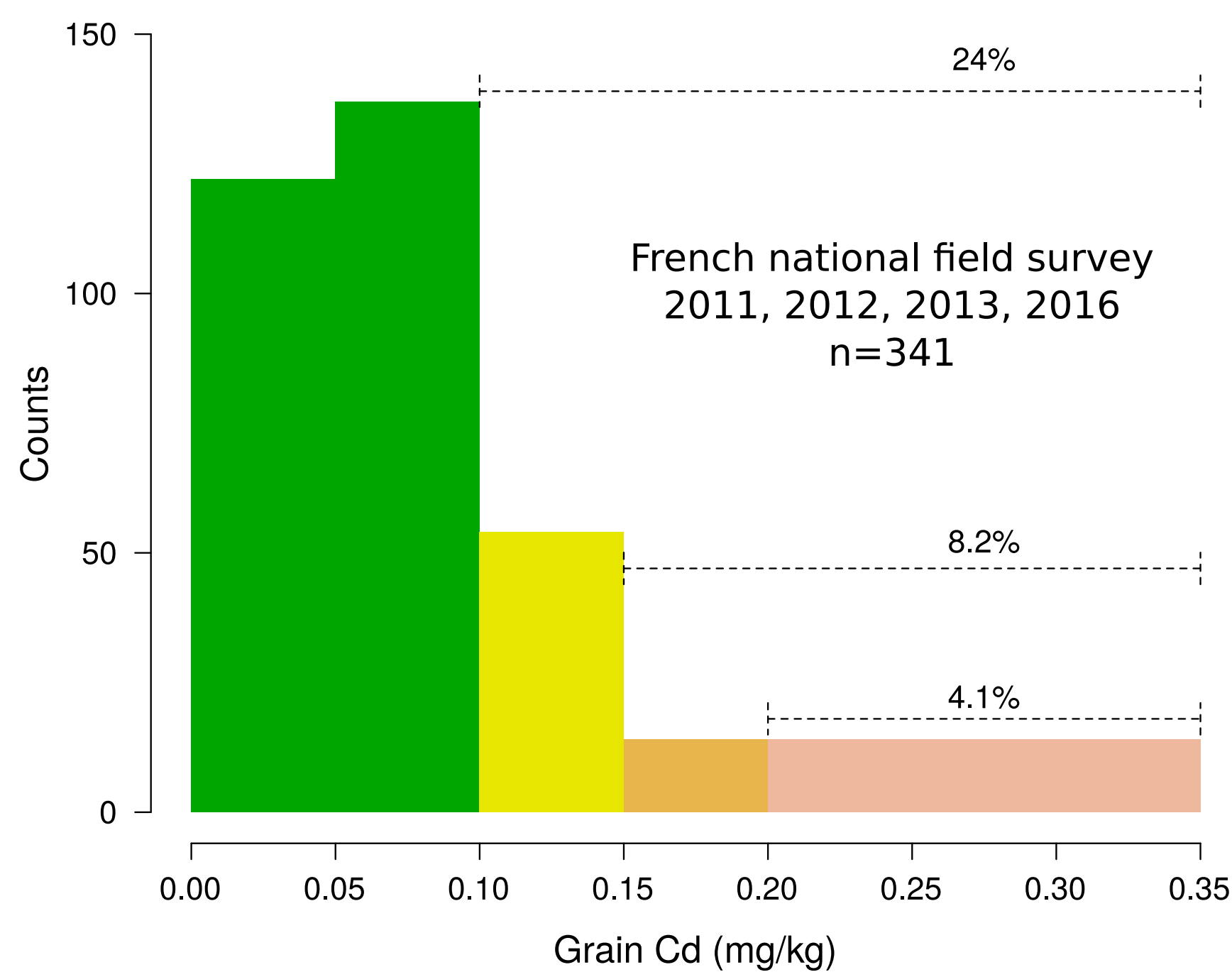
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