Comment on “Resource-Conserving Agriculture Increases Yields in Developing Countries”

A recent Policy Analysis in *Environmental Science and Technology* (1) implies that resource-conserving technologies can simultaneously increase crop yields and enhance environmental sustainability in developing countries by using water more efficiently, sequestering carbon, and reducing pesticide inputs. This deserves close scrutiny: the need to increase food production sustainably, equitably, and with least impact on wild species is one of the greatest challenges facing humanity (2, 3). While the volume and scope of data presented is impressive, we find that the analysis offers at most weak evidence for what can be achieved by these technologies.

We identify four principal shortcomings with the study: (i) There is a strong selection bias toward successful projects. (ii) Methods used to measure changes in yields, water and pesticide use, and carbon sequestration are poorly explained, and therefore, hard to reproduce. (iii) Crucially, the study lacks adequate controls, thereby failing to show that it is the introduction of resource-conserving practices which is responsible for reported increases in yield and sustainability. (iv) The extent to which these practices provide greater net benefits to farmers than conventional techniques is unclear. We explore each of these problems, and suggest how they could be overcome.

The sample of projects is biased in favor of “successful” initiatives, reporting improvements in both yields and sustainability. This bias is inherent in the methods (4): the authors looked only at agricultural sustainability projects, defined a priori as those that “improve productivity ... and do not harm the environment” (1, p 1114), explicitly solicited nominations for projects with proven impacts (4), and further excluded those relying heavily on fossil-fuel derived inputs (4). The results obtained from analyzing this “purposive sample of “best practice” initiatives” (1, p 1115) are unsurprising: projects chosen because they have delivered increased productivity at low environmental cost do indeed show gains in yield and sustainability, but tell us little about the success of agricultural sustainability projects in general.

The techniques and assumptions employed in quantifying changes in yields, water and pesticide use, and carbon sequestration are not clearly explained. It is not evident how subsets of the data were selected for analyses of pesticide and water use. Without clearer elaboration of methods, this study is difficult to interpret and impossible to reproduce.

Crucially, the study lacks adequate controls. Without these we remain unconvinced that the observed improvements in yield and sustainability are directly attributable to the resource-conserving practices introduced. While the authors acknowledge that other changes could play confounding roles, their title shows no such caution. Possible alternative explanations include (i) Other project-related changes (e.g., increased crop density/fertilizer inputs). Given that such changes are not necessarily environmentally benign, they may even have raised yields while reducing overall sustainability. (ii) Better training and technical support for farmers. (iii) Other non-agricultural inputs (e.g., increased access to credit/markets, improved healthcare/nutrition). Any of these factors could improve yields or aspects of sustainability, independently of any positive effects (or even masking negative effects) of resource-conserving practices introduced. Clearly, testing for the specific effect of the introduction of a resource-conserving technology requires comparing temporal changes on project farms with those on a control group of farms (with conventional or alternative technologies) matched as closely as possible for potentially confounding variables. Simply comparing yields and resource use before and after intervention is not an adequate control because it does not account for concomitant changes that may also affect these measures.

Last, we lack information on how far the sustainable agriculture projects analyzed provide net benefits to farmers, compared with conventional agricultural development. The authors assert that the technologies they examined are “low-cost” (1, p 1115), but were these costs (e.g., of training/better seeds) fully compensated by improvements in yield, and if so, did the net gains outweigh those of conventional farming? Unless these methods increase farmers’ economic wellbeing and offer viable alternatives to conventional techniques, widespread adoption seems unlikely.

In writing this comment, our intention is not to diminish the potential of resource-conserving agriculture, but rather to underline the importance of testing its effects rigorously. Concluding from the analysis that “resource-conserving agriculture increases yields in developing countries” (1) is analogous to claiming that college education makes people wealthier because a set of graduates who say they are better off have indeed seen their incomes rise (without any consideration of graduates as a whole, of otherwise similar people who did not attend college, or of confounding factors such as changes in age). In the case of sustainable agriculture, a more detailed and balanced analysis is essential. The shortcomings we identify could be addressed by (i) Minimizing sampling bias by following a set of projects representative of a defined set of farming practices, irrespective of their success. (ii) Measuring all variables of interest repeatedly over time, on all projects. (iii) Collecting the same measures on a control set of farms under conventional management but matched for potentially confounding variables. (iv) Assessing the net impact of alternative approaches on farmer livelihoods. These are not easy tasks. The analysis gives us some “grounds for cautious optimism” (1, p 1114), but provides only a first indication of the potential of new techniques to promote productivity and sustainability. The next step is to go further, to identify general and specific drivers of failure and success, and thereby map the most promising avenues for improving yields while reducing the environmental impact of farming.

**Literature Cited**


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