ORGANIC seed ALLIANCE

supporting the ethical development and stewardship of the genetic resources of agricultural seed

STATE OF ORGANIC SEED

2011

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USDA United States Department of Agriculture National Institute of Food and Agriculture

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Executive Summary

State of Organic Seed (SOS) is an ongoing project to monitor the status of organic seed systems in the United States. The project aims to develop diverse stakeholder involvement in implementing policy, research, education, and market-driven activities that result in the improved quality, integrity, and use of organic seed. Organic Seed Alliance (OSA), a national non-profit organization committed to the ethical development and stewardship of the genetic resources of agricultural seed, facilitates the project with the belief that developing and protecting organic seed systems is a top priority for organic food and farming.

This report is the first comprehensive analysis of the challenges and opportunities in building the organic seed sector. A planning team of farmers, non-governmental organizations (NGOs), certifiers, and food industry and seed industry representatives directed project activities. To collect information from a broad and diverse group of stakeholders, OSA and its partners conducted a series of surveys with farmers in 45 states, and gathered questionnaires from researchers, certifiers, food and seed industry representatives, and farm and food policy experts. OSA also hosted a full-day SOS Symposium to discuss data and prioritize next steps.

Why is the State of Organic Seed project important?

The USDA's National Organic Program (NOP) standards require the use of organically produced seed. Yet, even with the organic industry's impressive growth, the organic seed sector has not caught up to meet this demand. There is a limited availability of appropriate organically produced seed for a variety of reasons, including cutbacks in public plant breeding programs, lack of investments from the private sector, seed industry consolidation, and ongoing disagreement regarding implementing NOP requirements pertaining to organic seed, among others.

The lack of organically bred and produced seed is a barrier to the growth and ongoing success of organic farming. Seed is the critical first link in organic production, and provides farmers with the genetic tools to confront day-to-day challenges in the field. Organic systems have different challenges than conventional counterparts and have fewer spray-on solutions. Further investments in organic plant breeding will yield adapted genetics suitable to a range of pest and disease pressures, growing seasons, and flavor and nutrition needs. Organic seed that is appropriate for regional agronomic challenges, market needs, regulations, and the social and ecological values of organic agriculture is therefore fundamental to the success of organic farmers and the food system they supply.

As we work to build organic seed systems, other challenges must simultaneously be addressed. In crops for which there are genetically engineered (GE) counterparts (i.e., alfalfa, canola, corn,

cotton, soybeans, and sugar beets), organic seed increasingly contains detectable levels of GE material, a technology that is explicitly excluded in NOP regulations and rejected by the organic industry and consumers alike. The lack of federal protection for organic markets from GE contamination poses a serious risk to the credibility, viability, and success of organic farmers and the NOP.

Concentration in the seed industry is another challenge. The seed industry has consolidated quickly, concentrating the ownership of seed resources through corporate acquisitions and mergers and the restrictive use of utility patents. In addition to placing constraints on germplasm, this consolidation has decreased the number of regional seed and genetics firms with the potential to serve organic markets. Alternative intellectual property models that enhance innovation while protecting investments must be explored.

Key findings: Organic seed systems are improving but require increased attention and resources

SOS data shows that organic seed systems are developing. Farmers report increased attempts to source organic seed and more pressure from certifiers to do so. Research in organic plant breeding has increased slightly, with investments from both the public and private sector.

Still, challenges and needs loom large for expanding organic seed systems. While this project captured an array of priorities that varied by crop, region, and perspective of different professional sectors, overarching priorities are clear, including the need to:

- Develop seed systems that are responsive to the diverse needs of organic farmers through increased public-private collaboration.
- Refine understanding of organic plant breeding principles and practices.
- Engage the National Organic Program in policy initiatives that move organic seed forward.
- Reinvigorate public plant breeding with an emphasis on the development of cultivars that fit the social, agronomic, environmental, and market needs of organics.
- Protect organic seed systems from threats of concentrated ownership of plant genetics.
- Protect organic seed systems from threats of contamination from genetically engineered traits.
- Improve sharing of information in the areas of organic seed availability, lack of availability for specific varieties and/or traits, and field trial data.

- Create opportunities for organic farmers to work with professional breeders through trialing networks and on-farm plant breeding to speed the development of regionally adapted organic cultivars.

An important outcome of SOS is a general agreement from stakeholders that the challenges and opportunities to building organic seed systems are interwoven and demand comprehensive, collaborative approaches. Few priorities can move forward independently. The project has clarified the need for feedback loops to increase this collaboration within the organic community. As such, ongoing working groups will carry out the action items outlined in this report. Regional listening sessions and other follow-up meetings will move forward this discussion and work even further.

Introduction

The overall purpose of State of Organic Seed is to increase success and minimize risks for the organic farming and food sector by advancing the viability and integrity of organic seed systems.

State of Organic Seed (SOS) is an ongoing endeavor to monitor the status of organic seed systems in the United States. The project aims to develop diverse stakeholder involvement to implement policy, research, education, and market-driven activities that result in the improved quality, integrity, and use of organic seed for the benefit of organic farming and food systems. Stakeholders include organic farmers, the organic food sector and seed industry, accredited certifying agencies, regulatory agencies, researchers, educators, and public interest advocates.

