



# Seed Production and Variety Development for Organic Systems

A Publication of ATTRA, the National Sustainable Agriculture Information Service • 1-800-346-9140 • [www.attra.ncat.org](http://www.attra.ncat.org)

By Katherine L. Adam  
NCAT Agriculture  
Specialist  
© NCAT 2005

Most of the research to develop seed varieties specifically for organic production is in public and participatory breeding, and good technical material from such research is increasingly available. The USDA has also funded workshops to teach farmers the principles of participatory breeding for organics, to increase the availability of organic seed. In 2005, however, although there are breeding programs underway, no seed varieties bred specifically for organic production are commercially available.

## Contents

Overview .....	1
U.S. Seed Summit.....	1
How is seed produced for the market? .....	2
Issues in organic seed sourcing for commercial growers .....	5
Two major regulatory issues that directly affect U.S. organic farmers.....	5
Quality issues in farmer-saved and -traded seed vs. purchased commercial seed.....	8
The global picture .....	8
Tubers and alliums.....	10
Handling issues.....	10
Conclusion.....	10
References .....	11
Further Resources .....	12



©2005Clipart.com

## Overview

**B**reeding crop plants specifically for organic production is still in its infancy, although interest is already well established, to judge by Internet sites on organic seed. The USDA has provided funds to producers, small seed companies, and universities to hold on-farm workshops on organic seed production. Several sources list providers of organic seed. But questions about the future of organic seed remain.

Robert L. Johnston of Johnny's Seeds questions whether seed companies will want to invest in developing organic-specific varieties and does not advocate that the USDA's National Organic Program (USDA/NOP) mandate a requirement for organic seed. In a February 2004 statement posted on his company's Web site, [www.johnnyseeds.com](http://www.johnnyseeds.com), he says:

If the community of organic farmers and consumers is sure that it wants an organic seeds requirement, then the USDA/NOP decision making process needs to set this kind of deadline. The other alternative is to eliminate the requirement.

Are the environmental plusses of organic seed production worth the burden to the growers, in both increased seed costs and, for a few years at least, limited variety availability?

Other industry representatives, including other seed company owners and researchers, believe that the answer lies deeper than merely increasing the supply of existing varieties raised under organic conditions. They are actively seeking to develop new varieties bred specifically for organics before such time as USDA/NOP may set a deadline for organic farmers to use only organic seeds and propagation materials.

European researchers have studied the particular challenges of organic production—and by extension the varietal traits that would complement it. To address the challenges, Matt Dillon, director of the Organic Seed Alliance, has called for “participatory breeding” that uses farmer and university breeding collaboration.(1)

## U.S. Seed Summit

In the fall of 2003, a U.S. “Summit for Seeds and Breeds for 21st Century Agriculture” set as its key goal for the future of public breeding, “development of ‘a road map for invigorating public domain plant and animal

ATTRA is the national sustainable agriculture information service operated by the National Center for Appropriate Technology, through a grant from the Rural Business-Cooperative Service, U.S. Department of Agriculture. These organizations do not recommend or endorse products, companies, or individuals. NCAT has offices in Fayetteville, Arkansas, Butte, Montana, and Davis, California.





©2005Clipart.com

breeding to meet the needs of a more sustainable agriculture.”(2) This followed several decades of privatization of genetic resources (chiefly through patenting of “intellectual property”), a trend bitterly resisted in parts of the world with the greatest biodiversity and where indigenous people had selected and saved seed for thousands of years.(3) By 1990 China had banned plant hunters from its remote interior and refused to export viable seed of certain native medicinal plants (such as dong quai) to supply a potential industry in the West. India, with plans to become self-sufficient in seed production, and perhaps become a major exporter, considers indigenous seed genetics to be national intellectual property rights, and it has vigorously resisted Western patent encroachment. In a landmark decision on March 8, 2005, the European Patent Office (EPO) upheld the revocation in its entirety of a patent on a fungicidal product derived from seeds of the Neem, a tree indigenous to the Indian subcontinent. (For more information, see [www.grain.org/bio-ipr/?id+435](http://www.grain.org/bio-ipr/?id+435).)

The Michael Fields Agricultural Institute (MFAI), a planner of the 2003 U.S. Summit and strong advocate of seed breeding in the public interest, summarizes some implications for U.S. farmers of the shift toward privatization.

In the last century [1901–2000] a large portion of the breeding of food and feed crops was done by the public sector (universities and USDA). However, in the last two decades, as changes in ownership and patenting laws have come about, large agrichemical-pharmaceutical companies have purchased smaller seed companies, leading to greater concentration with a strong focus on biotechnology.(4)

MFAI asserts that, at the same time,

Public expenditures in breeding have declined, and there has been an erosion within public institutions in their ability to breed[plants] and [to] train breeders.(4)

Dillon (a Breeding Summit participant) provides a fuller rationale for the decline in public expenditures.

Public seed breeding efforts, once predominantly in the public sector through

land grant universities, have moved increasingly to consolidated private seed companies. Factors precipitating this shift include changes in university funding with greater private linkage and an increased focus on genomics [implying genetic manipulation of seed to induce desired traits].(2)

## How is seed produced for the market?

Commercial seed production starts with a breeder who develops a new variety. A portion of the original “breeder stock” always stays in the hands of the person who has developed that variety. Considered the purest form, breeder stock constitutes the “gold standard” for that variety, according to Dr. Jeff McCormick. A portion of the breeder stock becomes the parent of a larger quantity of foundation stock. The institution associated with the breeder controls the production of foundation stock, and in turn supervises production of registered seed for distribution to licensees, such as seed companies. These companies, in turn, contract (often with farmers) for a large quantity of certified seed. The final stage is production of seed from parent stock of certified (or select) seed for general distribution through commercial channels, although certified seed may be the final stage for large-scale grain production. *Select* is a term used more for vegetable seed, comparable to *certified* for grains.(5)

For information on university foundation seed stock programs, see the Web sites of most land-grant universities. Seed companies routinely drop older varieties in favor of new ones (often hybridized, plant variety protected, and, sometimes, patented). This practice gave rise in the 1980s to grassroots efforts—epitomized by organizations like the Seed Savers Exchange (SSE)—to preserve older varieties through seed-saving networks. SSE organized backyard gardeners to raise and distribute seeds of heirloom vegetable crops that might be especially adapted to discrete geographical regions, might form part of the heritage of an indigenous (or other) population, and, most important of all, could be saved by the grower from year to year because they are “open-pollinated” (self-pol-

linated or vectored from another plant of the same type) rather than hybrid (produced artificially by controlled cross-breeding).

