School of Agriculture, Policy and Development

Quantifying the genetic variation in Bambara groundnut elemental composition

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Swinburn et al., (2019) The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report. The Lancet, 393, 791-846

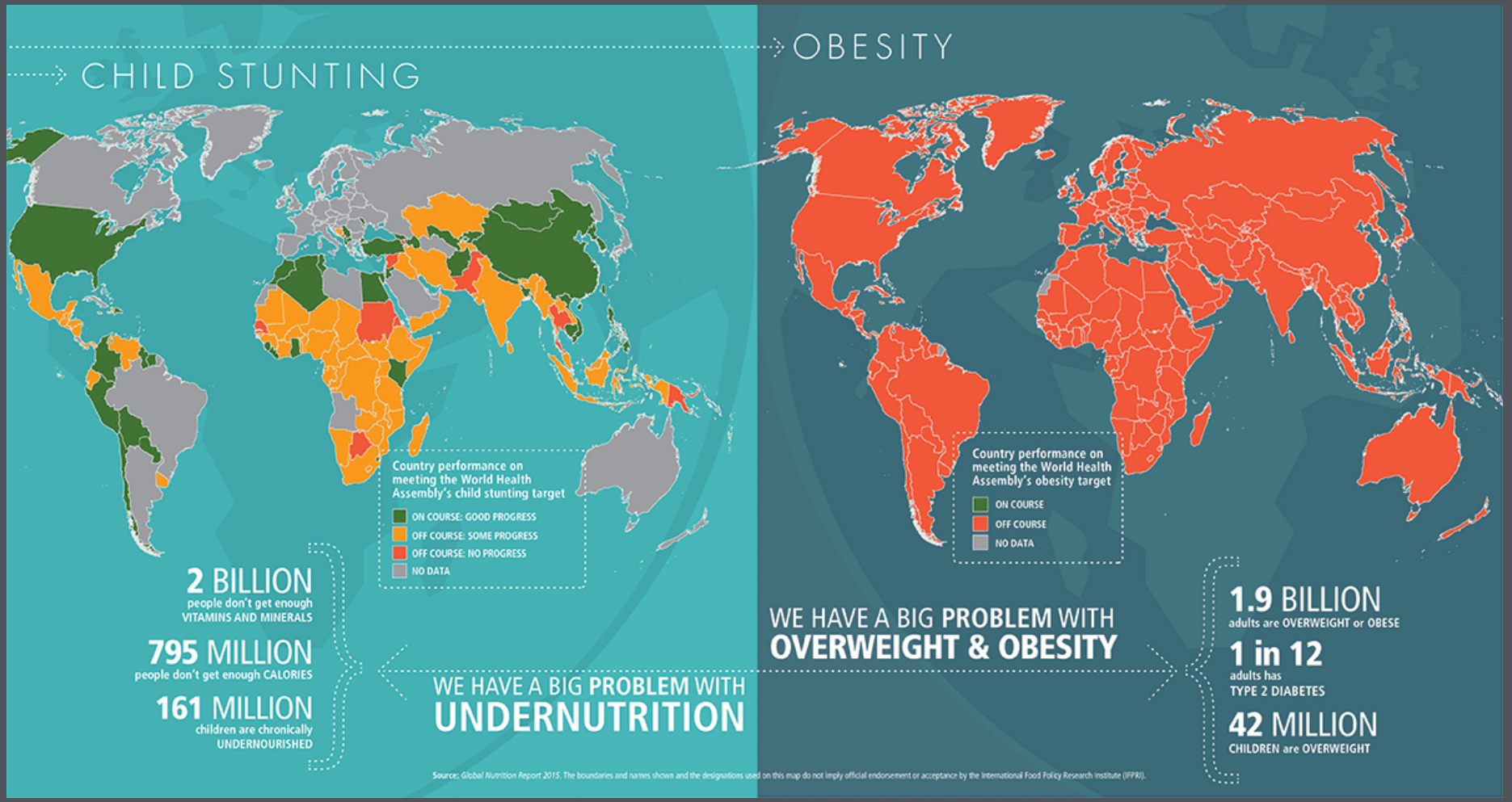
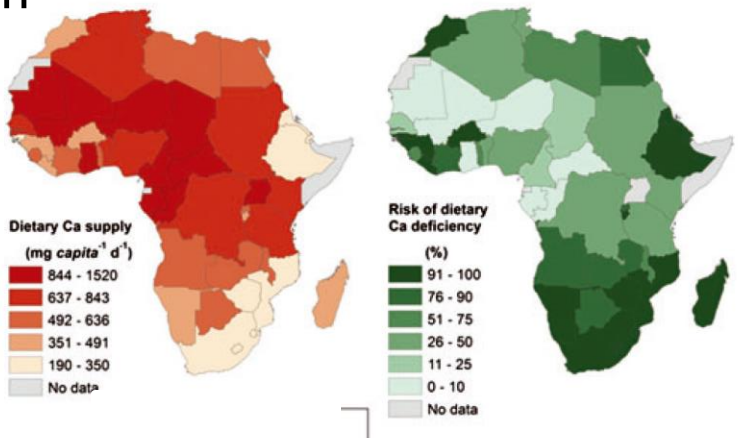


