
Placing Several Eggs in Our Basket: Keeping Diversity in Agriculture

RAPHAËL THIERRIN

EcoBio Design and Business Services

Calgary, Alberta, Canada

Organic growers are facing a significant challenge. Will we be able to procure, in the long term, enough seeds and seedlings, or will we be disconnected from the progress of plant breeding programs? Will controls over the movement of products guarantee that our livestock feed does not contain transgenic soya, or will we need to forbid to farmers any purchase of soya?

Are natural insecticides made with Bt still effective in potato, vegetable, vine and fruit tree production, or will we soon be forced to go back to pick off potato beetles by hand? Who will hold back the wind which blows bio-engineered pollen and seeds on our fields?" (Niggli 1996: 16)

Urs Niggli, Director
Research Institute of Organic Agriculture
Frick, Switzerland

INTRODUCTION

This paper explains why developers and users of agricultural biotechnology need to be concerned over the possibilities that its side effects may disable one important agriculture sector, organic farming.

Organic agriculture deserves to have a future because it makes a contribution to society's public good and because it can be used to demonstrate how it is possible to obtain good yields of many crops without the benefit of biotechnology or of synthetic pesticides and fertilizers. Should these types of agricultural technologies fail in the future, it will be advantageous to learn from the organic production system. Thus, aside from purely altruistic motives, there is a pragmatic reason why all farmers need to ensure that biotechnology does not harm the viability of organic agriculture.

There are currently several distinct technologies for food production. This is a healthy mixture because each technology offers its own environmental advantages and each is capable of producing the yields needed to feed the world. What is dangerous is if one technology eliminates another.

Risk assessment and contingency planning dictate that several eggs be kept in the basket of agricultural systems to ensure that the public good is maintained, now and in the future.

ORGANIC AGRICULTURE

Organic agriculture is a farming system "whose primary goal is to optimize the health and productivity of interdependent communities of soil life, plants, animals, and people" (Canadian General Standards Board [CGSB] 1997, p. 3). Organic farming avoids the use of chemical fertilizers, herbicides, pesticides, or growth regulators so as not to introduce into the environment substances that may compromise its integrity over the short term or cumulatively. Once crops leave the farm, various protocols ensure that no toxic chemicals are used to control pests such as rats or insects and that organic products continue to be segregated from nonorganic items (Organic Crop Improvement Association [OCIA] 1997, pp. 27-33).

Organic farming uses the tools provided by modern technology. In western Canada, it is not unusual to see growers use the same 54-foot-wide implements as their neighbors for seeding and harvesting. Organic production takes place on farms of similar size as conventional production, for example, from small, half acre herb farms to 4,000-acre grain operations.

An increasing amount of scientific research is taking place to enable organic farmers to develop production techniques adapted to all climatic and soil conditions. This research is reported at events such as the biennial International Federation of Organic Agriculture Movements (IFOAM) Scientific Conferences. IFOAM sets minimum, worldwide standards for the organic industry. The last conference, held in Copenhagen in 1996, attracted individuals from 92 nationalities and included more than 400 presentations.

RIGOROUS STANDARDS

The organic industry has developed an organic certification process which ensures that producers and processors follow internationally recognized standards, such as those of the Organic Crop Improvement Association (OCIA, 1997). Several nations are currently instituting uniform standards and accreditation mechanisms for their territory. In Canada, all organic certification processes will soon be brought under the same umbrella, with standards registered under the Canadian General Standards Board (CGSB, 1997). A similar process is under way in the United States, pursuant to the Organic Foods Production Act (Marbek Resource Consultants, 1996).

The certification process is very similar to an environmental audit (Thierrin, 1996). Standards are used as evaluation criteria, and an independent inspector is brought in to assess whether the farming operation can be certified as organic. The responsibilities of the organic inspector are to visit the farm, talk with the farmer, and write a report describing how the farm is managed, whether information in the certification application was correct, and whether the grower follows the organic standards. In addition, the inspector's report will usually include recommendations on how the organic producer could better address the organic standards or manage farm operations in a more ecological manner.

A GROWING INDUSTRY

The organic industry is currently growing by leaps and bounds in sales and number of acres of certified organic production. In the United States, \$3.5 billion worth of organic products were sold in 1996, according to the Natural Foods Merchandiser (Pesticide Action Network, 1997). This is the seventh year in a row that sales have grown, at a pace of 20 percent a year in the recent past. In North America, however, only a small number of farms are organic. The U.S. Department of Agriculture (USDA) estimated in 1992 that 0.1 percent of U.S. agricultural land was in organic production and 0.2 percent of farms were certified organic (Marbek Resource Consultants, 1996). Slightly more than one million acres of organic land were in production in the United States in 1994 (Dunn, 1996). In European countries, where organic production is sometimes encouraged by government programs, percentages of organic farms can be significantly higher, for example, 7.1 percent of Swiss farms (Dietler, 1997) and 16 percent of Danish farms (Kloppenborg, 1996).

