Rachel's Environment & Health News
#686 - Sustainability and Ag Biotech
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How will genetically modified seeds, crops and foods affect the sustainability of U.S. agriculture? During 1999, agricultural economist Charles Benbrook tried to answer that question.[1] Benbrook has a long history of analyzing all aspects of agriculture as an employee of the executive branch, the Congress, and the National Academy of Sciences, and more recently in the private sector.[2]

Benbrook defines "sustainable agriculture" as a food system that:[1]

** Provides a reasonable rate of return to farmers, to sustain farm families, agricultural infrastructure, and rural communities;

** Assures a reasonable rate of return to public and private providers of farm inputs (seeds, fertilizers, etc.), information, services, and technologies;

** Preserves and regenerates soil, water, and biological resources upon which farming depends, and avoids adverse impacts on the natural environment;

** Increases productivity and per-acre yields at least in step with the growth in demand;

** Adheres to social norms and expectations in terms of fairness, equity, compliance with regulations, food safety, and ethical treatment of workers, animals, and other creatures sharing agricultural landscapes.

First we should acknowledge that, by these criteria, U.S. agriculture is not sustainable now and hasn't been for many decades.[3] Loss of profitability is almost always the immediate cause of unsustainability in farming, Benbrook says. "All too often in the U.S. in recent decades, the only thing that really changes is that energetic and ambitious managers willing to accept lower returns per bushel find the capital to expand, maintaining their income only by expanding their acreage base," Benbrook says. Of course when one farm expands its acreage, often another farm family has to move off the land. As a result, the U.S. Bureau of the Census stopped counting "farm residents" in 1993 because there were so few of them left; their numbers had dwindled to fewer than 2% of total U.S. population (4.6 million people).[4] (In contrast, in 1900, farm residents made up 35% of total population.)

Benbrook believes that genetically modified seeds, crops and foods will amplify recent trends and will have the following effects on farms:

** Increasingly serious economic surprises and setbacks for farmers because many emerging biotechnologies are more expensive to bring to market, for several reasons:

(a) Biotechnology results from mergers of seed companies and pesticide companies. For example, as a result of a series of acquisitions and mergers, DuPont and Monsanto together now own 73% of corn seed producers in the U.S.[5] Seed companies have traditionally had a relatively low profit margin (around 12% to 15%), whereas pesticide producers have had a higher profit margin (20% to 30%). As pesticide companies try to raise the profit margins of their newly-acquired seed companies up toward the levels expected of pesticide companies, the cost of seed and chemicals will probably continue to rise for farmers.

This has, in fact, been happening, Benbrook shows. In the midwestern farm belt, corn and soybeans are the major crops. Since 1975, for soybean farmers, the share of the farmer's gross income per acre devoted to seed plus chemicals has risen more than 50%, from 10.8% to 16.3%. For corn farmers, the increase has been even larger (from 9.5% of gross income to 16.9%, 1975-1997).

(b) Genetically modified crops are requiring more herbicides than farmers were initially led to believe they would, thus driving up weed management costs. Take Roundup Ready crops. These are crops genetically modified to withstand dousing with Monsanto's premier weed killer, Roundup. The idea was that farmers would give their crop one good dousing with Roundup and that would solve their weed problems. Monsanto placed print ads telling farmers Roundup was "the only weed control you'll ever need." You can see one of these 1998 ads on the Iowa State University Herbicide Ad "Hall of Shame" web site.[6]

Roundup Ready crops offered farmers a modest reduction in costs per bushel if everything worked as advertised. However, the reality is different from what Monsanto promised in its ads. Farmers using Roundup Ready crops find they have to use two or three applications of two or more herbicides to control weeds. Some farmers are finding they must use as many as four different herbicides after planting a seed that supposedly makes weed management easier. This disappointing trend is putting more of farmers' income into the pockets of the seed and chemical giants. As Charles Benbrook points out, the full Roundup Ready system is now costing farmers "an amazing $68.77 per acre in 1999, about 50% more than the cost of [other] seed plus weed management systems in the Midwest in recent years." This trend promises to deliver "significantly lower average returns to growers," Benbrook predicts.