Image Source: Global Nutrition Report 2015, https://globalnutritionreport.org/

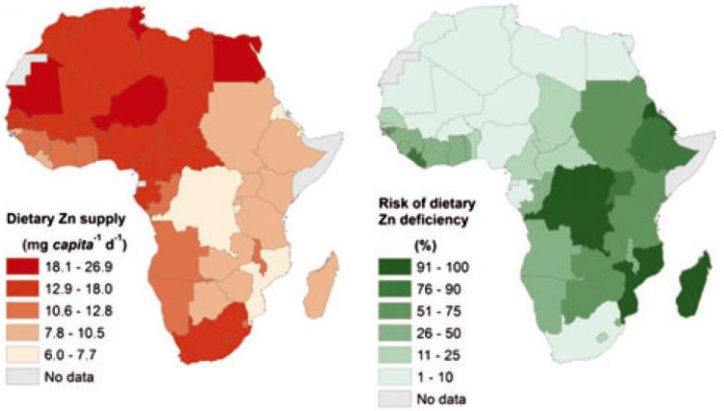
Significant disparities in human nutrition exist in our global food system

Dietary nutrient supply and deficiency risk in Africa

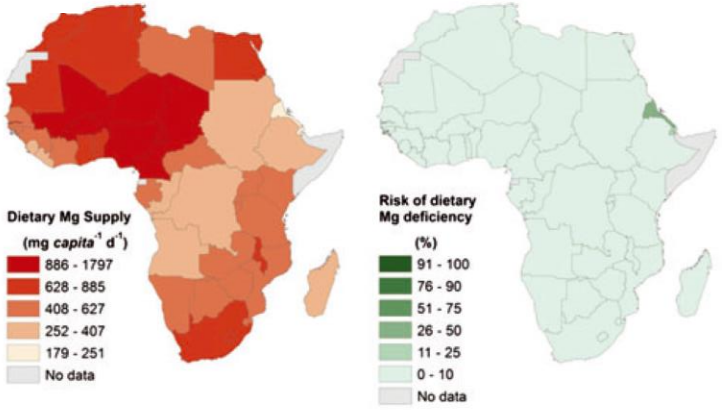
Calcium



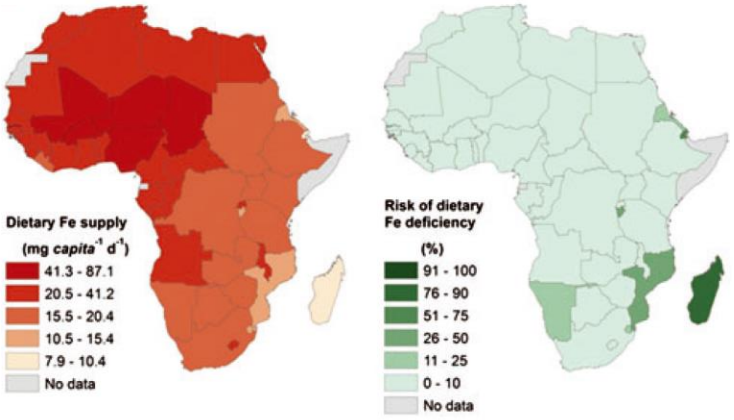
Zinc



Magnesium



Iron



Joy et al., (2014) Dietary mineral supplies in Africa. *Physiol Plantarum* 151: 208-229. https://doi.org/10.1111/ppl.12144

Biofortification of food crops

Increasing the *bioavailable* nutritional content, of the edible portion of crops through:

breeding (*genetic biofortification*)

agronomy (*agronomic biofortification*)