AN INDUSTRY THAT CONTRIBUTES TO THE PUBLIC GOOD

Organic agriculture contributes to the public good because it is sustainable from two desirable perspectives: it does not harm the environment and its productivity is good. Thus farmers obtain a sufficient income, and the produce from organic farms helps to feed the world.

Showing that a food production system is sustainable for both the environment and the producer requires the analysis of three attributes:

- Environmental accounting
- Carrying capacity
- Sustained yield

These are taken from a list of six attributes developed to describe a sustainable agriculture system from environmental, economic, and social perspectives (Brklacich, Bryant and Smit, 1991).

ENVIRONMENTAL ACCOUNTING

Environmental accounting includes the identification and measurement of the natural resources base so that its protection, conservation, degradation, and use transfer can be monitored (Brklacich et al., 1991). Environmental risks are minimized because toxic chemicals are not used for weed or insect control. Furthermore, it has been shown that, at least in western Canada, the organic certification process can competently evaluate whether an organic farm uses resources in a way that is environmentally sustainable, and it can also ensure that the operator improves his or her management of these resources if the annual inspection reveals that there are problems (Thierrin, 1996).

CARRYING CAPACITY

Carrying capacity is the ability of the ecosystem to continue to be used for agricultural production. Because organic certification requires an annual inspection in which fields are visually inspected by an inspector and the condition of crops is documented, the farm's carrying capacity is monitored as part of the certification process. Should a negative pattern emerge, it will be noted, and corrections will be recommended to the grower. If recommendations are not implemented within a reasonable time period, the certification status will be denied, and marketing of products from this farm as organic will cease.

SUSTAINED YIELD

The yields obtained by experienced organic farmers are very good because they pay close attention to soil fertility "by improving soil structure, increasing organic content, and balancing nutrients," as Steve McKaskle does, in the upper Delta in Missouri (Richards, 1996). Obtaining yields equivalent to 85 percent or more, compared to the yields of conventional farms, as Alberta producers Dwayne Smith and Ken Larsen regularly do (Smith, 1993; Larsen, 1997), is not without challenges. But it is possible, if meticulous care is taken to be aware of the local agricultural ecosystem, to understand its susceptibility to particular weeds and insects, to apply the appropriate preventive practices, and to use corrective measures only when needed.

There are occasional reports in popular farm newspapers that organic agriculture means low yield, and it is worth identifying here the reason for the discrepancy between the above paragraph and such reports. It is true that yields are lower during the three- to five-year transition from chemical to organic agriculture because, in such situations, the farmer has not yet identified which organic techniques and rotation system will work best in his or her ecosystem in order to grow the intended crops. Once this transition is complete, yields bounce back up.

Second, organic farmers often grow a greater diversity of crops than conventional farmers because most of them plant certain crops to encourage beneficial insects, or as part of a rotation designed to enhance fertility and to control diseases and pests (USDA, 1996). These measures reduce the yearly acreage dedicated to the farm's main crop and may give the illusion that the farm is not too productive for this particular crop. In fact, the productivity per acre may be as high as, or higher than that of a conventional farm.

AGRICULTURAL BIOTECHNOLOGY AND THE ORGANIC INDUSTRY

As mentioned in the quotation that introduced this paper, the organic industry feels most affected by three facets of agricultural biotechnology:

- Dissemination of transgenic plants through the ecosystem
- Availability of nontransgenic seeds and feed sources
- Rapid development of insect resistance to Bt

While the first two concerns have been slowly evolving for a while, the adoption of Bt plants in recent years has catalyzed the organic industry into a real fear because Bt is one of the most effective pesticides allowed under organic certification (OCIA, 1997). It targets and kills specific insects, is relatively harmless to people and other animals, and breaks down fairly quickly compared to synthetic insecticides (Swadener, 1994); these features make it unique. The use of Bt by organic farmers begs this question: Could bioengineered Bt crops be used by the organic industry?

Under current organic production standards, genetically modified organisms (GMOs) are not allowed. This could change in the future, if it can be absolutely demonstrated that bioengineering does not create unwanted side effects on food quality and on allergenic properties and that its ecological contribution is indeed limited to the intended effect, for example, insect control in the case of Bt plants. Even if the prohibition of GMOs is relaxed, it is very unlikely that Bt plants would be acceptable because the use that organic growers make of Bt is vastly different than its use as genetic material inside a plant.

INSECT CONTROL BY ORGANIC GROWERS

Organic farmers use Bt selectively, whereas its use within each plant in a field makes it pervasive during the cropping season. As was mentioned in the discussion on sustained yield, organic growers rely on preventive measures and use corrective measures only when needed.

For cotton, an example of a preventive measure is to interplant bean and cotton: two rows of beans follow two rows of cotton, and so on. If insects discover one set of cotton plant rows, they are less likely to travel to other rows if they need to cross over a set of bean plants first (Fox, 1996). Bt would be used as a corrective measure only if there were enough insects to cause economically important damage. If the use of Bt was always this limited, insect resistance would develop slowly, as it has in 30 years of use for the diamondback moth (Swadener, 1994). Many other insects have so far failed to develop resistance. This contrasts with the three- to five-year time frame being predicted for development of resistant insects now that pesticide-producing plants are grown across the United States (Snow and Palma, 1997). Thus there is a fear that Bt may be lost as a useful insecticide for the next generation of farmers, whether they be organic or not.