(c) Some weeds are developing resistance to Roundup -- notably hemp weed or pig weed -- so Roundup is becoming less effective, requiring additional measures for weed control, raising costs for those relying on Roundup Ready crops.[7]

(d) There is evidence that low-dosage herbicides can disrupt beneficial soil microorganisms and perhaps interfere with plant uptake of phosphorus, an essential nutrient. Benbrook believes this can have an important negative impact on plant health and farm profitability.

(e) There is evidence of a "yield drag" associated with some Roundup Ready crops, meaning that per-acre yields are not consistently as high as it was once thought they would be. A yield drag quickly translates into a profitability drag.

There are additional reasons why genetically modified crops are likely to produce economic surprises and setbacks for farmers:

(f) The costs of creating and protecting intellectual property are already high and they are bound to rise, Benbrook believes;

(g) The regulation of GMOs (genetically modified organisms) seems likely to increase, and so will regulatory costs;

(h) Biotechnology is being promoted and used in a way that tends to reduce diversity on the farm -- precisely the wrong direction for farms to be going, in Benbrook's view. Successful pest management requires a diversified system that spreads the burden across differing mixes of chemical, biological, genetic, and cultural (farming technique) tools and tactics. Reliance on a single approach to pest management will fail because pests will successfully evolve and thrive in response to single approaches, Benbrook says.

(i) Trouble has appeared in another line of genetically modified crops -- those containing the pesticidal Bt gene. Bt is a bacterium that is toxic to a large class of common insect pests called lepidopterans. Lepidopterans are butterflies and moths; during the caterpillar stage of their life-cycle, lepidopterans eat leaves and can cause great damage to leafy crops. Because of the damage they inflict, lepidopterans provoke some of the greatest use of pesticides world-wide.

Bt is a naturally-occurring killer of lepidopterans. As such, it is a priceless gift from nature to row-crop farmers who need to control outbreaks of lepidopterans. Charles Benbrook makes this comparison: Bt is to the control of lepidopterans what antibiotics are to the control of human diseases. If Bt loses its effectiveness, it will

have major consequences for vegetable farmers across the U.S., many of whom use Bt (in one form or another) as a foliar spray.

By inserting a gene from the Bt bacterium into plants, Monsanto and others have created crops that are themselves pesticidal to lepidopterans. For example, Monsanto's "New Leaf" potato, which is now sold in U.S. grocery stores, is itself a registered pesticide because every cell in every potato contains the Bt gene.[8] (Notably, it is one of the few registered pesticides that is not labeled as such.)

From the beginning, Monsanto and others have acknowledged that their Bt-containing crops might conceivably induce Bt resistance among lepidopterans, but they have insisted that the likelihood is "remote." Resistance is a well-understood phenomenon. When a group of insects is sprayed with a poison, those that are least affected survive and reproduce. Soon the only remaining insects are unaffected by that poison -- they have developed resistance to it.

When Monsanto approach EPA [U.S. Environmental Protection Agency] for permission to market Bt-containing plants, they came armed with numerous studies showing that resistance to Bt might take 30 years to develop, if indeed it developed at all. Because genetically-engineered Bt-containing crops had been developed in almost total secrecy, when EPA asked for public comment on Monsanto's proposal, the nation's agricultural experts had little to say. EPA assumed their silence meant all was well.

Traditionally, farmers get reliable information from the land grant colleges that Congress created in 1862. However, beginning with the Freedom to Farm Act of 1996, Congress has systematically reduced the role of the public sector in U.S. agriculture. Now development of genetically engineered crops is largely in private hands and the new technology is cloaked in secrecy. The veil of secrecy "raises an important public policy issue," says Benbrook. "When scientists are unwilling to share data, are constrained in what they can report, and/or have no opportunity to study new technology, public institutions and regulators have to fly blind for a period of time." So, flying blind and basing its decision on Monsanto's science, EPA approved crops with the Bt gene inserted into them.

Now it turns out that Monsanto's science was woefully weak and incomplete. New studies show that resistance to Bt is not nearly as rare in lepidopterans as Monsanto claimed it was, so resistance can be expected to develop much more rapidly than Monsanto initially projected. Furthermore, it is now clear that Bt-corn can adversely impact populations of key beneficial insects. Lacewing larvae, which eat lepidopteran larvae, are killed by Bt, thus removing a natural control on lepidopterans. It now seems clear that farmers who become reliant upon genetically modified crops containing the Bt gene can expect unpleasant surprises in the short term and loss of the effectiveness of Bt in the medium term.[9] It will be a grave loss indeed.

