From the First Green Revolution to the Second:  
What Can Agricultural and Extension Educators Do to Help Transform the  
Lessons from the Past into Successes of the Future?

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Abstract

In the middle of the 20\textsuperscript{th} century the world was predicting a starvation catastrophe  
that was halted by the Green Revolution of the 1960s and 1970s. To address continued  
population growth and the unsolved problems of the Green Revolution’s “forgotten” lands  
and peoples, many hope for a new and different second Green Revolution.

Supporters of a biotechnology-based revolution claim that it could increase crop  
quality and solve production problems in marginal lands in a manner that is environmentally  
benign and also appropriate for low-resource farmers. Critics base their arguments on often-  
cited secondary consequences of the Green Revolution together with concerns about  
biotechnology.

The purpose of the paper is to present approaches by which agricultural and  
extension educators can support and enhance a second Green Revolution. Some of these  
approaches include analysis of lessons learned in other development programs, learning,  
educating and planning for a "technology pull" instead of a "technology push," carrying out  
research to improve extension systems, addressing issues of equity and access, participating  
in public dialogue and information dissemination, networking and partnering with other  
development programs for comprehensive efforts, planning for alternative solutions, helping  
create public-private collaborations that favor small-farm agriculture, creating an enabling  
environment, advocating, lobbying, and communicating the urgency, advantages, and  
importance of agricultural development.
Introduction

In the middle of the 20th century the world was predicting a starvation catastrophe. However, the Green Revolution of the 1960s and 1970s "provided such a remarkable short term solution to such a horribly devastating long term problem that some have come to hail it as a miracle" (Everett, 2001). By using high-yielding varieties of wheat, rice, and maize, together with irrigation, chemical fertilizers and pesticides, world grain production doubled without using more farm land. The problem is that the first Green Revolution focused only on three crops and it did not work in poor, fragile, harsh, and risk-prone environments, omitting the poorest of the poor. Further, “population growth hasn’t stopped, so the Green Revolution has to happen all over again…. And it won’t be easy” (Brown, as cited in Mann, 1997, p. 1038; see also Borlaug, Swaminathan, Khush, et al., 2003; Food and Agriculture Organization [FAO], 1996; International Crops Research Institute for the Semi-Arid Tropics [ICRISAT], 2003).

Many hope for a second Green Revolution, also called a biotechnology revolution, grey to green revolution, evergreen revolution, and gene revolution, which could be "very relevant to the problems of food security, poverty reduction, and environmental conservation in the developing world" (Serageldin, 1999).

Supporters of a biotechnology revolution claim that it could accomplish “a safer, more stable and lower-cost food supply and responsible stewardship of the environment” (Parrott & Paterson, 2000). Some advantages of the new techniques, together with conventional plant breeding (Borlaug, 2002) and better agricultural methods, include, for example, the possibility of crop adaptability to marginal areas, lower water needs, lower pesticide and chemical fertilizer use, higher and more stable productivity, higher quality and nutritional characteristics, and more environmentally-friendly agricultural techniques (Mann, 1997).

Purpose of the paper

The purpose of the paper is to present approaches by which agricultural and extension educators can support and enhance a second Green Revolution. The paper provides specific ideas for good practice, research, advocacy, and action to help agricultural and extension educators contribute to a successful and equitable second Green Revolution.

Philosophical/Conceptual Themes

Skepticism about the potential benefits of a second Green Revolution is growing, based on often-cited secondary consequences of the first Green Revolution (e.g., reduction of agricultural and genetic diversity, environmental problems due to fertilizer, pesticide, and irrigation overuse or misuse, a growing gap between rich and poor, unemployment, marginalization of women and resource-poor sectors of the population, displacement of small and landless farmers, urban migration), together with concerns about biotechnology (e.g., ethics, farmer and intellectual property rights, access, equity, and biosafety).

Figure 1 summarizes the reasons for skepticism toward the potential benefits of a second Green Revolution, which must be addressed if progress is to be sustained.
Figure 1. Reasons for skepticism toward the potential benefits of a second Green Revolution.

A significant number of professionals in development are reluctant to participate in programs including the use of products from biotechnology applications merely to avoid getting involved in the controversy. Agricultural and extension educators must not eliminate themselves from the equation, which will be formulated whether they participate or not. As Parrott and Paterson (2000) indicated, scientists and educators "need to emulate the 'activist scientist' roles of Albert Einstein (who vocally opposed militarism, Nazism, anti-Semitism and the careless use of nuclear weapons)... and Peter Raven and E. O. Wilson (who promote conservation)."

Agricultural and extension educators have an important opportunity to make a second Green Revolution more successful and equitable, for they are best positioned to bring social, cultural, educational, economic, and political perspectives into the process, that will be key to success in developing countries and sustainable small-farm agriculture. They can contribute
with indispensable experience, knowledge, practice, resources, and contacts, and can interact with most of the peoples involved in the process.