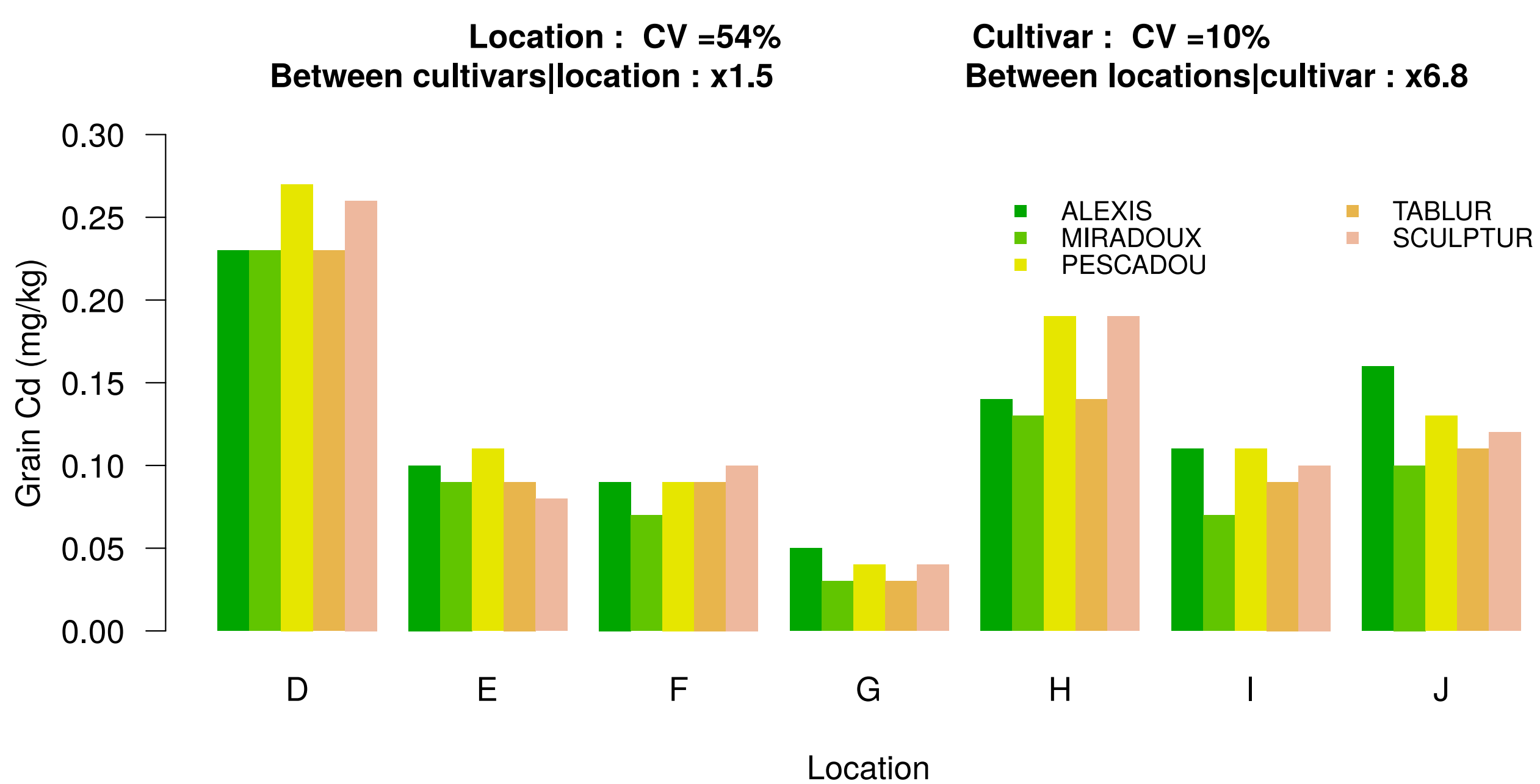
Cadmium (Cd)