Harvest Zinc
Exploring Fertilizer Use to Increase Zinc in Cereals

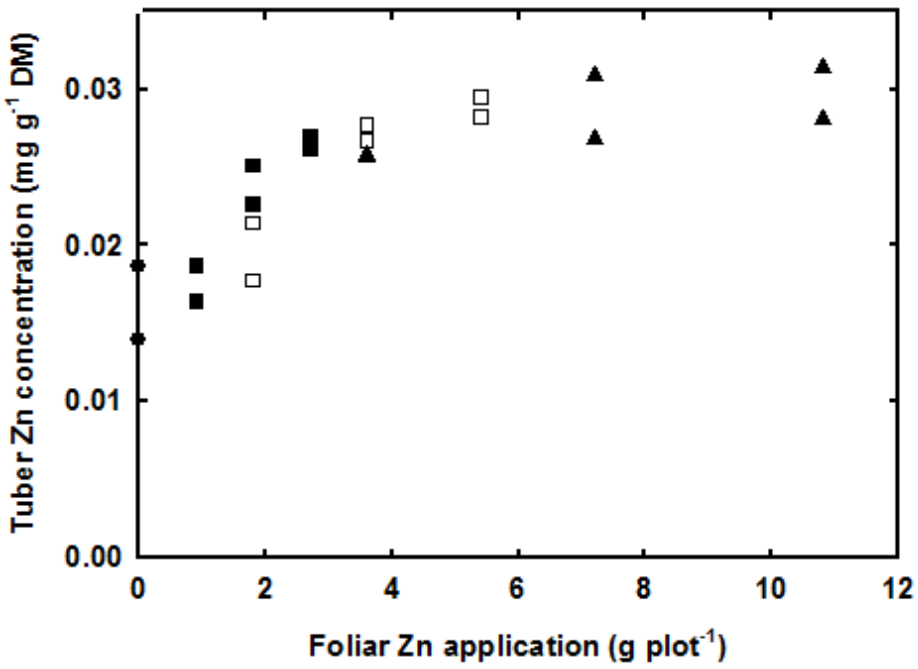
GeNutrition

HarvestPlus
Breeding Crops for Better Nutrition

Biofortification of food crops with fertiliser

Foliar Zn fertiliser applications
'Maris Piper' potatoes.

- ● No foliar Zn application
- ■ 0.9 g Zn plot^{-1} applied 1, 2, 3 times
- □ 1.8 g Zn plot^{-1} applied 1, 2, 3 times
- ▲ 3.6 g Zn plot^{-1} applied 1, 2, 3 times



White et al (2012) *J Hort Sci Biotech*, 87, 123-129

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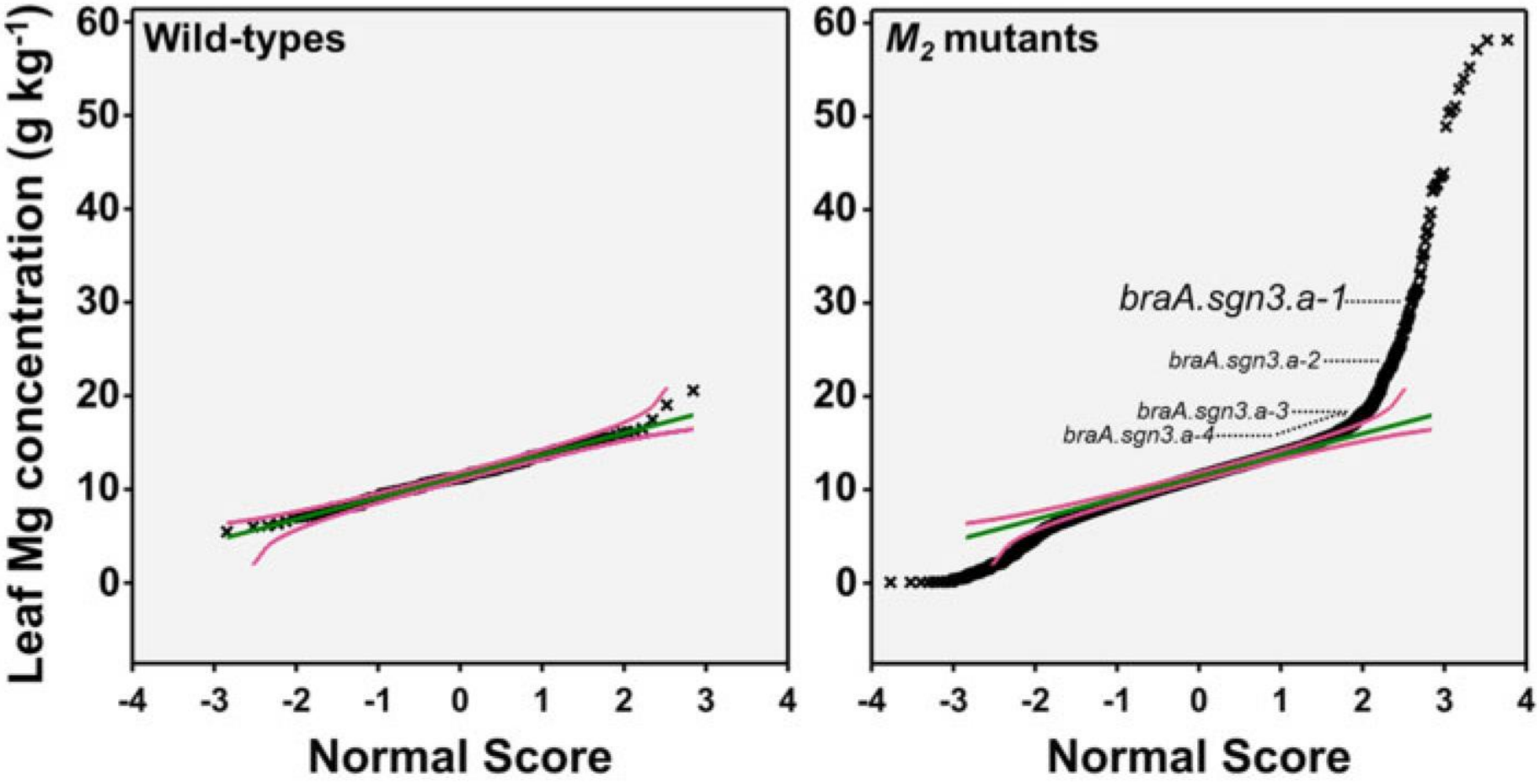
Biofortification of food crops through breeding

Screening a mutant Brassica population identified lines with significantly higher (and lower) leaf Mg concentrations.