Initially, agricultural and extension educators, just as anyone involved in a second Green Revolution, should analyze, together with the intended beneficiaries and taking into account their environment, the short-term and long-term consequences of the process, and try to anticipate and avoid undesirable consequences, as well as prepare for unexpected consequences (Rogers, 1995). Also, they should plan for a long-term sustainable process, and build a system that will eventually make their involvement unnecessary (Christiansen, 2000). Figure 1 outlines issues that should be taken into account in the analysis of possible negative consequences of the second Green Revolution.

The duties of and people interacting with agricultural and extension educators are many, and will continue to be many for those involved in the second Green Revolution. Figure 2 shows their operational framework by describing the roles that they can assume to support success of the programs with which they are involved, and indicating the types of people with whom they are most likely to interact during their efforts.

Figure 2. Operational framework of agricultural and extension educators participating in a second Green Revolution.
It would not be possible to now explore all responsibilities and situations presented in the operational framework of Figure 2 in just twelve pages. Next, the author explores the situations considered to be most urgent, and specific to a second Green Revolution.

Agricultural and extension educators need to:
- Educate stakeholders about the many issues regarding the second Green Revolution. Figure 3 shows some of these education activities and their recipients.

**Figure 3.** Some education activities to be carried out by agricultural and extension educators participating in a second Green Revolution.
Many of the education activities outlined in Figure 3 also involve other stakeholders. For example, “educating” researchers is a process that also includes farmers and decision makers. It involves needs assessments and adaptation of policies, research programs, and available resources to local culture and socio-economic needs and priorities (Conway, 1999). Other aspects of the efforts focus on local crops, adaptability, crop and genetic diversity, quality, stability, productivity, development of appropriate technology, environmental conservation, and indigenous knowledge. Many summarize the underlying philosophy of this scientist education process as agricultural and extension educators converting a second Green Revolution into a "technology pull" instead of a "technology push" (Tielens, 2003).

- Carry out research to improve the processes of a second Green Revolution. There are many research foci, and some of them are outlined in Figure 4.

*Figure 4. Research foci for agricultural and extension personnel involved in a second Green Revolution.*
Although all research foci are important, the most common involve the improvement and rejuvenation of education and extension methods so they are more accessible, participatory, and appropriate for local peoples and needs (FAO, 1996), better adapted to new strategies and technologies, and engage all stakeholders in the process (from resource-poor producers and women to decision-makers). Specifically important for a second Green Revolution are the analysis of lessons learned from past development programs and possible negative consequences of on-going and future programs. It is also important to better understand the influence of market mechanisms and policies in development programs, and to identify best ways to communicate with public opinion and policy makers about the urgency, advantages, importance, and needs of agricultural development programs.

- Interact with farmers at all levels: learn from them, educate them, and engage them in research at the planning, implementation, and evaluation levels. This interaction should involve the analysis of consequences of any development and change program, appropriate use of technology, access to resources, and alternatives;
- Be informed about new developments and participate in a "global public dialogue...involv[ing] everyone on an equal footing" (Conway & Toenniessen, 1999). The dialogue should include safety, social, cultural, ethical, environmental, economic, and equity considerations;
- “Provide objective and research-based information on agricultural biotechnology to assist the public in making informed decisions” (Davis, Irani, & Payson, 2003, p. 183), including possible risks and benefits. In that sense, “extension can play a critical role to provide a link between subject matter specialists and their clientele” (Davis, Irani, & Payson, 2003, p. 188);
- Communicate with the press, public opinion, and decision makers; “The future of our food supply may well depend on who is most vocal and most convincing” (Parrott & Paterson, 2000), or, as Cassman says, “I think that science could feed the world, but I’m quite worried that it won’t be allowed to” (Mann, 1997, p. 1043);
- Make sure that all stakeholders and their interests are taken into account in the new development programs, so as to avoid negative consequences similar to those of the first Green Revolution (e.g., broadening of the gap between the rich and the poor, increase of landlessness, marginalization of some sectors of the population, etc.) Special attention should be given to the less educated and resourceful, women, children, elderly, and landless farmers. Plans for alternative jobs for those displaced by change should be in place. Plan for new migration patterns;
- Analyze market situation, avoid overcapacity and associated reduction of minimum agricultural prices;
- Network and partner with other development programs and advocate for and prepare comprehensive programs that include, for example:
  - Programs on safety, effective use, and understanding of products and possible consequences of new technologies;
  - Quality, marketing, processing, postharvest technology, access to market, and transportation;
Diverse crop production, livestock, agroforestry, family gardens, and diversification of sources of income;