Commercial-scale organic production requires seed stocks (both open-pollinated and hybrid) with proven reliability—especially natural resistance to insects and diseases, as well as natural vigor to germinate promptly and out compete weeds. Good flavor and quality typically are considered more important than shippability. Additional attributes making for successful organic propagation are beginning to be identified.(1)

Recently, organizations such as the Organic Seed Alliance (OSA) and the Public Seed Initiative (Cornell) have outlined a new public participatory model for breeding organic seeds. The model aims to strike a middle course between the inexperience of seed-saving farmers and any special-interest bias in formal research. Prior to training, farmers often lack the skills to select traits important for enhancing organic production. They may also lack resources to carry on multi-year development of seed lines. Leaving the research agenda in the hands of institutions simply accelerates the movement toward genomics and patentable outcomes.

In 1999 the Northern Plains Sustainable Agriculture Society (NPSAS) undertook a three-state farmer-driven, participatory breeding program for organic varieties that is still ongoing. See [www.npsas.org/Breeding-Club.htm](http://www.npsas.org/Breeding-Club.htm) for information on NPSAS's Farmer Breeding Project and organic variety trials, funded by USDA's Sustainable Agriculture Research and Education (SARE) program and the Organic Farming Research Foundation (OFRF). Another ongoing project is Oregon Tilth's ambitious Farmer Cooperative Genome Project.

Other universities and organic seed companies are beginning to work with genetically diverse, open-pollinated plant populations, as well as hybrids, to breed varieties with multiple traits conferring "horizontal resistance," ideally suited to organic production.

Workshops, many funded by USDA/SARE grants, are reaching farmers around the

country, to explain the objectives and techniques of "participatory breeding" and seed saving. By 2004 this approach was bearing fruit in the Pacific Northwest, led by Wild Garden Seeds, Philomath, Oregon—one of the more advanced among the small group of breeders focused on re-introducing disease resistance into popular strains of lettuce and kale for organic production.(7) On 11 acres of certified organic trial ground, Washington State University wheat breeder Stephen Jones has developed wheat varieties suited to organic production in the Pacific Northwest by drawing samples of pre-1950 wheats from seedbanks and crossing them to modern lines, to take advantage of improvements but retain traits important in the era preceding chemical agriculture. Five varieties are already consistently producing higher yields for Washington state organic wheat farmers, but release of the new varieties is still several years off.(7, 8) The University of Minnesota has identified hard red spring wheat cultivars for organic production.(9) Other innovators include Lindsey du Toit, Washington State University horticulturist, and John Navazio of OSA.

Seeds of Change is leading the way in developing summer squash for organic production, especially zucchinis, emphasizing large canopies to shade out weeds, resistance to weather swings, adequate yields, and flavor. A preliminary evaluation of heirloom varieties at Cornell under organic conditions has identified a forgotten cantaloupe with superior flavor. 'Hannah's Choice' thrives under organic conditions, when grown for local markets and not for long-distance shipping.(7)

### **Farmer compensation**

Exactly how farmers participating in breeding the new organic varieties will be compensated for their time is not clear, except that the farmers will ensure organic versions of their favorite regional varieties for their own use. Neither has anyone offered a clear distribution model for the new varieties. One possibility is the collaborative model (like the California Sweet Potato Growers Group that distributes the virus-free planting material produced by University of California research



## How Farmers Can Participate in Horizontal Selection and Breeding

Professional plant breeders have never focused on breeding for horizontal resistance, at least for the past 65 years. During the 1960s, many plant breeders also began to doubt the profitability of breeding for vertical resistance (narrow selection for one or very few specific traits). The commercial life of most vertically resistant cultivars was too short to justify the amount of necessary work. The short market life of new introductions, combined with the development of improved crop protection chemicals and the financial involvement of chemical industries in breeding, led to abandonment of resistance breeding altogether, in favor of crop protection by chemicals. At present, the world spends about nine billion dollars annually on pesticides. Despite this, pre-harvest crop losses due to pests and diseases are estimated at 24 percent. In food crops alone, these losses are enough to feed about one billion people.

The only effective means of overcoming corporate and scientific opposition to horizontal resistance (broad selection for an array of resistance traits) is to make plant breeding as public and as widespread as possible. Fortunately, breeding crops for horizontal resistance can be undertaken in the public interest, according to R.A. Robinson, author of the seminal work *Return to Resistance: Breeding Crops To Reduce Pesticide Dependency*.<sup>(6)</sup> Robinson envisioned breeding groups composed of farmers, hobby gardeners, green activists, environmentalists, or university students, working with a reasonably wide genetic base of susceptible plants. It is not necessary to find a good source of resistance, as when breeding for vertical resistance. *Transgressive segregation* within a population of susceptible plants will usually accumulate all the horizontal resistance needed. Should this not occur, merely widening the original genetic base will probably remedy the situation. Transgressive segregation, a common term in plant breeding, is “the segregation of individuals in the F<sub>2</sub> or a later generation of a cross that shows a more extreme development of a character than either parent gene.” (See [www.desicca.de/plant\\_breeding/Dictionary\\_T/dictionary-t.htm](http://www.desicca.de/plant_breeding/Dictionary_T/dictionary-t.htm).) In other words, after the initial cross, in successive generations desirable traits and combinations of traits tend to become more pronounced in certain individual plants.

A second step is the use of recurrent mass selection as a breeding method. Robinson originally recommended about ten to twenty original parents. Dr. Jeff McCormick, of Garden Medicinals and Culinaries, recommends fifty to one hundred, usually high-quality modern cultivars, but also some older landraces, for exposure to cross-pollination in all combinations. The progeny should total some thousands of individuals that are screened for resistance by being cultivated without any crop protection chemicals. The majority of this early screening population dies, and the insect and disease pests do most of the work of screening. The survivors become the parents of the next generation. This process is repeated until the research group determines that enough horizontal resistance has accumulated. Usually, 10 to 15 generations of recurrent mass selection will produce high levels of horizontal resistance to all locally important pests. The process could take ten to fifteen years in temperate climates, but less where more than one cycle per year could be realized. McCormick has recently streamlined the process suggested by Robinson in 1996 to about five generations.