Very toxic (carcinogenic) - Accumulated by crops due to root uptake from soil - European regulatory limits for contents in some foodstuffs (EC 1881/2006) - Dietary exposure to Cd too high in Europe (Efsa, 2009) - Wheat = major contributor to dietary exposure to Cd
Project of lowering regulatory limit for Cd in wheat (DGSanco, 2011)

Cd in French durum wheat compared to current and possible new regulatory limits



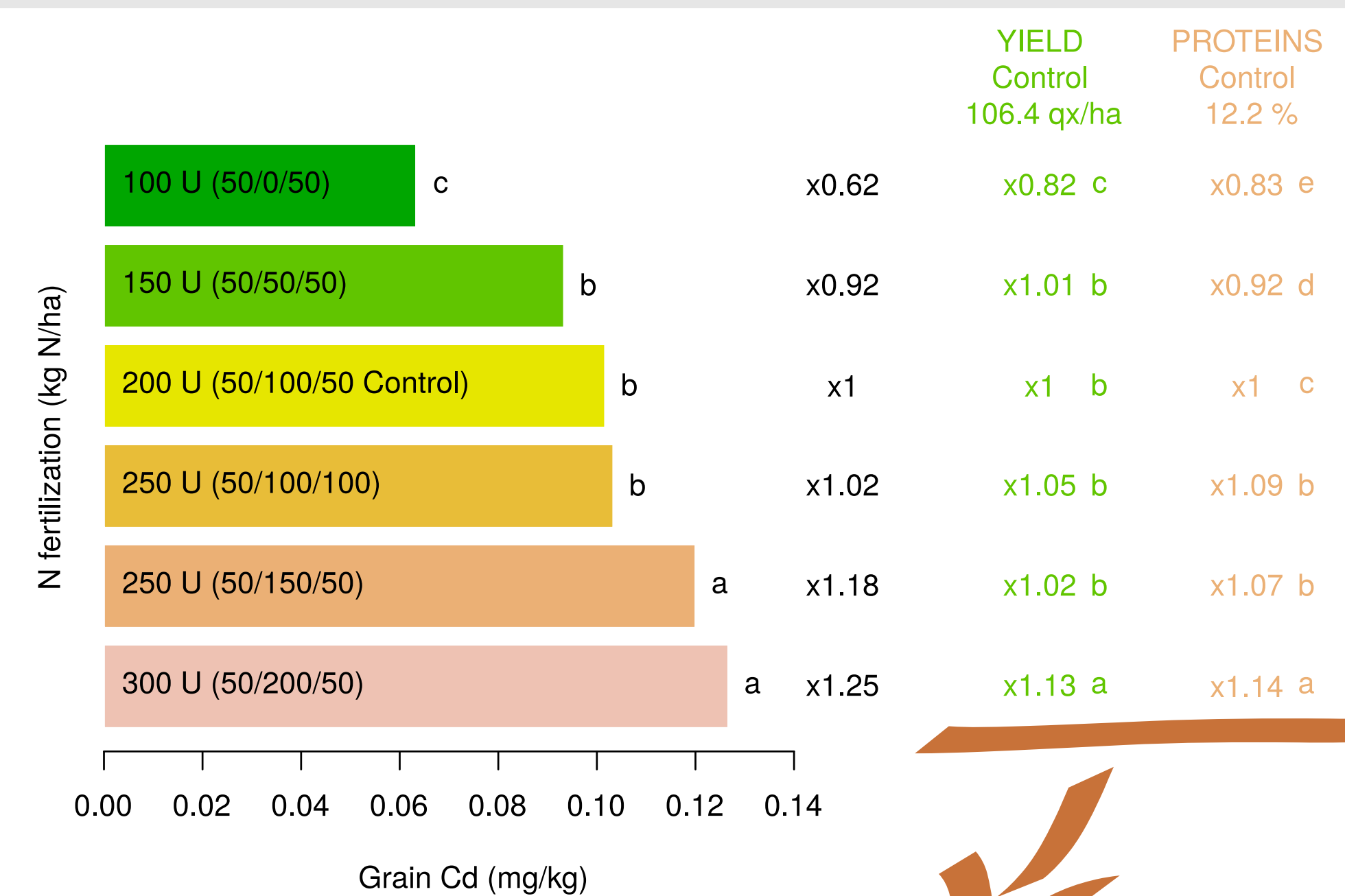
Cd in durum wheat grain : Phytoavailability of Cd in soil > cultivar differences



Field factorial trials comparing cultivars for different soils

Contrary to Canada, in France, cultivars are not yet selected for the low Cd accumulation allele (Zimmerl et al., 2014)