Fortunately, several interesting strategies are being proposed to ensure the management of resistance: cultivating mixtures of host plants, maintaining non-Bt refuges, using highly toxic Bt plants (Snow and Palma, 1997). Although such solutions are not ideal for the organic industry, at least they represent a step forward. Some of these solutions may offer the possibility of partnerships between conventional and organic farmers, especially the creation and maintenance of refuges.

OPTIONS FOR THE ORGANIC INDUSTRY

Organic production standards contain mechanisms to ensure that contamination from synthetic, potentially toxic substances does not occur on organic farms: buffer zones between organic and neighbors' fields, use of untreated seeds only, tolerance levels for contamination, the necessity of keeping beehives a minimum of two miles away from any sprayed crop. Except for beekeeping, these mechanisms are not useful to cope with the potential problems associated with agricultural biotechnology.

Instead, these options are being proposed by this author:

- Raising awareness
- Appealing for the use of appropriate technologies
- Labeling
- Litigation

RAISING AWARENESS

Raising awareness is done through a paper such as this one, to educate scientists and growers about the effectiveness of organic production and to show that there are good farming reasons why the organic industry is shying away from biotechnology.

APPEALING FOR THE USE OF APPROPRIATE TECHNOLOGIES

Farmers and scientists need to know that valuable ecological knowledge may be lost if organic agriculture is not allowed to establish itself firmly, because pressure from other agricultural systems may prevent its principles from being applied. Hence it is necessary for you, the reader, to ensure that appropriate technological paths are taken to prevent this potential disaster.

Such paths should ensure that the benefits of future plant breeding are not lost to the organic industry so that new varieties of high-yield or disease-resistant seeds are available for organic growers. More generally, agricultural technology needs to be developed in an inclusive manner, which enables all sustainable agricultural practitioners to benefit from it.

LABELING

Labeling of bioengineered consumer products is a topic that has generated copious literature in the recent past. Another type of labeling is of greater importance to the organic industry, namely labeling and segregation of bioengineered seeds and feeds to ensure that organic growers are not inadvertently planting herbicide-tolerant or Bt crops or feeding such crops to animals. The organic industry is able to move a great diversity of certified organic products in a labeled, segregated environment, and it believes that distributors of bioengineered products can do the same.

Once again, it is worth reiterating that organic growers are not likely to use products created through biotechnology in the near future because they already benefit from the interactions present in natural systems to grow crops. Hence, why risk the use of a technology that may harm ecological integrity?

LITIGATION

In Canada, nuisance claims can be filed against individuals who knowingly develop or apply Bt plants technology in a way that is known to endanger the future effectiveness of Bt by all or by some, thereby causing irreparable damage to the public good, to the organic industry, or to an individual farmer. Such claims can be used for other applications of agricultural technology, too. A public nuisance claim can be launched by the attorney general or by an individual, depending on circumstances. A private nuisance claim can be used only by an individual whose land is directly affected by the other party's actions

or inaction (Bird, 1983). I do not know whether the U.S. legal system has common law principles that support the above actions, but it is likely that similar legal recourses exist there, too.

The use of this type of litigation is unlikely because proof would be extremely difficult to obtain and because the organic industry has not yet mobilized itself to think and to act in this manner. Nonetheless, special circumstances could lead to a nuisance claim. It may be initiated, for example, if a group has been careful to monitor the activity of a company, of a scientist, or of a farmer, to issue a warning to the appropriate party about potential risks to the public or to an organic farmer, and to document inaction by these parties.

CONCLUSION

I hope that this paper has helped to dispel myths surrounding the organic industry and to outline the seriousness with which this sector views the immediate threat posed by the secondary effects of agricultural biotechnology, especially to the effectiveness of Bt and the availability of seeds.

A few critical choices need to be made by the farmers and other decision makers who continue to develop Bt crops and other biotechnologies. One sound choice may be to recognize the organic industry as a valuable partner that acts in the public interest. Another reasonable choice is to recognize that the public interest requires the development of a variety of sustainable agriculture systems. The corollaries of such a choice would be that:

- future plant breeding and seed registration should include varieties that may be used by organic farmers.
- bioengineered crops used for feed should be labeled and segregated from other crops so that organic livestock operations are able to purchase appropriate animal feed.
- Bt resistance strategies should be designed effectively and perhaps even with the collaboration of the organic industry.
- as other types of biotechnology applications are developed, their impact on organic agriculture should be weighed before proceeding too far.
- technologies which make organic agriculture impossible to practice should be discontinued.

Already the potential threats of biotechnology have led, in the United States, to the unprecedented alliance of many environmental and organic agriculture leaders to ensure that the government exclude genetically modified organisms from the U.S. national organic standards. Can the formation of an organic industry legal defense fund be far behind, if the advice in this article is not heeded?

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