Recurrent mass selection must be performed “on-site”—that is, in the area of future cultivation, at the time of year of future cultivation, and according to the future farming system (i.e., organic production). This will produce new cultivars that are in balance with the local agro-ecosystem.

only to its members). Plant breeding clubs share seeds among their own members, and the membership model has emerged as the preferred method for organic farmers to obtain transplants. The Organic Seed Alliance calls for “developing new relationships and exploring novel avenues of collaboration to bring quality seed to the organic movement.”<sup>(10)</sup> In the U.S., plant breeding clubs generally include a group of farmers assisted by a university researcher or other technical assistance provider.

The Northeast Organic Farming Association of New York (NOFA-NY) continues to work

with Cornell University in Cornell’s Public Seed Initiative, under a 2004 USDA organic farm research grant, for expansion of on-farm vegetable breeding, on-farm trials, and farmer education to develop and deliver improved vegetable varieties for organic systems. According to a NOFA-NY newsletter,

[A]ppropriate procedures to manage the transfer of these materials [vegetable germplasm] between breeders and to our trialing network are in place that preserve the originators’ rights, if desired.<sup>(11)</sup>

## **Issues with the conventional seed industry**

Heretofore, the increasingly consolidated seed industry has served as the main engine of commercialization and distribution of new introductions by producing certified (for grain crops) and registered (for vegetable varieties) seed. The industry has sought greater returns for its crucial service by acquiring intellectual property rights to seeds of unique varieties, limiting the number of varieties sold, and most significantly, finding advantageous legal or legislative avenues. A main attraction of biotechnology for seed companies is enhanced worldwide market share, not improved yields (as the case of Bt corn has shown). Accordingly, Gunnar Rundgren, president of the International Federation of Organic Agriculture Movements (IFOAM)—concurring with the assessment of World-Watch Institute— asserts that

in the case of GMOs (genetically modified organisms) there are no benefits for either consumers or producers—only for the companies producing and selling them. If farmers feel they need herbicide-resistant varieties, that is because they are locked into a production system that depends on chemical inputs... [a system] that leads to further degradation of the environment, increased dependency of farmers and more risks for everybody.(12)

Acquisition of exclusive ownership of seed varieties is limited under the 1970 Plant Variety Protection Act, which safeguards the rights of farmers and gardeners to use their own saved seed, and the rights of plant breeders to use PVP varieties for breeding new varieties, while affording seed developers a means to recoup their investment. Lobbying groups demanded protection for small farmers in the PVPA legislation. Seedsaving farmers and gardeners had become concerned by the European ban on many traditional open-pollinated varieties as part of a program of varietal “standardization.”

However, under an obscure 2001 U.S. Supreme Court decision (*Pioneer Hi-Bred International vs. J.E.M. Ag Supply*), companies for the first time could freely patent plant varieties under the 1795 U.S. Utility Patent law, without any reservations to pro-

tect small growers or farmers who wished to save (and sometimes sell) seed from their own crops.(13) So far, this has affected mainly U.S. commodity grain crops. At the end of 2004, owners of patents on genetically engineered varieties had filed 90 lawsuits, involving 147 farmers and 39 small businesses, alleging seed patent violations.(14)

## **Issues in organic seed sourcing for commercial growers**

In setting as a key goal for the future of public breeding, “development of ‘a road map for invigorating public domain plant and animal breeding to meet the needs of a more sustainable agriculture,’” the 2003 Seed Summit committed itself to the totally new area of breeding for organic production. In doing so, it shifted ground beyond increasing the supply of currently available varieties of organic seed to developing new varieties designed specifically for organic production.

## **Two major regulatory issues that directly affect U.S. organic farmers**

### ***Should U.S. organic producers be required to use organic seed?***

Seed companies complain bitterly that for the past two years organic farmers have used the availability exemption in the USDA/NOP standards to avoid buying organic seed. Organic seed may be more expensive, and farmers may have to go outside their usual seed sources to find it. Farmers also say that organic seed is simply not available for their preferred varieties. Because the rule that encourages the planting of organic seed is relatively new, many types of organic seed have been in short supply. This situation is improving, as organic production for the seed market grows. Organic certifying agents differ in their interpretations of this regulation, which simply states that the producer must use organically grown seeds except “when an equivalent organically produced variety is not commercially available.” Some certifiers require only that a farmer document

**S**ee the new IFOAM publication, *Genetic Engineering vs. Organic Farming*, at [www.ifoam.org](http://www.ifoam.org).

three instances in which seed companies that are likely sources for organic seed cannot provide a specific variety. Where a farmer has found organic seed of the desired variety, but it is of poor quality, some certifiers have not required the farmer to use the low-quality seed (i.e., seed with poor germination, low purity, low test weight, etc.). In this instance, the certifier is interpreting the word “equivalent” in the rule to include seed quality characteristics. The quality problem occurs mainly when an organic farmer attempts to use “bin-run,” on-farm produced seed that is not certified.

However, in 2005 NOFA-NY began cautioning its certified organic farmers (mainly vegetable growers) to use organic seed. In the fall of 2004 NOFA staff compiled an updated organic seed list that included organic varieties available in 2005 and comparable conventional varieties.(11) For certified organic farmers in the U.S. as a whole, the access problem seems to have been solved for now by the certified organic sourcing service the Carolina Farm Stewardship Association’s Save Our Seed Project has begun providing to growers.(15)

Any grower who wants to plant certified organic seeds may submit a list of the cultivars/ varieties sought, along with the quantity needed. CFSA’s Save Our Seed Project will then send to the grower a list of all of the certified organic sources for every cultivar. If no sources exist, the project will send the grower full documentation of this circumstance, for the grower’s certification agent.