Given the diversity of crops, scale, and regions in organic farming in the United States, there is an inherent complexity that must be accounted for in order to address organic seed issues in an integrated manner. We have striven for input and perspectives that reflect this complexity, including breeding, production, regulations, policy, and information on and perception of organic seed.

While the volume of material contained within this report may be overwhelming for some, others will point out important issues that we have failed to address in sufficient detail. We encourage your input and constructive suggestions for further refining this report as we update it the future. Seed work is slow work, and many hands and minds will lead to improvement.

Purpose: The overall purpose of State of Organic Seed is to increase success and minimize risks for the organic farming and food sector by advancing the viability and integrity of organic seed systems. In order to reach this goal we developed SOS with the following objectives: 1) improve organic farmers and agricultural professionals' (e.g., certifiers, seed industry, extension, researchers) understanding of concerns, obstacles and realistic potentials in organic seed systems; 2) enhance public-private partnerships and farmer collaboration in the development of organic seed systems that fit agronomic, market, regulatory, and social needs; 3) improve organic farmers' abilities to meet the National Organic Program (NOP) requirement that they use certified organic seed; 4) develop regulatory approaches to protect organic seed from genetically engineered (GE) trait contamination; 5) improve management of seed resources to reduce concentration of ownership and stimulate competitive and innovative seed systems.

Organic systems require the use of organically produced seed varieties that serve farmers' and processors' needs, and that meet the regulatory requirements of the NOP. We have not yet reached such a level of usage in organic production systems due to a lack of availability in quantity of appropriate organically bred varieties and organically produced seed.

Lack of appropriate genetics and commercial availability are the result of multiple economic, social, and political factors, including:

- Severe cutbacks in public plant breeding programs;
- Lack of responsiveness from the seed industry toward organic;
- Concentration in the seed industry,
- Investment costs necessary to build seed capacity along the entire production chain; and
- Continued disagreement and infighting within the organic community regarding implementation of the NOP rule as it pertains to organic seed.

If these factors are not addressed, organic farmers will be at increasing risk of being underserved in appropriate plant genetics, thus hindering their success.

Concurrent with the need to develop and build organic seed systems is the need to protect the integrity of these systems. In crops for which there are GE counterparts (i.e., alfalfa, canola, corn, cotton, soybeans, and sugar beets), organic seed increasingly contains detectable levels of GE material, a technology that is explicitly excluded in NOP regulations and rejected by the organic industry and consumers alike. The lack of federal protection for organic markets from transgenic contamination poses a serious risk to the credibility, viability, and success of organic farmers and the NOP. The same section of the seed industry that is contaminating the natural resource of seed is also actively consolidating seed resources through corporate acquisitions and mergers, the restrictive use of utility patents, and campaigns of fear and intimidation to slow competitors and even public researchers from innovation and investment in seed systems.[1] As we invest in organic seed, we must also address challenges that threaten progress toward developing decentralized, farmer-oriented, and organic seed systems.

The lack of federal protection for organic markets from transgenic contamination poses a serious risk to the credibility, viability, and success of organic farmers and the NOP.

Process: We can meet our overall goal of advancing organic seed systems through the collection of information and opinions of diverse stakeholders, ongoing dialogue among organic professionals, and the implementation of organic seed working groups. In order to include broad and diverse input from stakeholders to develop this

[1] As explained in section four, the seed industry is one of the most concentrated in agriculture. Concentrated ownership of plant genetic resources, largely facilitated by exclusive rights afforded under utility patents, has limited private and public plant breeders' access to genetics. Onerous genetic licensing agreements dictate if and how genetics will be used and create a culture of fear, as some breeders worry about legal actions against them if they unknowingly or incorrectly use patented material.

report and action plan we: 1) created a planning team that included farmers, NGOs, certifiers, and food industry and seed industry representatives; 2) conducted a national organic farmer survey on seed; 3) conducted a questionnaire with the food industry, seed industry, NGOs and researchers to glean their assessment of "challenges and solutions" in organic seed systems; 4) reviewed and analyzed past and ongoing public funding of organic seed education and research, including interviews and questionnaires with researchers; 5) reviewed and analyzed past and ongoing efforts to prevent transgenic contamination and protect organic integrity; and 6) hosted a full-day seed symposium with diverse participants to review the farmer survey, discuss challenges and opportunities, and prioritize next steps in a plan of action. This work is described more fully within this report.

Urgency in Organic Seed: The lack of organically bred and produced seed is a barrier to the growth and ongoing success of organic farming. Seed is the critical first link in organic production. It provides the genetic tools for farmers to confront many of the day-to-day challenges in the field. Organic seed that is appropriate to regional agronomic challenges, market needs, regulations, and social and ecological values of organic agriculture is fundamental to the success of organic farmers and the organic food system they supply.