Alcock et al., 2021, Plant Physiology, 186, 1616–1631. doi:10.1093/plphys/kiab150

Elemental profile of the high Mg lines

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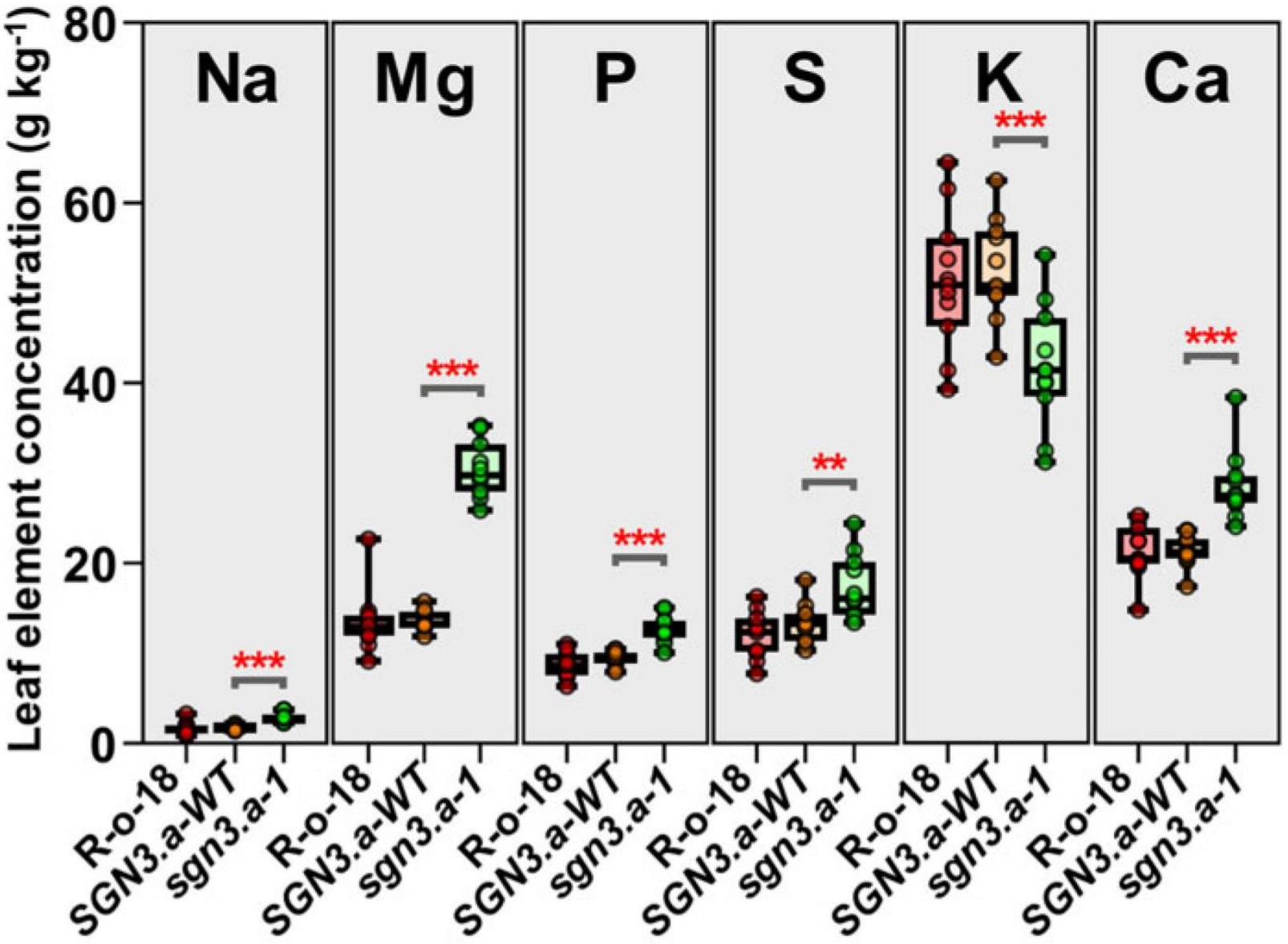

Alcock et al., 2021, Plant Physiology, 186, 1616–1631. doi:10.1093/plphys/kiab150