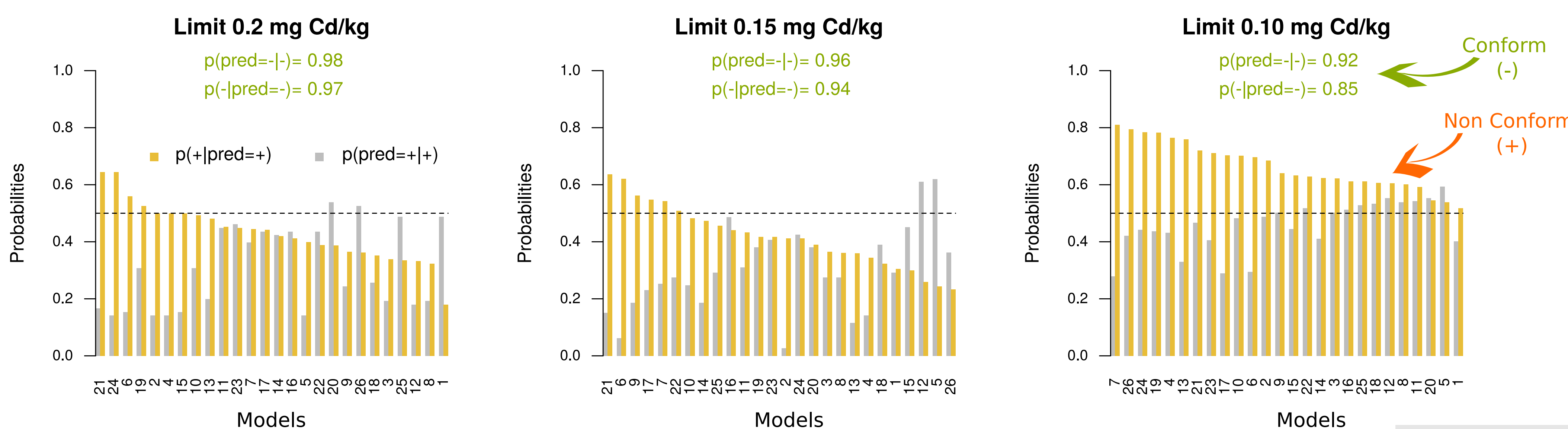
N fertilization increases Cd in durum wheat grain Splitting N dose can help limiting contamination



NH₄NO₃ fertilization increased more importantly grain Cd than yield and protein content

Increase proteins but not Cd in grains = Split N quantity NH₄⁺ assumed to desorb Cd and/or acidify soil solution