Organic cultivars are currently available for seeds, tubers, and rootstocks. Not available for 2005 are mixtures (for example, mesclun), trees, and seedlings. Growers can submit lists by FAX (706-788-0071), mail (Carolina Farm Stewardship Ass’n, 49 Circle D Dr., Colbert, GA 30628), or e-mail ([sourcing@savingourseed.org](mailto:sourcing@savingourseed.org)).(15)

The American Seed Trade Association (ASTA) has recently met with NOP to request that NOP manage an organic seed database. According to the *Organic Observer*:

ASTA would like to see an interactive database established to provide real-time access to seed suppliers and the public regarding availability of organic seed varieties. ASTA also requested that certifiers

be required to supply monthly reports on exemptions granted for non-organic seed. NOP indicated that they are willing to sponsor a database, but are expecting ASTA to provide the data. NOSB members [present] questioned the scope of this project.(16)

The problem of varietal “equivalence” has emerged mainly in vegetable production. Seed companies acknowledge that many, practically identical vegetable varieties are sold under different names by different suppliers—in part to get around trademark or copyright issues. Growers have apparently been claiming to their certifiers that an organic variety under a different name is not equivalent to their preferred variety. (Seed companies have favored interpretation of the regulation as “kind,” rather than “variety” equivalence. For more on this question, see the statement by Rob Johnson, at [www.johnnyseeds.com](http://www.johnnyseeds.com).) Other farmers argue that high prices alone exempt them from using organic seed.

Some farm support organizations counter that farmers should be willing to pay higher prices to support the efforts of seed companies to produce organic versions of the major crops. An article in *The Land* asserts that there is no shortage of any type of organic seed for 2005 for Minnesota farmers, and they should voluntarily use organic seed.(17) Some farm support groups (and the American Seed Trade Association’s Organic Division) have proposed an integrated national database of organic seed availability to forestall the “three-call” rule-of-thumb. The hard question of determining “equivalence” remains, but it should subside with increased availability of varieties especially bred for organic production.

***Should testing be required to insure that seed producers do not use or distribute seed that may contain unintended genetically modified material?***

Requiring testing for GM material is another contentious issue. Some organic grain producers have had export lots rejected by foreign buyers because the lots were contam-

inated with GMOs. The sheer number of GMOs that have migrated into U.S. food crops leaves the organic industry in a quandary. It's an immediate problem for crops such as canola, soy, and corn, where GMO varieties predominate, and it threatens potential migration of stray GMO material to related weeds and nearby food crops. Two schools of thought have proposed two different solutions.

The American Seed Testing Association favors a system of testing organic seed to certify it as GMO-free before it can be planted or sold. On the other hand, the American Seed Trade Association guidelines include this statement:

ASTA strongly supports that organic certification under the NOP is a process, not product certification. . . . ASTA strongly maintains that any movement toward organic seed testing or product certification is not only counter to USDA and NOP policy, but also the U.S. seed industry and organic producers at large. It is well recognized in numerous food and agricultural production standards, including organic standards, that zero is not possible. Furthermore, any movement by seed producers to respond to such unrealistic market demands will not only undermine the viability of the U.S. government's organic policy but could erode the U.S. seed industry's future participation in the organic market.(18)

New procedures are increasingly able to identify GMOs, even in large quantities of seed, with a high degree of accuracy. Some U.S. export grains are tested, and many suppliers of organic grain seed verify that their stocks are free *only to a certain tolerance level* (usually .05 or .01). Tolerances have yet to be set by NOP. Monsanto recently conducted a lab analysis seminar at its St. Louis facility to demonstrate the latest methods of detection. European scientists have detected GMOs in 100% of samples tested.(19) Iowa State University has developed a new software program, using weather data and other geographical parameters, that can predict genetic purity at harvest for hybrid corn in the field, to aid farmers in marketing decisions.(20)

A big problem for on-farm seed producers is that certain crops with GMO analogues already exhibit pervasive, low-level GMO contamination. According to a 2004 study conducted by the Union of Concerned Scientists (UCS) on conventionally produced U.S. soybeans, canola, and corn, representing a wide array of popular varieties with no history of genetic engineering, "more than two-thirds of 36 conventional corn, soy, and canola seed batches contained traces of DNA from genetically engineered crop varieties." The report concluded, "The US may soon find it impossible to guarantee that any portion of its food supply is free of gene-altered elements, a situation that could seriously disrupt the export of US foods, seeds, and oils. Many believe it could also gravely harm the domestic market for organic foods." The lab tests were commissioned by UCS and conducted on certified seed.(21) Many scientists, universities, farmers, and other have questioned plans for GMO wheat. Canola is a major oilseed; domestic corn and soybeans are major ingredients in many products—including starches, emulsifiers, and animal feeds.

Some sources have suggested that bacteria can spread GMO material from a genetically engineered crop to a nearby unrelated crop or weed. In fact, this mimics the process used in genetic engineering.(22)

These developments raise serious questions about geographically indiscriminate on-farm production of organic seedstocks for grains and oilseeds. Moreover, many varieties of GE crops—including "pharmacrops"—are being grown as trial crops in undisclosed locations in the U.S.(23) As a result, some western organic growers increasingly discriminate among seed suppliers.(24)

### **Industry positions on testing for GMOs**

Organic spokespeople like Jim Riddle, recently elected to chair the National Organic Standards Board, point out that required testing for GMOs would deeply alter the concept of organics from a process-based system to a testing system. (This is also the position of ASTA.) However, there is a marketing issue.





The public now believes organic is 100% GMO-free. Will the public accept a chance of pharma-crop “pig vaccines” in its organic corn flakes? Or will it demand testing?

A system of tolerances for GMO contamination may eventually need to be established for certified organic crops—especially wind-pollinated crops like some grains and oilseeds.(25) Governmental agreements, especially on harmonization of organic standards, would open the door for U.S. organic farmers to participate in foreign trade. Other suggestions include setting aside areas of the world still remote enough to produce foundation stock of wind-pollinated crops or establishing a U.S. government public seed bank of pure stock (before it is too late).

### **Quality issues in farmer-saved and -traded seed vs. purchased commercial seed**

The highest quality grain seed sold to farmers is “certified,” with minimum standards for purity, germination, test weight, trueness to type, and absence of physical damage. Ideally, seed for planting organic grain crops would be both “certified” and “certified organic.” Shortages of certified organic grain seed have sometimes led farmers to use “bin-run” seed from a nearby organic farm or from a previous year’s harvest that (while it is “certified organic”) may contain light or broken seed, weed seed and other foreign matter, or pathogens. Such seed is also likely to germinate poorly. This is not invariably the case, of course. According to many certifiers’ interpretations of NOP regulations, farmers can by-pass available low-quality organic seed in favor of untreated conventional seed of higher quality.