Candidate SNP identified in the kinase domain of Shengen3

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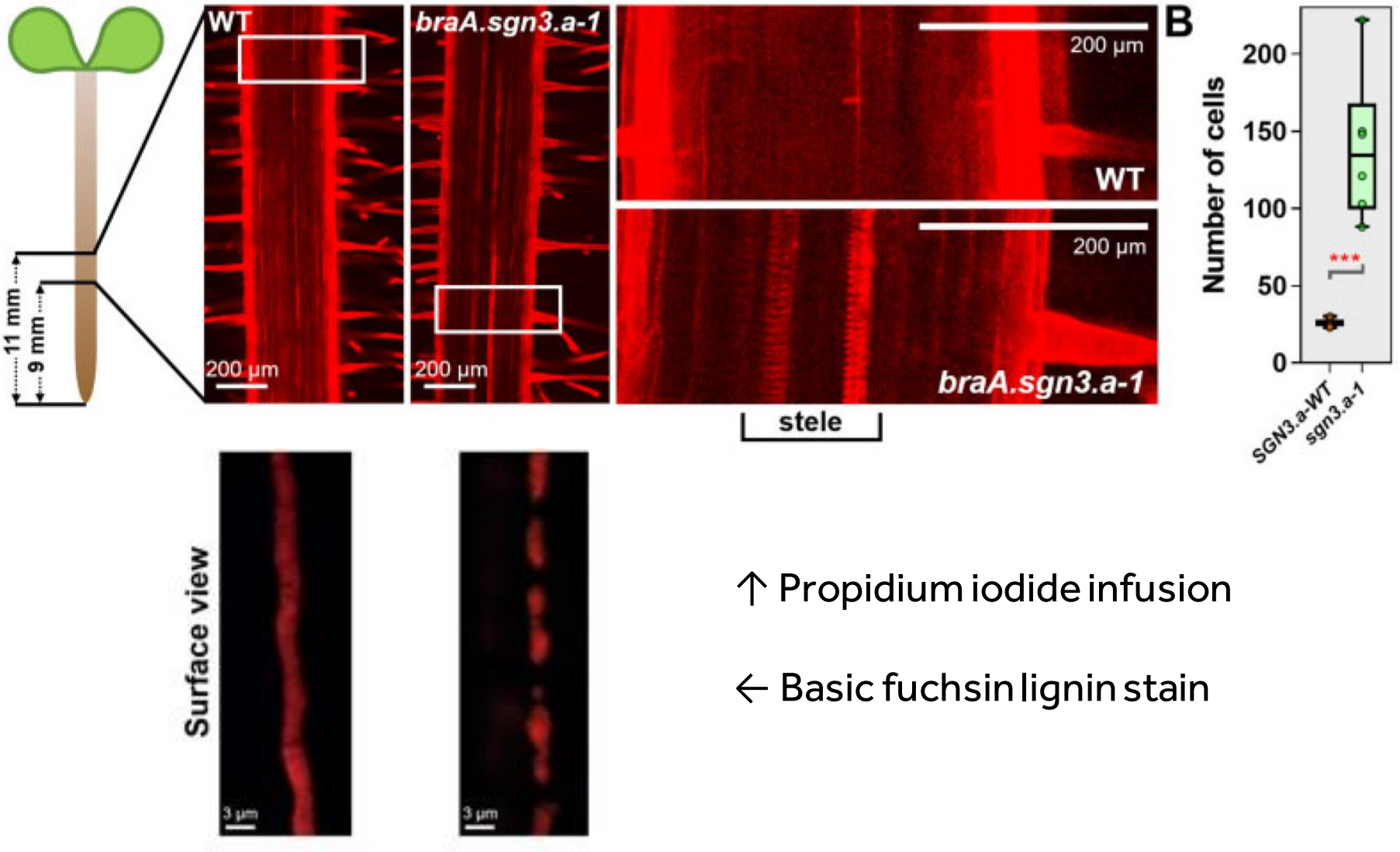


↑ Propidium iodide infusion

← Basic fuchsin lignin stain

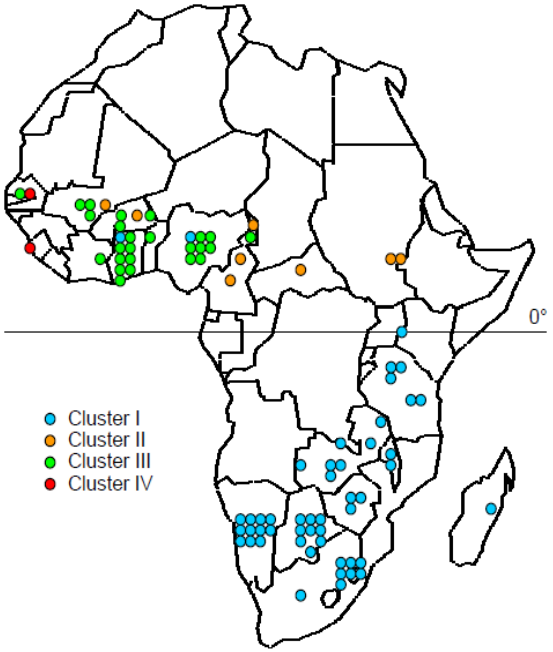
Alcock et al., 2021, Plant Physiology, 186, 1616–1631. doi:10.1093/plphys/kiab150

Determining the genetic potential of Bambara groundnut for delivering improved nutritional security in Africa

Aim - To quantify the genetic variation in the elemental composition and anti-nutritional factors present in current Bambara germplasm.

Objectives –

- Grow 150 lines of diverse Bambara germplasm* at NDU.
- Measure elemental composition in the seeds of Bambara.
- Measure anti-nutritional factors in the seeds of Bambara.
- Shortlist of genotypes with high nutritional value for breeding.



*Subset of diversity panel representing accessions from 25 countries maintained at the International Institute of Tropical Agriculture (IITA)-Ibadan, Nigeria.