Risk assessment for the contamination of durum wheat grain by Cd



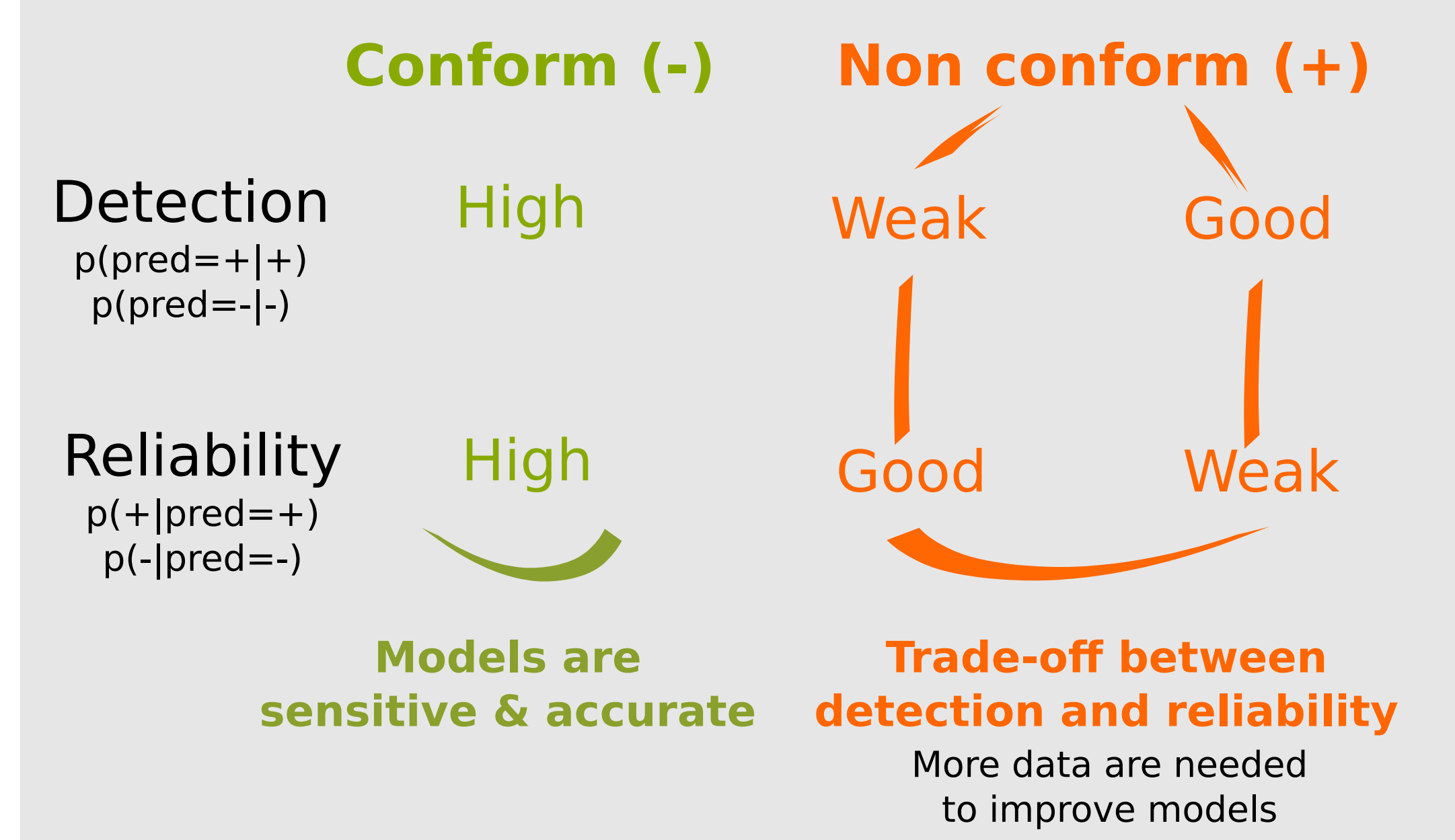
Logistic models

Probability (grain Cd > limit) = f(Cdtot : total soil Cd, pH : soil pH, Corg : soil organic carbon, Calc : soil calcareous, Clay : soil clay, Silk_C, Silk_F : coarse & fine silk)
Field data : n=408
(2008-2016, French production of durum wheat)

Model performances for field applications

The models predict correctly more than **91%** of the cases

Which model(s) ?



- 1 Cdtot
- 2 Cdtot + pHeau
- 3 Cdtot + pHeau + Clay
- 4 Cdtot + pHeau + Silt_F
- 5 Cdtot + pHeau + Silt_C
- 6 Cdtot + pHeau + Corg
- 7 Cdtot + pHeau + Calc
- 8 Cdtot + pHeau + Clay + Silt_F
- 9 Cdtot + pHeau + Clay + Silt_C
- 10 Cdtot + pHeau + Clay + Corg
- 11 Cdtot + pHeau + Clay + Calc
- 12 Cdtot + pHeau + Silt_F + Silt_C
- 13 Cdtot + pHeau + Silt_F + Corg
- 14 Cdtot + pHeau + Silt_F + Calc
- 15 Cdtot + pHeau + Silt_C + Corg
- 16 Cdtot + pHeau + Silt_C + Calc
- 17 Cdtot + pHeau + Corg + Calc
- 18 Cdtot + pHeau + Clay + Silt_F + Silt_C
- 19 Cdtot + pHeau + Clay + Silt_F + Corg
- 20 Cdtot + pHeau + Clay + Silt_F + Calc
- 21 Cdtot + pHeau + Clay + Silt_C + Corg
- 22 Cdtot + pHeau + Clay + Silt_C + Calc
- 23 Cdtot + pHeau + Clay + Corg + Calc
- 24 Cdtot + pHeau + Clay + Silt_F + Silt_C + Corg
- 25 Cdtot + pHeau + Clay + Silt_F + Silt_C + Calc
- 26 Cdtot + pHeau + Clay + Silt_F + Silt_C + Corg + Calc

Increase grain Cd : Cdtot, Clay and Silk (buffer power)
Decrease grain Cd : pH (solubility, speciation), Corg (sorption), Calc (sorption, precipitation)