

Towards a sustainable supply of underutilized cereals and beans to improve micronutrient supply in China

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Nutrient-dense and low-input underutilized cereals and beans (UCBs) are promoted as promising crops that can combat micronutrient deficiency and mitigate environmental externalities. But, they have lower yields, smaller areas than major staple crops (e.g., rice, wheat), and are often neglected in the current food system. It is unclear how to integrate the UCB crops into the current food supply system to fully realize their potential. Here, we explore replacing and reallocating cultivated areas of major crops to these UCB crops in China. We aim to increase micronutrient supply and decrease environmental impact while simultaneously maintaining dietary energy supply. We constructed a linear programming model considering elements influencing indicators related to nutrient supply and environmental impacts of six UCB crops, rice, and wheat. When individually optimizing each indicator while ensuring others are not worse than the baseline, replacing rice and wheat with UCB crops increases the supply of iron, dietary fiber (by 12%-15%), calcium, thiamin, and riboflavin (8%-10%), zinc and protein (5%), and reduces GHG emissions (<13%) and total water use (<7%), while supporting healthier dietary options. Further improvements in calcium supply, GHG emissions, and total water use come at the cost of a reduction in dietary energy supply. The benefits depend on replacing 17% and 4% of areas currently grown to respectively rice and wheat with UCB crops. Achieving this shift of crop areas requires collaboration among multiple stakeholders, along with support from data sets, policies, and technologies and a shift toward healthier diets.