Foreword

It is generally acknowledged that malnutrition imposes a heavy burden on society, with far reaching consequences for the well-being, health and productivity of the individuals at-risk. This is true for overweight and obesity in industrialised countries and, increasingly, in emerging economies, and it is true for undernutrition in low income countries. However, there is a particular form of undernutrition, known as micronutrient malnutrition, that largely goes unnoticed by the general public, by many decision makers and even by the affected individuals themselves, because its – often severe – health consequences are not attributed to poor nutrition. This is why this form of malnutrition is also called "hidden hunger". For the same reason as micronutrient malnutrition, the search for potential remedies and their respective assessments have for a long time attracted relatively little attention among academics outside the more obvious fields of nutrition and public health. Yet, more recently a new, agriculture-based approach to help control micronutrient malnutrition has emerged: "biofortification" – breeding staple food crops for higher levels of essential minerals and vitamins. Information on biofortified crops and their potential impact and cost-effectiveness is scarce. As such, biofortified crops are not yet grown at a larger scale. Nonetheless, given the novelty of the approach, thorough, policy-relevant information is needed to evaluate this proposition relative to more common micronutrient interventions to be able to design strategies to address the problem of hidden hunger effectively and efficiently. This is the more indispensable if a crop is biofortified through genetic engineering, a technology that is often met with considerable – and emotional – resistance, irrespective of the purpose it is used for.

In this analysis Alexander Stein puts micronutrient malnutrition and biofortification into a wider context and he develops a framework for ex ante evaluation of biofortification, both regarding its potential impact on public health and its cost-effectiveness. He applies this methodology to three case studies for India, of biofortified rice and wheat that are to address deficiencies in iron, zinc and vitamin A. As such, his study is the first detailed and comprehensive assessment of several biofortified staple crops within one consistent framework. Moreover, paying particular attention to the more contentious "Golden Rice", he seeks to clarify common misconceptions about this genetically modified crop, with an attempt to rationalise the ongoing debate.

The results of this work indicate that biofortification may prove to be an effective and very efficient intervention to reduce the overall burden of micronutrient malnutrition, both for society and at the individual level. As biofortified crops follow the normal food chain, biofortification may also reach those consumers and subsistence farmers that are not regularly covered by other interventions. Therefore biofortification may become a valuable intervention to complement existing strategies. However, as Alexander Stein also points out, for biofortification to have the maximum impact, it will be necessary to achieve sufficiently high levels of minerals and vitamins in the crops, which consumers and farmers alike will have to accept and adopt at a larger scale. He therefore suggests that, for this to happen, current research and breeding efforts should continue and appropriate agricultural extension and social marketing strategies will have to be devised.

The findings of this study provide a sound and important basis for decision makers in the fields of human nutrition, public health, agricultural policy and economic development; they also point other researchers to as of yet unresolved issues and open questions, thus hopefully furthering the academic debate and generally sparking broader interest in the important topic of agricultural technology, nutrition and public health.

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