



# Variability in grain cadmium concentration among durum wheat cultivars: impact of aboveground biomass partitioning

Bofang Yan, Fanny Perrier, Oleg S. Pokrovsky, Christophe Nguyen, Jean-Yves Cornu

## ► To cite this version:

Bofang Yan, Fanny Perrier, Oleg S. Pokrovsky, Christophe Nguyen, Jean-Yves Cornu. Variability in grain cadmium concentration among durum wheat cultivars: impact of aboveground biomass partitioning. 18. International Conference on Heavy Metals in the Environment, Sep 2016, Ghent, Belgium. 2016, 10.13140/RG.2.2.30998.55368 . hal-02797006

HAL Id: hal-02797006

<https://hal.inrae.fr/hal-02797006>

Submitted on 5 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Variability in Grain Cadmium Concentration among Durum Wheat Cultivars:



## Impact of Aboveground Biomass Partitioning

Bofang Yan<sup>1</sup>, F Perrier<sup>1</sup>, OS Pokrovsky<sup>2</sup>, C Nguyen<sup>1</sup> and JY Cornu<sup>1</sup>

<sup>1</sup>ISPA, INRA, Bordeaux Sciences Agro, Villenave d'Ornon, France

<sup>2</sup>GET, CNRS, Université de Toulouse, Toulouse, France

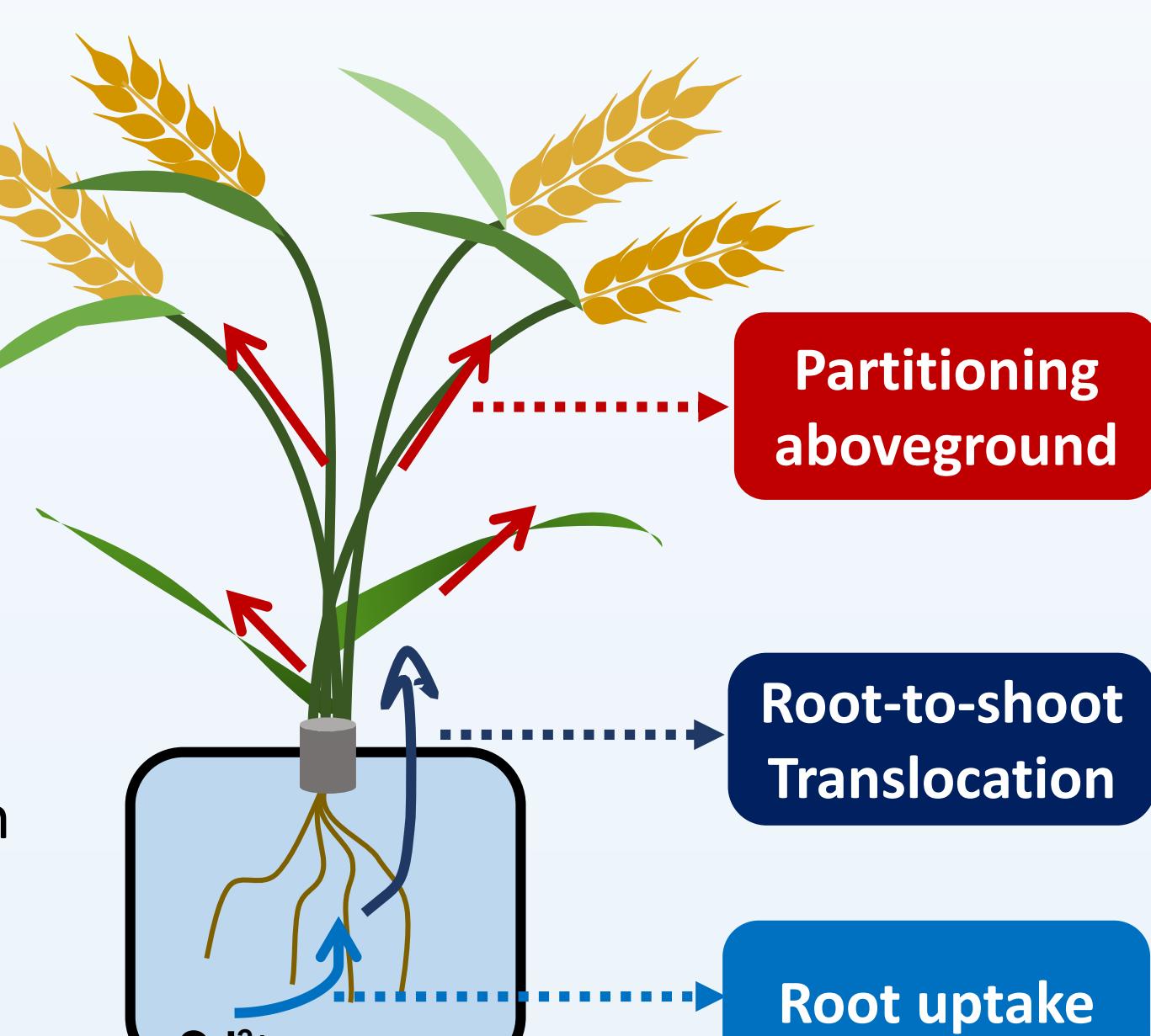


jycornu@bordeaux.inra.fr

### BACKGROUND

Cd pollution in agricultural soil is a common challenge around the world. Cereals are a major component of the human diet. The dietary intake of Cd contaminated cereals is toxic to humans. This problem is particularly important in durum wheat (*Triticum turgidum* L. subsp. *durum*) since this species accumulates more Cd than other commonly grown cereals.

Using low-Cd accumulating cultivars is one approach to minimize the Cd load in durum wheat grains. This option first needs to evaluate to what extent the concentration of Cd in the grain varies among durum wheat cultivars and to understand the main processes responsible for this variation.

