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Can organic agriculture feed the world? – A re-analysis of Badgley et al. (2007)

Verena Seufert and Navin Ramankutty
Department of Geography, McGill University, Montreal, Canada

By 2030 agriculture needs to produce food for approximately 8.5 billion people. It is expected that this will need a 50% increase in food production compared to 2000. However, already today agriculture occupies more than 1/3 of the productive land area and is responsible for more than 30% of anthropogenic greenhouse gas (GHG) emissions. Organic agriculture is often proposed as a solution to the challenge of producing sufficient food in a sustainable way. Organic management has been shown to reduce nitrous oxide emissions and to increase soil carbon sequestration compared to conventional management. However, critics of organic agriculture argue that it cannot produce enough food to satisfy human needs and that it is less environmentally friendly than conventional agriculture as it reduces crop yields and thus necessitates considerably more land to grow food. In a recent paper Badgley et al. (Renew Agr Food Syst 2007; 22: 86-108) challenged this argument through an analysis that estimated the potential food supply if all agriculture would convert to organic methods, based on a literature review of organic yield ratios. The study was however much criticized as being biased pro-organic and for not applying stringent scientific methods. The purpose of the present study was to re-analyze Badgley et al. (2007) by means of a consistent meta-analysis of organic yield ratios. Due to a lack of data the meta-analysis could not be conducted for developing countries but was restricted to the developed world. The overall yield response of crops to organic management was considerably weaker than found by Badgley et al. (2007). Preliminary results showed that overall organic yields were 14% lower compared to conventional yields, while cereal yields were lower by as much as 22%. There were significant differences in yield responses between different experiment and management types. A simple calculation showed that potential food production under organic management on current agricultural land would decrease substantially compared to current conventional methods. If all grain production in developed countries would convert to organic management, considerably more land would have to be put under cultivation to produce the current cereal harvest. The greenhouse gas benefit of organic management could thus be offset due to additional greenhouse gas emissions from conversion of natural land to organic crop production. If developed countries reduced their cereal exports and/or food losses, organic agriculture could however potentially still supply sufficient grain to feed the developed world on current agricultural land.