In sum, genetically modified crops seem poised to reduce diversity on farms, reduce farm profits, and make U.S. farms even less sustainable than they already are. For the U.S. food system, this hardly seems like progress.

CORRECTION: PRECAUTION IN LOS ANGELES SCHOOLS

We owe an apology to the Los Angeles Safe Schools Coalition (LASSC) who did the work that resulted in the path-breaking new pesticide policy adopted last year by the Los Angeles Unified School District, which we described in Rachel #684.

The new policy says Los Angeles schools will look for the least damaging way to control pests, in accord with the precautionary principle, and that the goal is to control pests by non-chemical means whenever possible. The policy represents a major step forward in environmental decision-making.

LASSC is a coalition of 20 organizations, including Pesticide Watch, Physicians for Social Responsibility, United Teachers Los Angeles, the Parent Teachers Association, and Action Now.

Six individuals made up the core group that successfully persuaded the Los Angeles Unified School District that "better safe than sorry" is the best pest management philosophy:

** Dr. Kirk Murphy of Physicians for Social Responsibility, who inserted the precautionary language into the draft policy;

** Sandy Schubert, a lawyer who negotiated the terms of the policy. Though not a member of any of LASSC's constituent groups, she contributed her writing skills and her extensive knowledge of California pesticide policies

** Robina Suwol, a parent who saw her child disappear in a cloud of pesticidal fumes as she dropped her child off at school one day; her tenacity and commitment ultimately drove the coalition to success.

** Yvonne Nelson, a member of Action Now, who culled through reams of school pesticide-use reports and documented the widespread mis-use of pesticides in Los Angeles schools;

** Christina Graves, a community organizer with Pesticide Watch, hired to help the coalition find the political strength it needed to overcome the opposition of the pesticide corporations and their friends in high places.

We implied in Rachel #684 that the new pesticide policy in Los Angeles resulted from efforts by Californians for Pesticide Reform (CPR). CPR and Pesticide Watch jointly raised the funds that paid the community organizer who helped build LASSC, and CPR generated support and publicity for the new policy at a crucial moment, just as it came up for a vote. But LASSC worked tirelessly for two years to make the new policy a reality and it is they who deserve the credit for this important public policy innovation.

--Peter Montague (National Writers Union, UAW Local 1981/AFL-CIO)

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[1] Charles M. Benbrook, "World Food System Challenges and Opportunities: GMOs, Biodiversity, and Lessons From America's Heartland," unpublished paper presented January 27, 1999, at University of Illinois. Available in PDF format at http://-www.pmac.net/IWFS.pdf Dr. Benbrook gave a talk based on his paper; if you have an audio-enabled computer, you can listen to the talk and see the slides via the world wide web: http://www.aces.uiuc.edu/worldfood/1999/broadcast/ schedule.html.

[2] During the early 1980s Benbrook served as an agriculture policy analyst for the President's Council on Environmental Quality, then as staff director of the Subcommittee on Department Operations, Research and Foreign Agriculture of the Agriculture Committee of the U.S. House of Representatives; from 1984 to 1990 he was executive director of the Board of Agriculture, National Academy of Sciences. Since 1990 he has operated Benbrook Consulting Services.

[3] David Tilman, "The Greening of the Green Revolution," NATURE Vol. 396 (November 19, 1998), pgs. 211-212.

[4] Associated Press, "Too Few Farmers Left to Count, Agency Says," NEW YORK TIMES October 10, 1993, pg. 23.

[5] Ann M. Thayer, "Ag Biotech Food: Risky or Risk Free?" CHEMICAL & ENGINEERING NEWS [C&EN] November 1, 1999, pgs. 11-20.

[6] http://www.weeds.iastate.edu/weednews/roundupcotto nad.htm.

[7] http://www.weeds.iastate.edu/mgmnt/qtr98-4/roundup future.htm.

[8] The amazing story of the New Leaf pesticidal potato was told in Michael Pollan, "Playing God in the Garden," NEW YORK TIMES MAGAZINE October 25, 1998, pgs. 44-51, 62-63, 82, 92-93.

[9] On Bt resistance, see http://www.pmac.net/ge.htm.

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