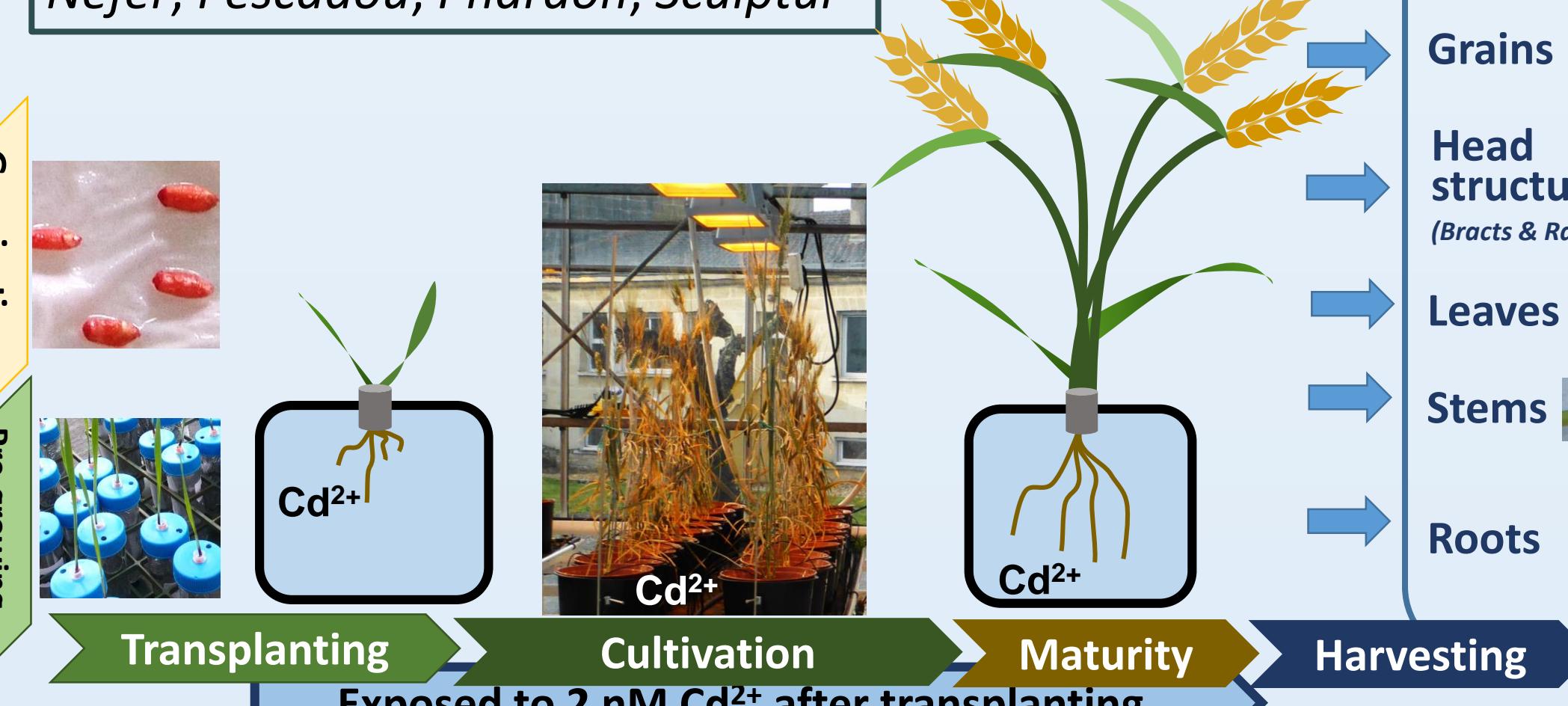


### MATERIALS

- Cultivar: eight French durum wheat cultivars, no *Cdu1* allele;
- Plants were trained to develop 4 tillers from the start of elongation.
- Hydroponics: modified Hoagland's nutrient solution at pH 6.0, refreshed automatically;
- Cd<sup>2+</sup> was supplied after transplanting at low dose:** non-toxic, fixed at 2 nM (to reproduce the level of exposure