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Population level variation in elemental composition

Element	Units	Mean	SEM	Min	Max	Fold-change
Calcium	g kg^{-1}	0.45	0.005	0.26	1.04	**4.1**
Iron	mg kg^{-1}	29.17	0.275	16.45	53.90	**3.3**
Zinc	mg kg^{-1}	26.95	0.237	17.65	54.46	**3.1**
Magnesium	g kg^{-1}	1.91	0.011	1.27	3.07	**2.4**
Manganese	mg kg^{-1}	20.08	0.248	8.67	46.79	**5.4**
Phosphorus	g kg^{-1}	4.36	0.037	2.46	6.83	**2.8**
Sulphur	g kg^{-1}	2.72	0.027	1.64	4.73	**2.9**
Potassium	g kg^{-1}	15.44	0.086	10.94	24.96	**2.3**

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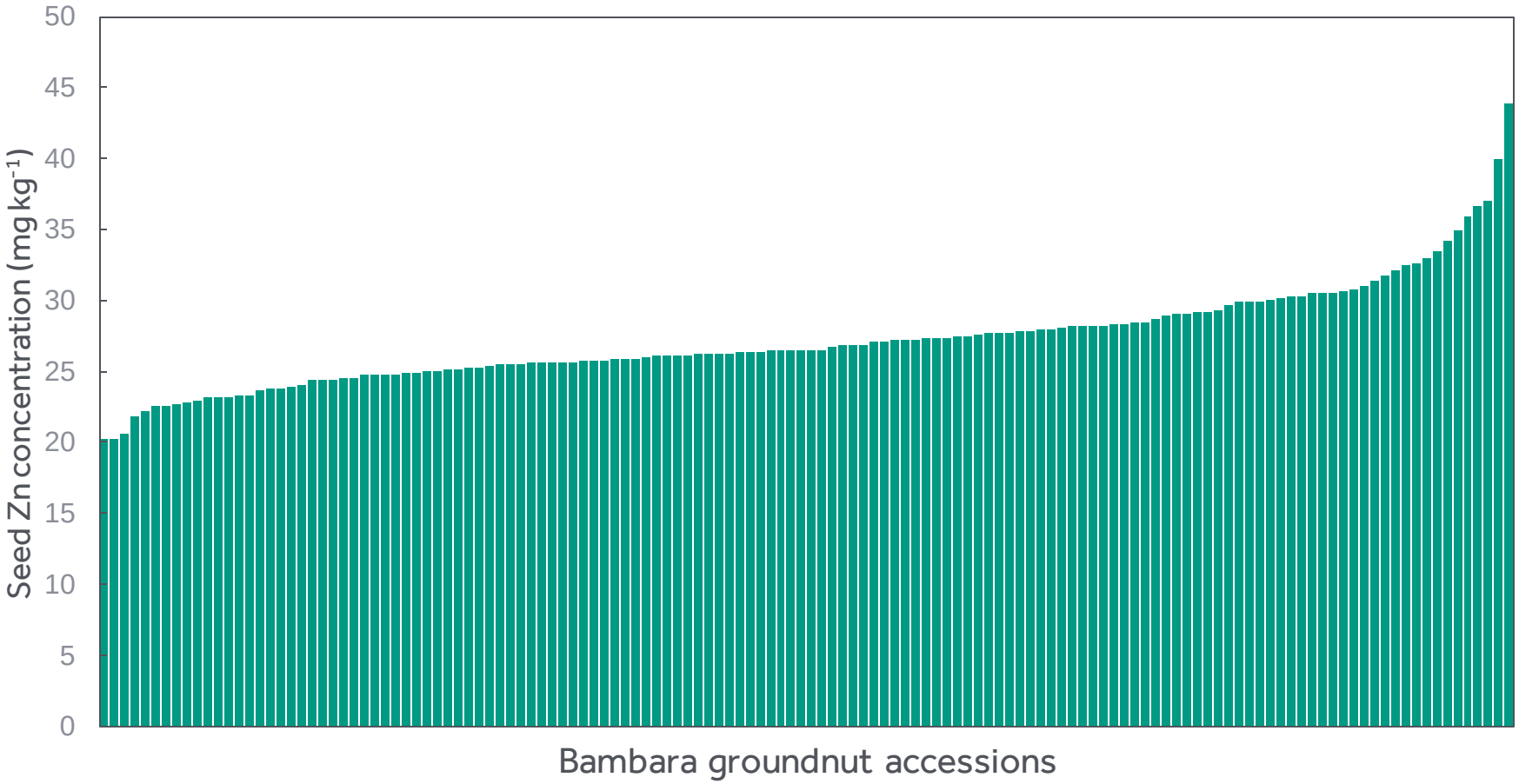