#### ***Value in going back to certified seed every few years if you save your own***

Although Canadian farmer Percy Schmeiser asserts that he selected and saved seed most of his 35 years of growing canola crops—thereby developing a landrace adapted to Saskatchewan conditions—the unfavorable out-

come of the internationally publicized court case in which he was involved with Monsanto underscores the advisability of commercial farmers going back every few years to a reliable source of organic seed of their preferred variety. This practice guards against disease buildup, inadvertent contamination of the stock, and reversion of the crop to undesirable traits. This reliable source can be certified seed from a conservator university or commercial seed company. Jeff McCormick, a pioneer new-breed seed company owner, has suggested that vegetable farmers growing a contract seed crop may find it to their advantage to go back to the company every year for “select” (certified) seed for the vegetables they are raising for market, as well.(5)

### **The global picture**

While European Union (EU) and global standards are beyond the scope of this publication, there was extensive discussion of the need for global harmonization of organic standards at the 2004 World Seed Conference in Rome. (See *Proceedings* at [www.ifoam.org](http://www.ifoam.org).) Differing standards, of course, affect trade policy, and intense negotiations between the U.S. and the European Union continue. As of 2005, some GMO plantings in Europe, as well as exports of U.S. Bt corn to Europe, had been approved.

Another major issue at the World Seed Conference was intellectual property rights, or the implications of governmentally approved lists of permitted varieties. This is a special concern for traditional farmers in many countries, who are used to saving seed from year to year and have over the centuries developed unique landraces. A recent example is in Iraq, where a new report by GRAIN and Focus on the Global South cites a U.S. edict in occupied Iraq that “prevents farmers from saving their seeds and effectively hands over the seed market to transnational corporations.” (See [www.grain.org/nfg/?id+253](http://www.grain.org/nfg/?id+253).) This was also reported in *In Good Tilth*, February 2005.(26)

Traditional practices of indigenous farmers are mostly compatible with organic produc-



tion: planting a mix of adapted types (landraces) to ensure some survivors, despite vagaries of weather and insect/disease attacks; use of older varieties geared to minimizing capital investment; hand-harvesting and other labor-intensive practices precluded by modern, uniform, machine-harvestable varieties; and use of labor-intensive crop protection strategies like hand weeding and watering, rather than purchased off-farm inputs. For information on breeding in Europe compared to the U.S, see *SeedWorld*, November 2004.(27)

But can hand labor feed burgeoning urban populations, or is it a relic of a younger, less densely populated Earth, where 98% of people grew their own food? In the best of all possible worlds, a blend of traits uniquely adapted to organic production (not only resistance to local pests and diseases, but improved vigor and flavor) will result from horizontal breeding. This implies a far more decentralized food production system than we have at present.

For a more detailed comparison of the different positions taken by the European Seed Association and the American Seed Trade

Association—especially in regard to trialing and proprietary rights—see the handy table in the November 2004 issue of *SeedWorld*.(27)

Geography of organic seed production has ramifications mainly in the context of GMOs. Spain and Italy raise seed for the rest of Europe. Traditionally U.S. garden seed has been produced in Idaho and other arid West Coast and Intermountain regions. Relative severity of pest and disease pressures is a major consideration in producing quality seed. However, labor costs for seed production became an issue in the 1980s, leading to seed production for commercial growers as far away as Taiwan and Argentina—a development worrisome on several counts, not the least of which is the newly announced Chinese plan to invest billions of dollars in Argentina and Brazil in return for access to land and natural resources, an agreement finalized at the recently concluded (December 11, 2004) Summit in Chile. Argentina has been identified as an emerging leader in GMO crop production.(22)

### Section from the National Organic Standards.

#### What the New Rule Says

- a) The producer must use organically grown seeds, annual seedlings, and planting stock, Except, That,
  - 1) Nonorganically produced, untreated seeds and planting stock may be used to produce an organic crop when an equivalent organically produced variety is not commercially available. Except, That, organically produced seed must be used for the production of edible sprouts;
  - 2) Nonorganically produced seeds and planting stock that have been treated with a substance included on the National List of synthetic substances allowed for use in organic crop production may be used to produce an organic crop when an equivalent organically produced or untreated variety is not commercially available.
  - 3) Nonorganically produced annual seedlings may be used to produce an organic crop when a temporary variance has been granted in accordance with §205.290(a)(2);
  - 4) Nonorganically produced planting stock to be used to produce a perennial crop may be sold, labeled, or represented as organically produced only after the planting stock has been maintained under a system of organic management for a period of no less than 1 year; and
  - 5) Seeds, annual seedlings, and planting stock treated with prohibited substances may be used to produce an organic crop when the application of the materials is a requirement of Federal or State phytosanitary regulations.

—National Organic Rule §205.204, *Seeds and planting stock practice standard*  
[www.ams.usda.gov/nop/](http://www.ams.usda.gov/nop/)

Much of the U.S. supply of grain seed is contaminated with GMOs. From tests conducted on commercial-grade certified seed, The Union of Concerned Scientists, Washington, D.C., concluded that “more than two-thirds of 36 conventional corn, soy and canola seed batches contained traces of DNA from genetically engineered crop varieties in lab tests commissioned by UCS.” Moreover, UCS warned that “The US may soon find it impossible to guarantee that any portion of its food supply is free of gene-altered elements, a situation that could seriously disrupt the export of US foods, seeds, and oils.”(21)

## Tubers and alliums

Commercial growers rarely try to produce their own starts or sets; they rely on specialized suppliers or on grower associations to provide high quality propagation material each year. (For more information on how this works for sweetpotato starts, see the section on cultivars and propagation in the ATTRA publication *Sweetpotato: Organic Production*. Also see <http://fps.ucdavis.edu/sweetpotato/background.html>.) In 2004 growers temporarily obtained organic vegetable starts from their associations or even from state departments of agriculture, in the absence of commercial production.

