# The role of plant science in food security

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"Increased demand for food, driven by population growth and dietary change, along with the degradation of natural resources and climate change, render the challenge of achieving food security for all substantial."

This is how Dr. John S. I. Ingram from Environmental Change Institute, University of Oxford, UK, and Professor Dr. John R. Porter from Copenhagen Plant Science Centre, Department of Plant and Environmental Sciences, University of Copenhagen, DK, start their article in *Nature Plants*.

They also point out that climate change is a particular concern for food

security.

"Rising temperatures are reducing yields; an effect which is projected to intensify over the coming decades. And increases in the frequency and intensity of extreme weather events such as floods and droughts, widely anticipated in future climate scenarios, are not only expected to affect production, but also to disrupt food storage and distribution systems, and to raise food prices in national and international markets."

They therefore conclude that a business-as-usual approach to satisfying food demand for the current let alone future population is not sustainable. New concepts, tools and approaches are needed to address the broad food security agenda.

And post-production factors need to have a higher priority in the debate on food security. This was also the conclusion reached in the food security chapter of the 5th IPCC Assessment in 2014 of which John R. Porter was the main lead author and John Ingram a contributing author, the chapter having been downloaded more than 50,000 times.

"Plant science clearly has a role to play in the food security agenda on the supply side of the equation by enhancing crop nutrient content and productivity. Most progress is likely to be made if the gap between plant and crop physiology is more strongly bridged, and the tools and concepts available at the field level are utilized. But to be most effective this approach needs to be better integrated with the social, environmental, economic and political factors that also influence the food system," they point out.

## The role of plant science

"Plant science can help to bolster supply, by raising the availability and nutritional content of crops, and increasing the efficiency of 'post-farm-

gate' practices," they write and continue to underline the clear need to increase food production per unit land area.

To this end, cropping systems must be designed to use water, nutrients and sunlight more efficiently. Efficiency gains made thus far are the result of crop breeding and better management. However, the actual production of food occurs in the field and not the laboratory and this must be recognized by plant scientists.

The researchers illustrate how plant science can contribute with a line of examples. First of all further improvements in water-use efficiency can be made by better matching crop water demand to supply, and by reducing water loss. And improving resistance to the major pests and diseases, such as cereal rusts, late-blight of potatoes, corn-borers in maize, and bacterial and fungal diseases of rice, is key to raising production per unit land.

Next the global prevalence of nutrient deficiency necessitates an increase in the nutrient content of crops, especially the essential protein, amino acid and micronutrient content. Molecular approaches can help in this respect, as illustrated by work to enhance vitamin A content in rice and protein quality in maize.

And finally could crops for example also be modified to increase the efficiency of post-farm-gate food chain activities, such as food processing and storage. For instance, the gluten content of wheat could be modified to reduce staling in bread, and thereby food waste.

And fruits, vegetables and grains could be modified to retain more beneficial compounds, such as antioxidants, when undergoing processing operations such as drying, dehydration and canning; staple crops such as cassava, maize and sweet potato have already been bred to increase retention of provitamin A carotenoid after processing, cooking and

storage. And such modifications will be especially important given the increased risk of reduced vitamin and micronutrient concentration in crops with climate change.

**More information:** John S. I. Ingram et al. Plant science and the food security agenda, *Nature Plants* (2015). DOI: 10.1038/nplants.2015.173

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