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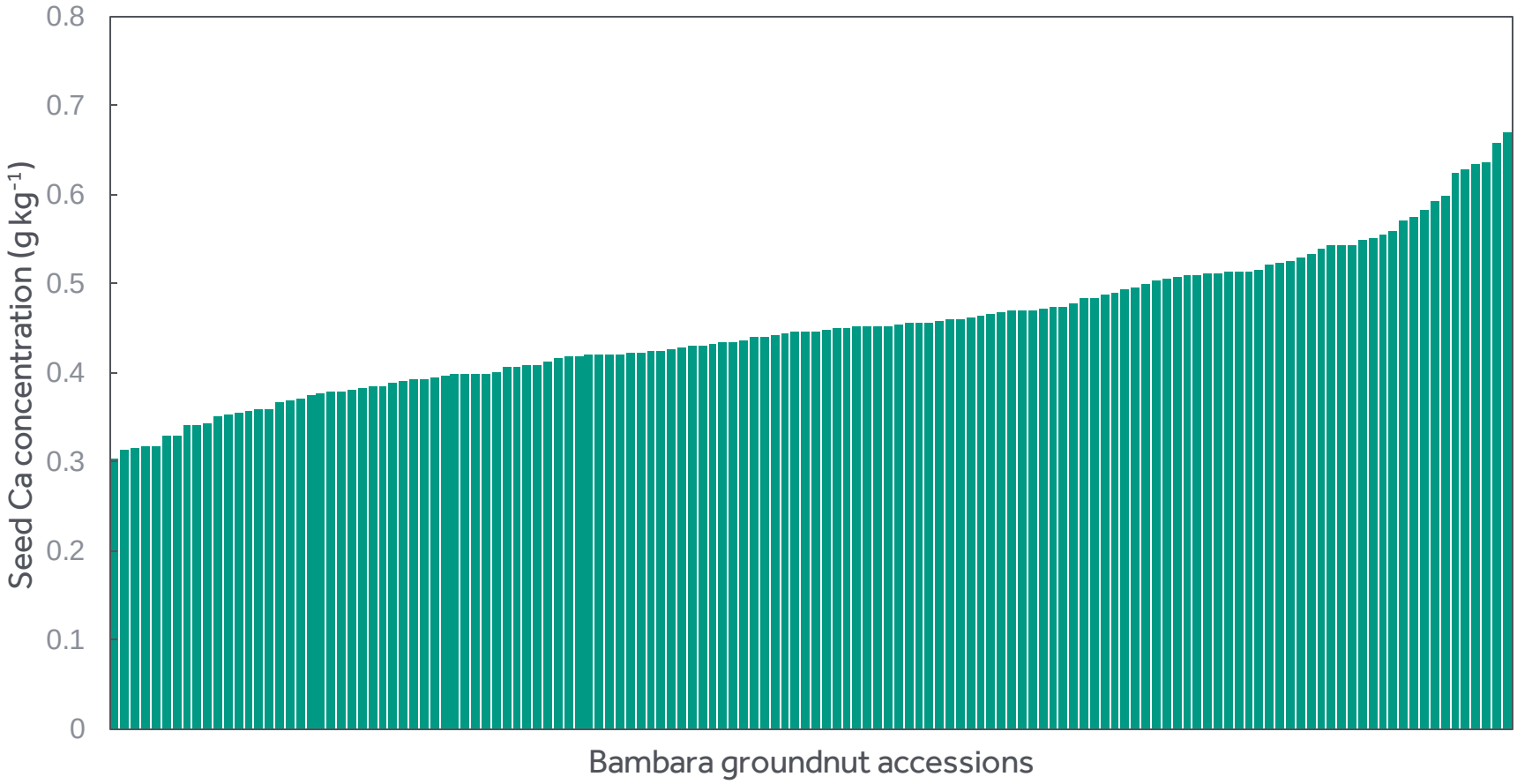