## Handling issues

Recently, the Saving Our Seeds Project, with funding from USDA’s Sustainable Agriculture Research and Education Program, has published several detailed seed production guides, including *Seed Processing and Storage*. These publications are available on the SOS Web site, [www.savingourseed.org](http://www.savingourseed.org). They are

### Seeds for sprouting

The National Organic Standards require that seeds for producing organic sprouts be organic, with no “availability” exception. In late 2004 the U.S. Department of Health and Human Services announced plans to overhaul regulations (set in 2000) for the production of all sprouts and seeds intended for sprouting, to reduce microbial food safety hazards. No report is expected for some time. Some states also regulate production and handling of seeds for sprouting. For a comprehensive treatment of sprouting seeds and additional sources of information, see the ATTRA publication *Sprouts and Wheatgrass Production*. For food safety information involving production of sprouts, see <http://ucfoodsafety.ucdavis.edu>.



©2005Clipart.com

being distributed at a series of SARE-funded farmer workshops and are also available on CD from Saving Our Seed, Carolina Farm Stewardship: Order by fax (706-788-0071), mail (Carolina Farm Stewardship Ass’n, 49 Circle D Dr., Colbert, GA 30628), or e-mail ([cricket@savingourseed.org](mailto:cricket@savingourseed.org)).

Topics covered in the handling publication include dry processing, wet processing, threshing and cleaning equipment, storage and longevity, seed dormancy, germination enhancement techniques, labeling, record-keeping, shipping, and federal and state seed laws.

## Conclusion

The trend toward globalization, centralization, standardization, uniformity, substitution of capital for labor (and even for management) in agriculture underlies many of the seed conundrums that organic agriculture faces. Most new seed varieties in the West have come out of university research, funded by industry. A countermovement is gathering momentum to protect indigenous landraces from Western patents by securing intellectual property rights for traditional landraces/genetics that have been improved over thousands of years by indigenous farmers. Many grassroots seed conservation groups are saving varietal types from mandated extinction. Solutions are emerging for specific procedural issues that have arisen with the implementation of the USDA National Organic Standards—such as equivalence and perhaps even testing, as well as setting tolerances for

GMO presence. The farmer-led move toward developing specific varieties for organics through participatory breeding, while in its infancy, is well underway.

## References

- (1) Colley, Michaela, and Matthew Dillon. 2004. The next great challenge: Breeding seed for organic systems. *Organic Farming Research Foundation Information Bulletin*. Winter. p. 1, 4, 5, 29.
- (2) Dillon, Matthew. 2003. E-mail attachment. Summit on Seeds and Breeds for 21st Century Agriculture, Washington, DC, September 6–8, 2003. 3 p.
- (3) Kelemu, Segenet, et al. 2003. Harmonizing the agricultural biotechnology debate for the benefit of African farmers. *African Journal of Biotechnology*. October. 50 p. [www.academicjournals.org/AJB/manuscripts/manuscripts2003/](http://www.academicjournals.org/AJB/manuscripts/manuscripts2003/)
- (4) Staff. 2003. MFAI participates in summit on seed breeding in the public interest. MFAI newsletter. September. p. 1. [www.michaelfieldsagainst.org](http://www.michaelfieldsagainst.org)
- (5) McCormick, Jeff. 2005. “Saving Our Seed” Conference, Twin Oaks, Louisa, VA, February 24, 2005. *Dr. McCormick is founder and previous owner of Southern Exposure Seed Exchange, and current owner of Garden Medicinals and Culinaries. He has also served on the Board of Directors of the Seed Savers Exchange.*
- (6) Robinson, R.A. 1996. *Return to Resistance: Breeding Crops To Reduce Pesticide Dependency*. AgAccess, Davis, California, and IDRC Books, Ottawa, Canada.
- (7) Rich, Deborah K. 2004. Seed crossings bring back old traits for organic farmers. *The Chronicle*. August 28. 3 p. [www.SFGate.com](http://www.SFGate.com)
- (8) Jones, Stephen. 2004. Breeding resistance to special interests. *OFRF Information Bulletin*. Fall. p. 4–7.
- (9) Kandel, Hans, and Paul Porter. 2004. Small grain cultivar selection for organic systems. *The CornerPost*. Fall. p. 11. *Includes table of varieties. For more information, contact Hans Kandel at kande001@umn.edu*
- (10) Staff. 2004. Of note. *Organic Trade Association News Flash*. February 4. p. 2.
- (11) NOFA certification staff. 2004. NOFA-NY Certified Organic, LLC. *Organic Farms, Folks & Foods*. Mid-Fall. p. 5.
- (12) Rundgren, Gunnar. 2003. EU organic seed regulation adapts to reality. *The Organic Standard*. July. p. 16.
- (13) Guebert, Alan. 2001. Supreme Court blesses plant patents; bye-bye bin-run seed. *The Land (MN)*. December 21. p. 3.
- (14) Center for Food Safety. 2005. *Monsanto vs. U.S. Farmers*. [www.centerforfoodsafety.org/press\\_release1.13.05.cfm](http://www.centerforfoodsafety.org/press_release1.13.05.cfm)  
Also: Staff. 2005. Corporate farming notes: *Monsanto vs. U.S Farmers* report released. *Center for Rural Affairs*. February. p. 3.
- (15) Organic Trade Association Staff. 2005. *News & Trends: Sourcing Organic Seed*. *The Organic Report*. p. 7.  
Also: Rakita, Cricket. 2005. Seed sourcing. *Carolina Farm Stewardship News*. March–April. p. 4. [www.savingourseed.org](http://www.savingourseed.org)
- (16) Staff. 2004. Database development. *The Organic Observer*. December. p. 3.
- (17) King, Tim. 2004. Growing organic seed fits farm’s rotation. *The Land*. December 17. p. 9A–11A.
- (18) Condon, Mark. 2003. The View of the American Seed Trade Association on Organic Agriculture. p. 2. [www.amseed.com/newsDetail.asp?id+74](http://www.amseed.com/newsDetail.asp?id+74)
- (19) Staff. 2004. Genetic ID Augsburg receives perfect scores in ISTA proficiency test. *The Non-GMO Source*. August. p. 15.
- (20) Brook, Rhonda J. 2002. Pollen tracker. *Farm Industry News*. mid-February. p. 30–32.
- (21) Mellon, Margaret, and Jane Rissler. 2004. *Gone to Seed: Transgenic Contaminants in the Traditional Seed Supply*. *Union of Con-*

cerned Scientists. Washington, DC.  
p. 33, 36–47.  
Also:, Phillabaum, Larry. 2005. Change  
blows in on the wind: Pollen from trans-  
genic grass runs amok in Oregon. In Good  
Tilth. February 15. p. 12.  
*Transgenic effects were found outside the  
genus of the test grass and 13 miles distant.*

