The Limits of Organic Crop Production

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The potential of organic agriculture to feed the world sustainably was a point of discussion in 2013.[1] Notwithstanding individual success stories, the question remains whether organic agriculture would be feasible and sustainable if it were practiced at a global scale.

Organic yields are between 25 and 50 percent lower than conventional yields, depending on whether the organic system has access to animal manure. The amount of animal manure available on organic farms is usually not sufficient to produce similar crop yields as in conventional systems, even when green manures such as legumes are used. When organic yields reach levels similar to those in conventional production, they usually involve very high nutrient inputs that are, to a large extent, transferred from conventional production. The rules that define organic agriculture—exclusive use of manures and untreated minerals, and avoidance of synthetic pesticides--greatly limit the potential to increase yields. The only way for organic agriculture to achieve the same level of aggregate output as conventional agriculture is to compensate for lower yields by expanding cropland.[2] However, accelerated conversion of natural ecosystems into cropland would cause significant loss of natural habitats.

Extensive organic production would also affect the type of crops that are grown and the food that is supplied to the market. For example, in Sweden organic crop rotations use a higher proportion of forage and legumes and thereby reduce the supply of cereals, potato, and oilseed rape.[3] These shifts affect human diets away from pork, poultry, and eggs and toward more red meat and dairy products.

Moreover, the demand for organic products is limited and is concentrated in North America and Europe—which account for 96 percent of global revenues in the sector—and in some rich countries in Asia, such as Japan, Singapore, South Korea, and Taiwan. Currently most consumers in poor countries are not willing to pay a premium price for organic products.[4] Organic production in developing countries in Africa, Asia, and Latin America is mainly export driven.[5] If the agroecological, infrastructure, and market conditions are favorable, organic farming can be profitable for some of these export-oriented farmers in developing countries, but it cannot feed the world at a global scale.

Combining expected population growth and projected land use reveals that low-yielding agriculture is an unrealistic option for producing sufficient food in the future. Organic agriculture is subject to severe supply-side constraints, not least because of the lack of plant-available nutrients, and cannot be a major food source for the world. Further improvement of conventional agriculture based on innovations, enhanced efficiency, and improved agronomic practices seems to be the only way to produce sufficient and affordable food for a growing world population while minimizing negative environmental impacts.[6]

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[1] See, for instance, R. Auerbach, G. Rundgren, and N. El-Hage Scialabba, *Organic Agriculture: African Experiences in Resilience and Sustainability* (Rome: Food and Agriculture Organization of the United Nations, 2013), http://www.fao.org/docrep/018/i3294e/i3294e.pdf; M. Bennett and S. Franzel, "Can Organic and Resource-Conserving Agriculture Improve Livelihoods?" *International Journal of Agricultural Sustainability* 11, no. 3 (2013): 193-215, http://dx.doi.org/10.1080/14735903.2012.724925.

[2] H. Kirchmann, L. Bergström, T. Kätterer, O. Andrén, and R. Andersson, "Can Organic Crop Production Feed the World?" in *Organic Crop Production: Ambitions and Limitations*, edited by H. Kirchmann and L. Bergström, 39–72 (Amsterdam: Springer, 2008), http://dx.doi.org/10.1007/978-1-4020-9316-6_3.

[3] Statistics Sweden, *Yearbook of Agricultural Statistics 2012* (Örebro, Sweden, 2012), http://www.jordbruksverket.se/swedishboardofagriculture/statistics.4.68dc110a12390c69dde8000500.html.

[4] W. Edwardson and P. Santacoloma, *Organic Supply Chains for Small Farmer Income Generation in Developing Countries,* Agribusiness and Food Industries Series 2 (Rome: Food and Agriculture Organization of the United Nations, 2013), http://www.fao.org/ag/ags/ags-division/publications/publication/en/c/171733/.

[5] A. Sahota, "The Global Market for Organic Food and Drink," in *The World of Organic Agriculture*, edited by H. Willer and L. Kilcher, 121–126 (Frick, Switzerland, and Bonn, Germany: Research Institute of Organic Agriculture [FIBL] and International Federation of Organic Agriculture Movements [IFOAM], 2012), https://www.fibl.org/fileadmin/documents/shop/1581-organic-world-2012.pdf.

[6] Kirchmann, et al., "Can Organic Crop Production Feed the World?"