to Cd found in low to moderately contaminated agricultural soils [1]);

#### 8 French Cultivars (×5 repetitions) differing in their aboveground biomass partitioning

Clovis, Dakter, Isildur, Miradoux, Nefer, Pescadou, Pharaon, Sculptur



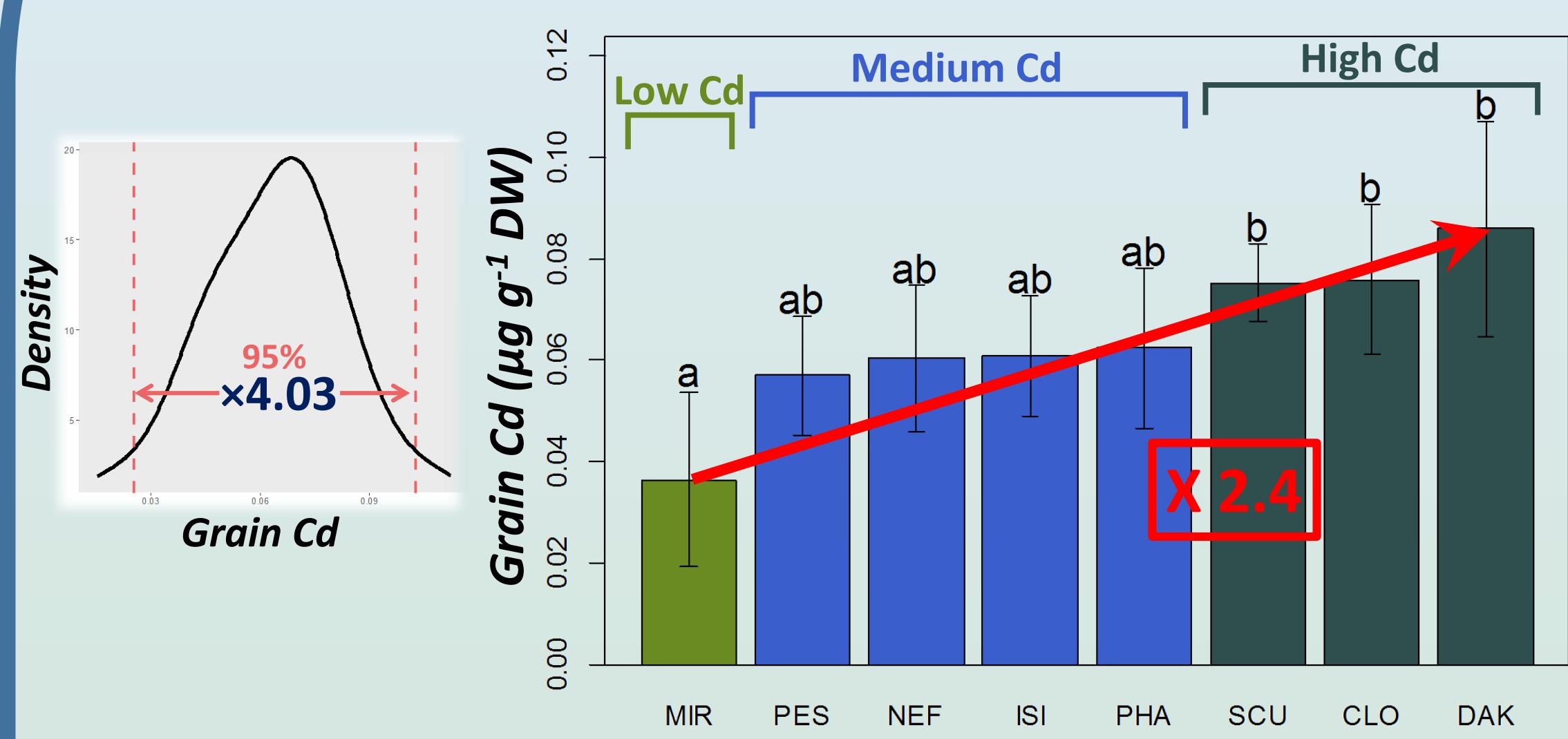
$$\text{Grain Cd} = \alpha \times \frac{QCd_{tot} \times (1 - RSF) \times \text{Leaves DW}^{-\beta}}{(\text{Grain DW})^{(1-\beta)}}$$