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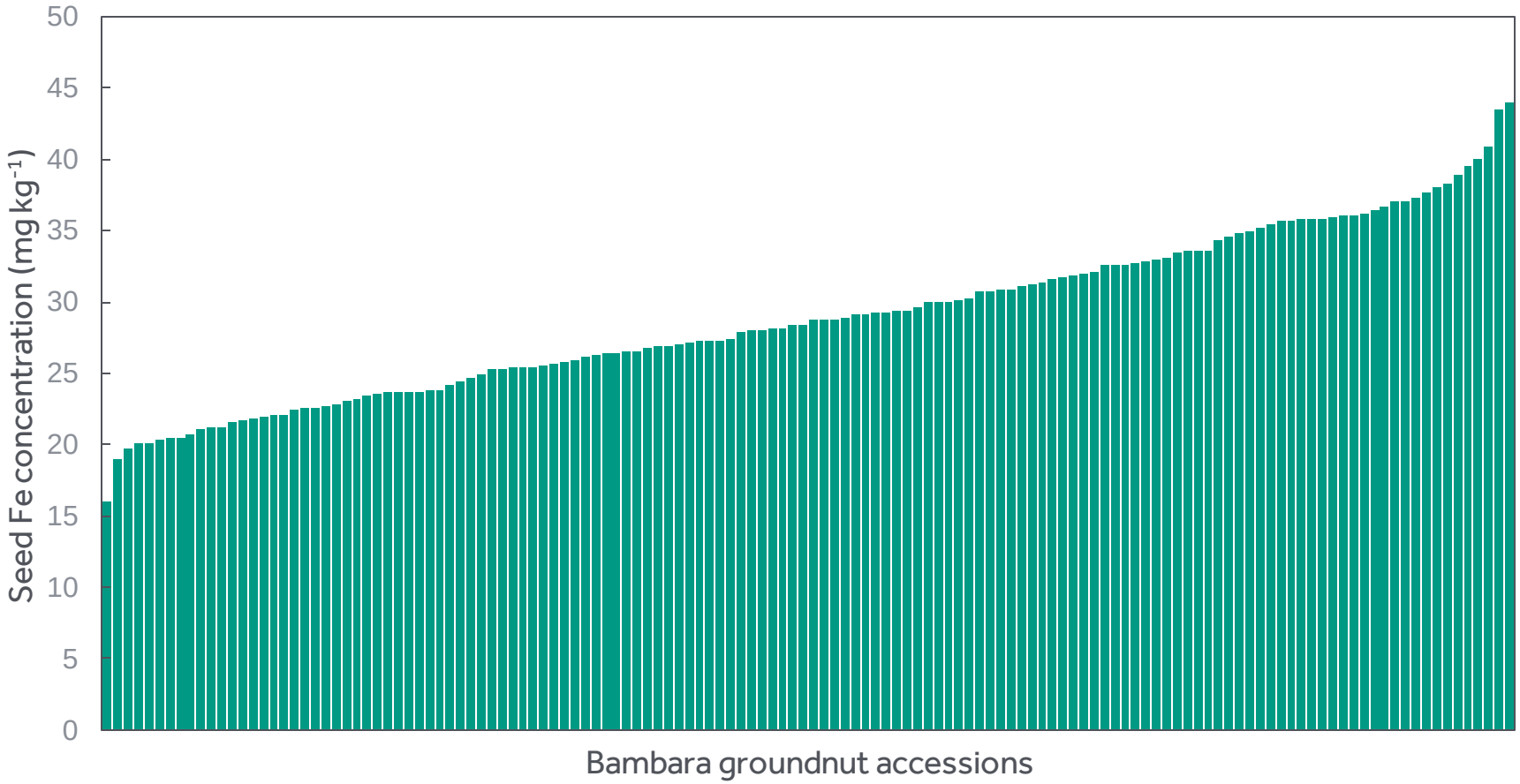

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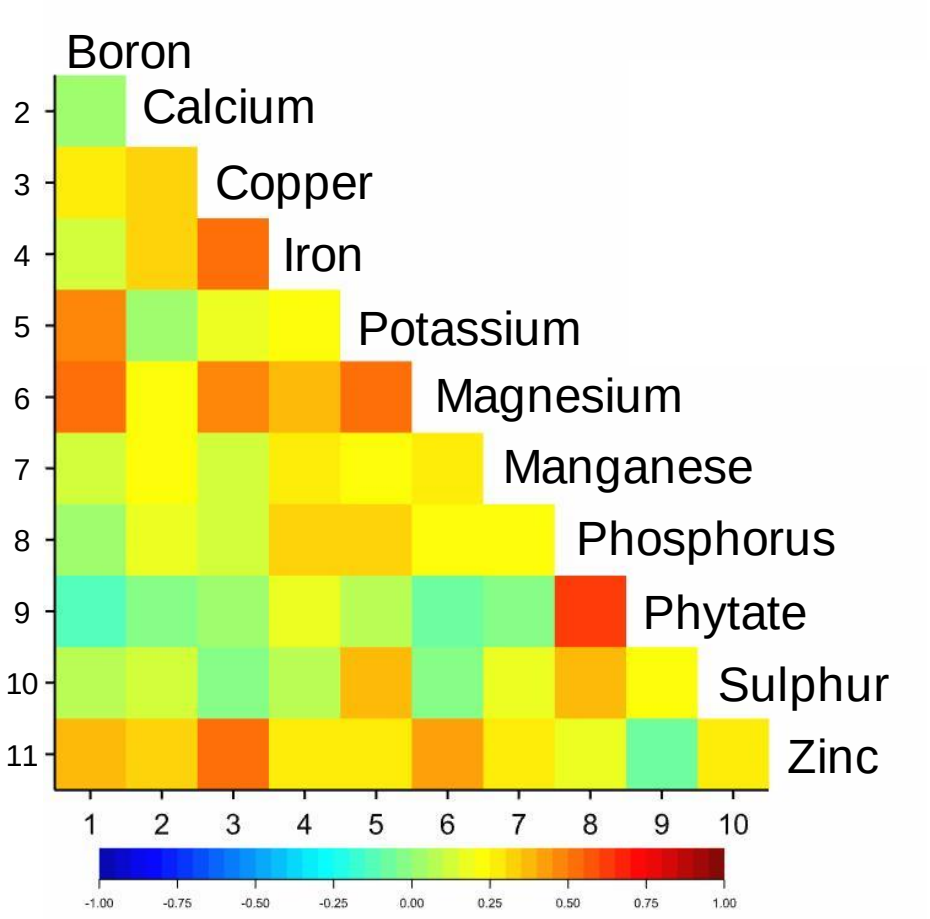

Thank you!

UKRI Innovate UK

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