- (22) Cummings, Claire Hope. 2005. Trespass.  
WorldWatch. January–February.  
p. 24–35.
- (23) Staff. 2005. Government forced to disclose  
locations of test sites of biopharmaceutical  
crops [in Hawaii]. February 8.  
[www.centerforfoodsafety.org/  
press\\_release2.8.05.cfm](http://www.centerforfoodsafety.org/press_release2.8.05.cfm)
- (24) Lipson, Mark. 2005. Presentation to NCAT  
staff. April 6.
- (25) Staff. 2004. Should there be a GMO tolerance  
for organic? The Non-GMO Source. April.  
p. 1–2.
- (26) Staff. 2005. Iraq’s patent law hurts farmers. In  
Good Tilth. February 15. p. 20.
- (27) Dansby, Angela. 2004. EU vs. US: Is a com-  
promise position possible? Research  
exemptions and patents sticking points.  
SeedWorld. November. Chart. p. 9.

## Further Resources

---

### **Organic seed production materials**

- Bean Seed Production: An Organic Seed  
Production Manual  
[http://www.savingourseed.org/pdf/  
BeanSeedProductionVer\\_1pt4.pdf](http://www.savingourseed.org/pdf/BeanSeedProductionVer_1pt4.pdf)
- Isolation Distances  
[http://www.savingourseed.org/pdf/  
IsolationDistancesVer\\_1pt5.pdf](http://www.savingourseed.org/pdf/IsolationDistancesVer_1pt5.pdf)
- Seed Processing and Storage  
[http://www.savingourseed.org/pdf/  
SeedProcessingandStorageVer\\_1pt3.pdf](http://www.savingourseed.org/pdf/SeedProcessingandStorageVer_1pt3.pdf)
- Tomato Seed Production: An Organic Seed  
Production Manual  
[http://www.savingourseed.org/pdf/  
TomatoSeedProductionVer\\_2pt6.pdf](http://www.savingourseed.org/pdf/TomatoSeedProductionVer_2pt6.pdf)

Connolly, Bryan (with C.R. Lawn, ed.). 2005.  
Organic Seed Production and Saving.  
NOFA, Barre, MA.  
*Order handbook for \$7.95 plus 2.00 s/h from  
NOFA Handbooks  
c/o Elaine Peterson  
411 Sheldon Rd.  
Barre, MA 01005  
For more information visit  
[www.nofa.org](http://www.nofa.org).*

### **Participatory breeding for organics**

Pepper Genetics and Genomes  
[www.plbr.cornell.edu/psi/ppb.html](http://www.plbr.cornell.edu/psi/ppb.html)

Selfers and Crossers  
[www.growseed.org/selfersandcrossers.html](http://www.growseed.org/selfersandcrossers.html)

### **Organic seed research programs**

Cornell. Public Seed Initiative  
[www.plbr.cornell.edu/psi/ppb.html](http://www.plbr.cornell.edu/psi/ppb.html)

Organic Seed Alliance  
[www.seedalliance.org/classes.htm](http://www.seedalliance.org/classes.htm)

Seeds of Change  
[www.seedsofchange.com/market\\_growers/  
field\\_report\\_39.asp](http://www.seedsofchange.com/market_growers/field_report_39.asp)

Washington State University  
[www.wsu.edu/](http://www.wsu.edu/)

### **Other resources**

*If a source is not indicated, contact your local librarian to  
order the publication or article through Interlibrary Loan.  
Publications or articles cited in the text are not included.*

- Farmers Guide to GMOs  
*Available from*  
RAFI-USA  
274 Pittsboro Elementary School Road  
Pittsboro, NC 27312  
919-542-1396
- Journey to Forever.  
[Journeytoforever.org/seeds.html](http://Journeytoforever.org/seeds.html)  
Seed resources, library.
- Moeller, David R./Farmer’s Legal Action Group, Inc.,  
and Michael Sligh/Rural Advancement  
Foundation International. 2004. Farmers’  
Guide to GMOs. 51 p.  
[www.flaginc.org](http://www.flaginc.org)

## Books

2005 Non-GMO Sourcebook (global)

*500 suppliers of non-GMO products and services, including seeds and grains. Features non-GMO corn, soy, and canola grains and organic seeds. Also experts for GMO testing, identity preservation, and organic certification.* \$24.

800-854-0586

[ken@non-gmosource.com](mailto:ken@non-gmosource.com)

[www.non-gmosource.com](http://www.non-gmosource.com)

National Research Council. 2004. Biological Confinement of Genetically Engineered Organisms. National Academy of Sciences. 219 p.

Tokar, Brian (ed.). 2004. Gene Traders: Biotechnology, World Trade, and the Globalization of Hunger. Toward Freedom, Burlington, VT. 124 p.

Genetic Engineering vs. Organic Farming  
IFOAM.

*New periodical.*

## Articles

American Seed Trade Association. 2003. News Release: The view of the American Seed Trade Association on Organic Agriculture. 3 p.

[www.amseed.com/newsDetail.asp?id+74](http://www.amseed.com/newsDetail.asp?id+74)

Beck's Hybrids. 2003. Final Report: Promotion of Organic Seed and Farming Practices, USDA Block Grant for Promotion of Agriculture project. July. 22 p.

Bonina, Jennifer, and Daniel J. Cantliffe. 2004. Seed Production and Seed Sources of Organic Vegetables. University of Florida Extension. 18 p.

<http://edis.ifas.ufl.edu/HS227>

Brown, Greg. 2004. Commercial organic seed grower continues to spread the word. The Spudman. January. p. 28.

[www.spudman.com](http://www.spudman.com)

Colley, Micaela. 2004. Organic Seed Alliance hosts Organic Seed Growers Conference. 2 p.

[www.seedalliance.org/](http://www.seedalliance.org/)

[newsletter\\_Spr\\_04b.htm](http://www.seedalliance.org/newsletter_Spr_04b.htm)

Condom, Mark. 2004. Can organic and biotech coexist? AgBiotech Buzz: Roundtable. 4 p.

<http://pewagbiotech.org/buzz/>

DeVore, Brian. 2004. The secret lives of seeds. Land Stewardship Letter. April–June. p. 1, 14–15.