- Environmental conservation, with special attention to conservation of genetic diversity;
- Access to credit and other resources;
- Family planning (Sen, 1997), nutrition, and health;
- Literacy programs, leadership, communication, empowerment, and governance;

- Plan for alternative solutions to proposed changes;
- Do needs assessments, plan, implement, and evaluate; Specifically address access and equity issues;
- Help create imaginative public-private collaborations (Chrispeels, 2000; Serageldin, 1999) that favor small-farm agriculture. When dealing with ethical and access issues, “the answer lies not in abolition of patenting or discouraging private research. Rather, an imaginative approach is needed, one that recognizes the interests of poor people” (Serageldin, 1999, p. 389);
- Communicate with funding sources (international development cooperation donors, governmental officials, corporations, public-private partnerships, private investors, etc.) Find new donors;
- Create an enabling environment. Advocate and lobby for:
  - Public agricultural research that concentrates on poverty alleviation (Anandajayasekeram, 1999) and is central to food security in marginal areas, even if without commercial pay-off, and more funding for this research;
  - Necessary local, national, and international policies and policy changes;
  - Necessary resources allocated for sustainable development;
  - Measures that assure affordable food at the right place at the right time. Include considerations of infrastructure, transportation, access to land and credit, equity, governance, health and education for all.

**Adapting to new trends of development cooperation**

The United Nations Millennium Development Goals (United Nations Development Program [UNDP], 2003) address many aspects of poverty, most of them faced by the poorest of the poor, the rural people: poverty and hunger, maternal mortality, death before the age of five, spread of HIV/AIDS, lack of education, and inequality among genders. The goals mark a milestone in international cooperation. Addressing them will “have consequences for the way we deal with development issues” (Johnson, 2002) and will need a concerted, intensified, and diversified effort among donors. During the 2002 international conference on Financing for Development in Monterrey, Mexico, the leaders of industrialized countries announced plans to increase resources devoted to development assistance and presented development cooperation from the perspective that fighting poverty would also contribute to global security (United Nations [UN], 2002). This “new” focus got the attention of public
opinion of rich countries and further raised awareness of the need for development cooperation.

Many in development cooperation assessed the summit as another step toward the realization of the Millennium Development Goals. Others, however, are seeing the new “political” trends of cooperation as a threat to maintaining the focus of development in the reduction of extreme poverty. The argument is that whether or not there is a relationship, direct or indirect, between poverty and global security, the global security issue is being used as an excuse to focus development resources on programs exclusively addressing terrorism prevention actions. Putting a “development co-operation lens on terrorism prevention” (as labeled by the Organization for Economic Cooperation and Development [OECD], 2003), they claim, will prioritize and concentrate resources in actions that conceptually and directly reduce the incidence of terrorism, and distract the focus from efforts that don’t seem related to terrorism but specifically address the needs of the poorest of the poor. Resources and programs for rural and agricultural development are among the efforts most in danger of being blurred by these new trends.

These new “political” trends in development cooperation add one more responsibility to the list of agricultural and extension educators in their pilgrimage toward a successful second Green Revolution: assuring that agricultural development is not only not forgotten, but put at the forefront of the new plans for development, investment, trade, and policy making. This will require not only effective education and communication about the urgency, advantages, and importance of agricultural development, but also strong political influence.

Conclusions, implications, and recommendations

The following summarizes the approaches reviewed in this article by which agricultural and extension educators can support and enhance a second Green Revolution:

- Continue with present activities;
- Analyze lessons learned in other development programs. Plan to anticipate and avoid undesirable consequences, as well as prepare for unexpected consequences;
- Plan for a long-term sustainable process, and build a system that will eventually make their involvement unnecessary;
- Educate about the many issues regarding a second Green Revolution. Include education to researchers so that a second Green Revolution is a "technology pull" instead of a "technology push" (Tielens, 2003);
- Learn from, educate, and engage farmers in research;
- Carry out research to improve the processes of a second Green Revolution. Most important are research for the improvement and adaptation to local needs of education and extension methods;
- Be informed and participate in public dialogue;
- Communicate with the press, public opinion, and decision makers;
- Include all stakeholders, their interests, and their situation in all decisions and processes;
• Network and partner with other development programs and advocate for and prepare comprehensive programs;
• Plan for alternative solutions to proposed changes;
• Do needs assessments, plan, implement, and evaluate. Include access and equity issues;
• Help create imaginative public-private collaborations that favor small-farm agriculture;
• Communicate with funding sources. Find new donors;
• Create an enabling environment. Advocate and lobby for many issues involving agricultural development and poverty alleviation;
• Communicate the urgency, advantages, and importance of agricultural development and build a strong, political influence to assure that agricultural development has an important place in new global development cooperation plans.

References