$$GAF = \alpha \times \left( \frac{\text{Leaves DW}}{\text{Grain DW}} \right)^{-\beta}$$

The concentration of Cd in the grain (Grain Cd,  $\mu\text{g g}^{-1}$ ) was modeled as a function of the grain biomass (Grain DW, g), the amount of Cd taken up by the roots (QCd<sub>tot</sub>,  $\mu\text{g}$ ), a root sequestration factor (RSF) and a grain allocation factor (GAF) itself modeled as a function of the ratio between the biomass of leaves and that of grains.

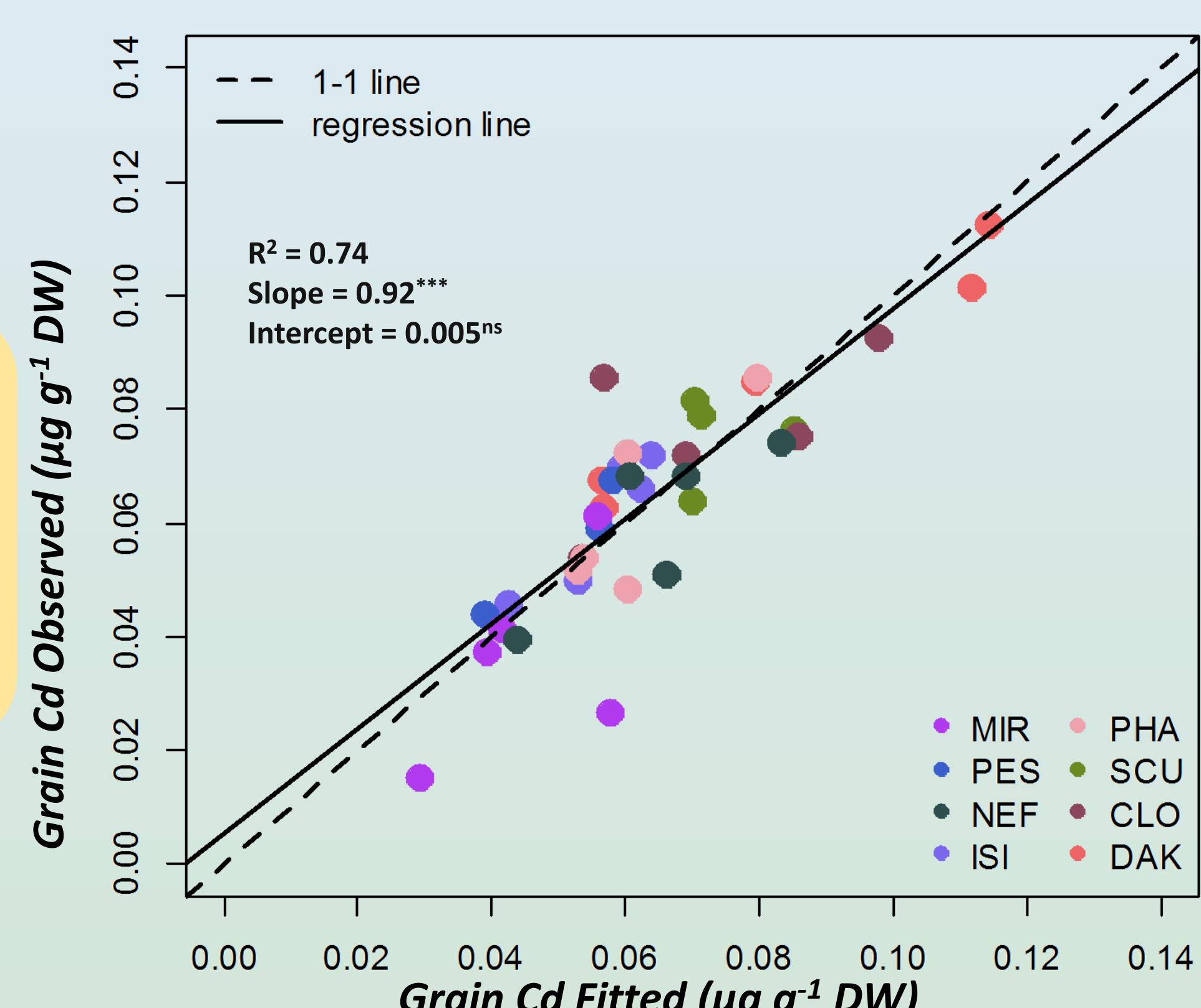
### RESULTS

#### Grain Cd level



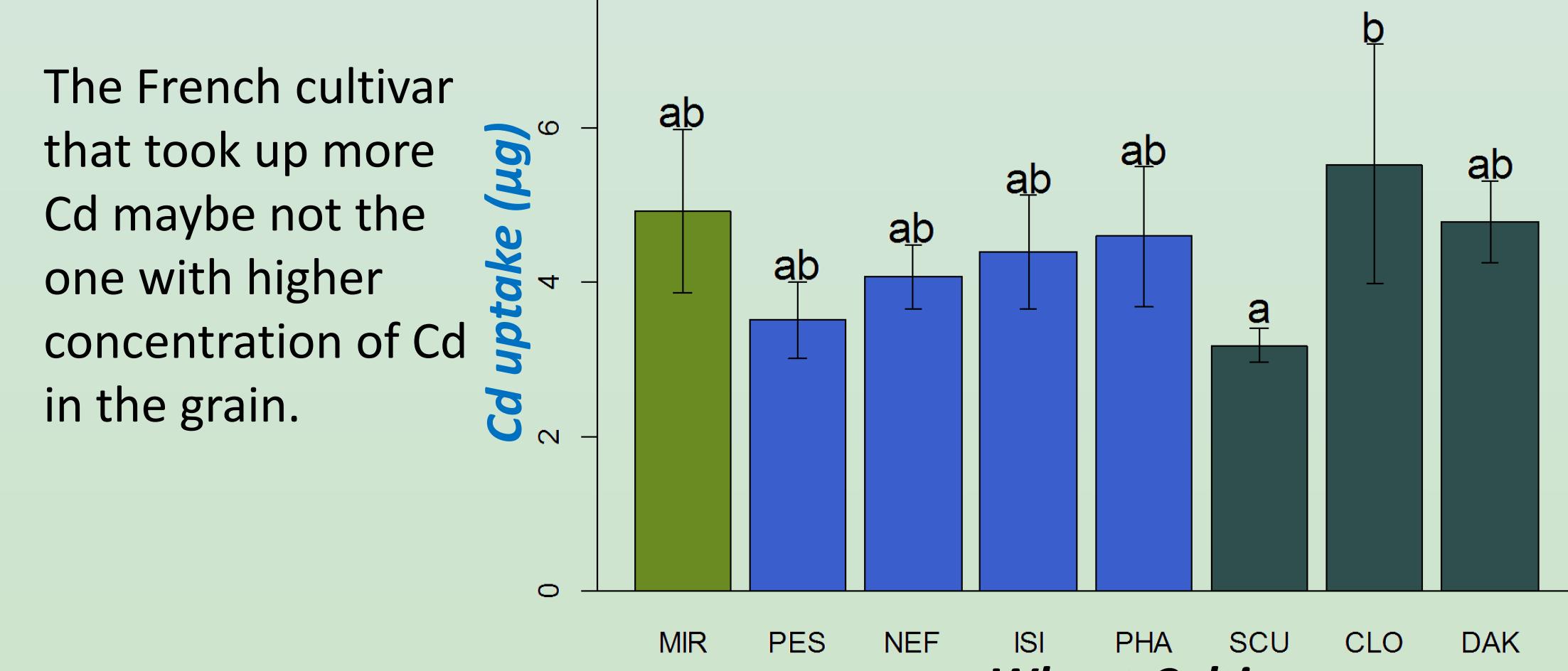
Grain Cd concentration ranged from 0.03 to 0.08  $\mu\text{g g}^{-1}$  (2.4-fold) among cultivars and was thus in the same range as that measured in field trials.