Dillon, Matthew. 2005. “We have the seeds”: Monsanto now the largest vegetable seed producer [with purchase of Seminis]. The Organic Broadcaster. March–April. p. 2–4.

Dillon, Matthew. 2004. Organic Seed Alliance hosts Organic Seed Growers Conference. The Seed Midden. Spring. p. 1, 5.

Dillon, Matthew. 2004. Breeding for organics. The Seed Midden. Winter. p. 3.

[www.seedalliance.org](http://www.seedalliance.org)

Dillon, Matthew. 2004. First World Conference on Organic Seed, Rome, Italy. New Farm. (2-part article). August. 8 p. September. 4 p.

[www.newfarm.org](http://www.newfarm.org)

DeVore, Brian. 2004. Public Seeds, Public Goods. Land Stewardship Project (compilation of newsletter articles). 11 p.

[www.landstewardshipproject.org/pdf/pubseeds\\_pubgoods.pdf](http://www.landstewardshipproject.org/pdf/pubseeds_pubgoods.pdf)

Glos, Michael. 2004. Public Seed Initiative News. The Natural Farmer. Fall. p. 8.

Haapala, J.J. 2004. A gardener's guide to blocking the bio-pirates. In Good Tilth. June 15. p. 8–9.

Hamilton, Molly. 2004. North Carolina Organic Grain Project. CFSA. September–October. p. 7.

High Mowing Seeds. 2005. Press release: All Things Organic Conference, April 30–May 3, 2005. 2 p.

[www.organicexpo.net](http://www.organicexpo.net)

Industries Research and Development Corporation (Australia). 2004. New rule to ensure integrity of organic vegetables. Shaping the Future for Australian Organics. p. 6. [www.rirdc.gov.au/pub/newsletters/organic/organic9.html](http://www.rirdc.gov.au/pub/newsletters/organic/organic9.html)

Jensen, Erika. 2004. A model of cooperation: Public Seed Initiative unites organic farmers, plant breeders. Organic Broadcaster. January–February. p. 1, 2, 9.

- Jones, Stephen. 2004. Breeding resistance to special interests. Organic Farming Research Foundation. Fall. p. 4–7.
- Kandel, Hans, and Paul Porter. 2004. Small grain cultivar selection for organic systems. CornerPost (MN). p. 11.
- Kittredge, Dan, and Hali Shellhause (transcribers). 2004. Vandana Shiva's Keynote to the 2004 NOFA Summer Conference. The Natural Farmer. Fall. p. 23–26.
- Lawn, C.R., and Eli Rogosa Kaufman. 2004. Organic Seed Crop Production: A new niche for New England farmers. 5 p. [www.growseed.org/niche.html](http://www.growseed.org/niche.html)
- Rauch, Jonathan. 2003. Will frankenfood save the planet? The Atlantic Monthly. p. 103–108.
- Rich, Deborah K. 2004. Essay: Seed crossings bring back old traits for organic farmers/Today's varieties grow poorly in natural soils. SFGate.com. August 28. 3 p. [www.sfgate.com](http://www.sfgate.com)
- Sonnabend, Zea. 2004. Report from Rome: World Conference on Organic Seed held at FAO headquarters. OFRF Information Bulletin. Fall. p. 9.
- Staff. 2002. Pollen tracker: New software program predicts the genetic purity of corn hybrids. Farm Industry News. p. 30. [farministrynews.com](http://farministrynews.com)
- Staff. 2003. Sociologist surveys public attitudes on food. The Voice of Demeter. Summer. p. 8–9.
- Staff. 2003. Public Seed Initiative update (Summer 2003). The Natural Farmer. Fall. p. 35.
- Staff. 2004. News briefs: Commercial seeds of major U.S. crops pervasively contaminated with DNA from engineered varieties.... Alternative Agriculture News. March. p. 2.
- Staff. 2004. Genetically engineered DNA found in traditional seeds. Michigan Organic Connections. January–March. p. 6.
- Staff. 2004. Research reports: Engineered DNA found in seeds. In Good Tilth. April. p. 24.
- Staff. 2004. News shorts: Sweden spreads the burden of organic seed. The Organic Standard. January. p. 11.
- Staff. 2004. What's new: Bayer withdraws GM crop. Organic Matters. May–June. p. 6.
- Staff. 2004. Seed merchants must be licensed and bonded. Tilth Producers Quarterly. Summer. p. 18.
- Staff. 2004. First world conference on organic seed held in Rome. OMRUpdate. Summer. p. 1, 7, 10, 11.
- Staff. 2004. Organic seed issues discussed at Rome meet. Organic Business News. July. p. 3.
- Staff. 2005. Organic corn hybrid and soybean varieties test in Wisconsin. The Organic Broadcaster. March–April. p. 5.
- Staff. 2005. Corporate Farming Notes: Monsanto vs. U.S. Farmers report released. Center for Rural Affairs Newsletter. February. p. 3.
- Williams, Paul. 2004. ATTRA Trip Report: CORNS Benefits for Earth's Low-Income Emergent Farmers conference, Stillwater, OK. Oct. 29–30. 2 p.
- Wisner, Robert. 2004. GE wheat would harm wheat exports. In Good Tilth. Feb. 15. p. 1.
- Wood, Robin, and Brian Smith. 2001. Organic vegetable seed production—more difficult than you think. 1 p. [www.hri.ac.uk/site2/news/news/organicseed.htm](http://www.hri.ac.uk/site2/news/news/organicseed.htm)

# Notes

### **Acknowledgements**

Oregon organic farmers Maud and Tom Powell offered several very helpful suggestions at an early stage of this publication. I greatly appreciate the expert assistance of Nancy Matheson, NCAT Agriculture Specialist, who intensively reviewed a later draft. Any errors that remain are solely my own. —KLA

*Seed Production and Variety Development for Organic Systems*

By Katherine L. Adam  
NCAT Agriculture Specialist  
©NCAT 2005

Paul Williams, Editor  
Cynthia Arnold, Production

This publication is available on the Web at:  
[www.attra.ncat.org/attra-pub/seed\\_variety.html](http://www.attra.ncat.org/attra-pub/seed_variety.html)  
or  
[www.attra.ncat.org/attra-pub/PDF/seed\\_variety.pdf](http://www.attra.ncat.org/attra-pub/PDF/seed_variety.pdf)

IP272  
Slot 273  
Version 061005