#### Modelling to Explain the Variability in Grain Cd

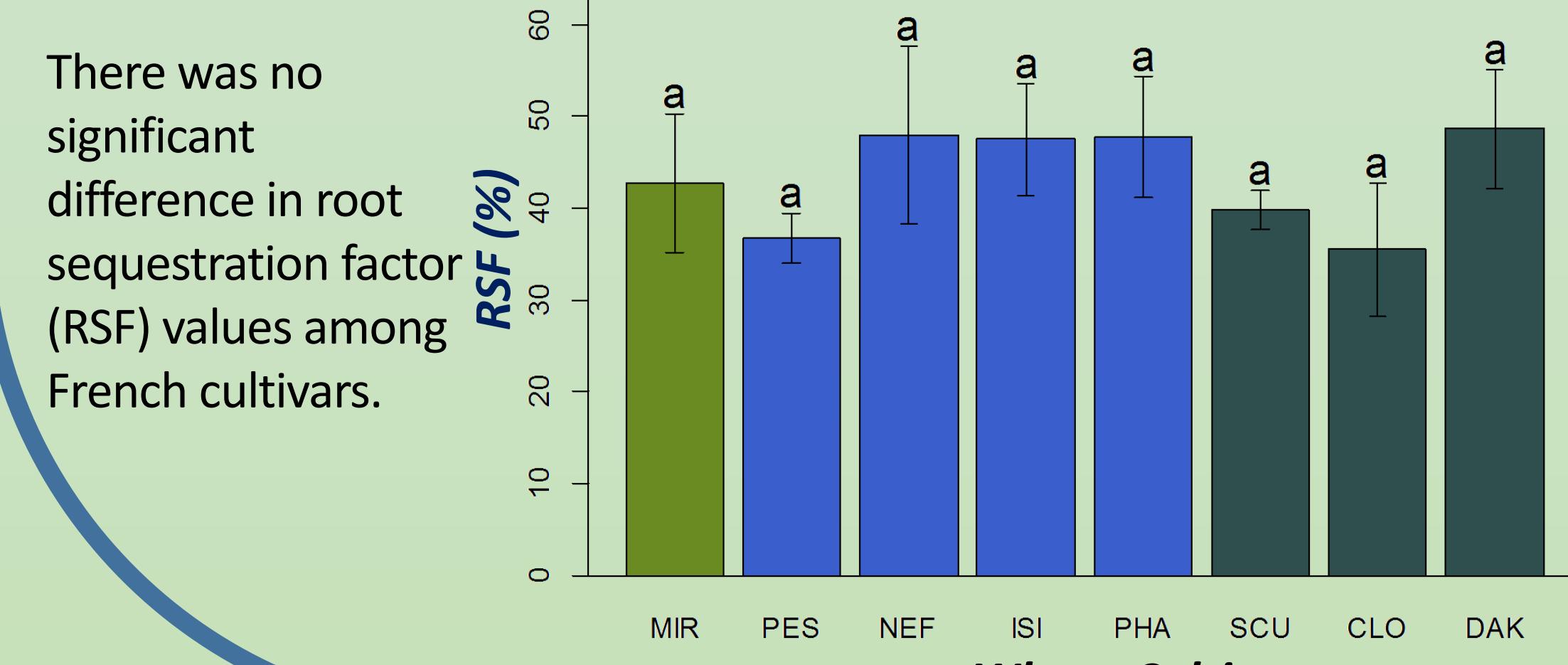


The model shown in the equation above provides a good prediction of the intraspecific variation in grain Cd.

#### Uptake and Root sequestration of Cd



The 2.4-fold variation in grain Cd within French lines was NOT explained either by a difference in uptake or by a difference in the root sequestration of Cd.



There was no significant difference in root sequestration factor (RSF) values among French cultivars.

### CONCLUSIONS

- The grain Cd concentration varied 2.4-fold among French durum wheat cultivars.
- The partitioning of aboveground biomass may influence the concentration of Cd in grain.
- Breeding programs tending to reduce the stem height may promote the accumulation of Cd in durum wheat grains.