Unfortunately, organic seed systems are not meeting the current needs of organic agriculture, and, without increased attention, will continue to fall behind for reasons already described. Organic farming requires adequate biodiversity and vitality of the genetic resource of seed, which necessitates increased initiative and investment at public and private levels.

The issues are complex, with somewhat daunting obstacles and challenges. The input we received from organic stakeholders engaged in this project reflected the seriousness of the issues, with summary statements such as "the problems are all tied together; it's overwhelming" and "the seed industry is broken." These stakeholders fully understand that we cannot address the lack of breeding for organic systems without also addressing concentration in the seed industry and restrictive intellectual property protections; the absence of legal and financial protection for organic seed companies from contamination by GE crops; and a lack of clarity in the NOP regarding seed issues.

We also found that when these same stakeholders came together to discuss these issues there was positive momentum toward an action plan that would move organic seed forward. Researchers talking to other researchers reinforced support for collaborative solutions, as did certifiers talking to seed companies, and seed companies talking to farmers, and all of these voices speaking to the larger organic brands and retailers asking for their involvement. While these feedback loops seem obvious, there has been little opportunity or facilitation of such dialogues.

This project has clarified the urgent need for such feedback loops in order to increase

collaboration among diverse organic stakeholders. As such, ongoing working groups will be necessary to carry out the actions outlined in this report, as will follow-up meetings, regional listening sessions with stakeholders, and updates to this report. *Each stakeholder group must maintain their commitment to improve, protect, and promote organic seed systems with the knowledge that we will all share in the benefits.*

Benefits of Organic Seed Systems: Reasons to support improving the quality, integrity, and use of organic seed are clear:

- Seed varieties evaluated and/or bred under organic conditions and for organic markets will provide organic farmers with the optimum genetics for their production systems.[2]
- Organically bred seed will provide food processors, companies and retailers with improved traits that organic consumers value, including nutrition, flavor, color, and other quality traits.
- The NOP calls for organic seed usage.
- The lack of organically produced seed allows for conventional seed to be used if certain requirements are met, yet conventional seed production uses highly toxic chemicals and their use is therefore in conflict with the principles of organic agriculture.
- Organic seed production results in benefits such as increased organic acreage and diversified income streams for organic farmers.
- The success of an organic seed industry further strengthens the organic industry.

There is potential for much greater benefits. The challenges of resource depletion, climate change, and population growth require ongoing improvements in agriculture, including innovation in plant breeding to deliver beneficial traits that address these issues. Organic farming and organic seed systems are particularly suited to address these challenges in a scientifically integrated, socially ethical, and environmentally responsible manner. While the agricultural biotechnology sector invests in propaganda campaigns to promote traits such as herbicide tolerance as "sustainable," we in the organic community have an opportunity to go beyond rhetoric and marketing to provide future generations with improved food, health, and environmental security. Organic research and breeding are in their infancy. With further investments we will see exponential improvements that recognize local ecological systems and address food consumer needs, such as regionally adapted seed varieties that are suitable to a range of growing seasons, resist important crop diseases, and have enhanced flavor and nutrition.

Actions Guided by Principles: It is essential that policies, education, research initiatives, market-based solutions and other actions to

[2] For example, varieties must have appropriate resistances for an organic production system, which may be unique compared to a conventional system.

move organic seed systems forward be grounded in the same values and principles that have guided the organic movement. With this goal in mind, we have captured several recurrent principles that emerged from our assessments.

While the recommendations articulated in this report are intended to increase the viability and integrity of the organic sector, we believe they are also useful in revitalizing better policy and management of the natural resource of seed in U.S. agriculture as a whole. The lack of access to a wide variety of seed options is a problem for most farmers in the nation. Our public officials have provided poor oversight of this invaluable resource when considering the future needs of American farming and food. We have a responsibility to change this.

The principles guiding our actions include:

1. **Seed, as a limited natural resource, must be managed in a manner that enhances its long-term viability and integrity.**

2. **The maintenance and improvement of genetic and biological diversity are essential for the success of sustainable food systems and greater global food supply.**

3. **The equitable exchange of plant genetics enhances innovation and curtails the negative impacts of concentrated ownership and consolidated power in decision making.**

4. **Sharing information enhances research and leads to better adaptation of best practices.**

5. **True agricultural innovation serves more than one goal and increases benefits for all living systems, including soil, plants, animals, and humans.**

6. **Public institutions and public employees serve public needs.**

7. **Farmers have inherent rights as agricultural stewards, including the ability to save, own, and sell seeds, and are key leaders in developing best practices, applicable research, and agricultural regulations and policy that affect them and the future of seed.**

8. **Application of the precautionary principle, the social responsibility to protect food systems from harm when scientific investigation has found potential risk, is necessary to create food security into the future.**

Role of Farmers in Prioritizing and Developing Seed Solutions: We believe a diversity of decision makers are needed to guide us into an even more sustainable, successful, and vibrant organic seed future. Farmers are the keystone in creating a foundation of workable strategies and tactics. There is a long and unfortunate history in agricultural policy of treating farmers unfairly (from their lack of bargaining power in the prices they receive to laws that restrict seed saving) in order to benefit consumers, retailers, food companies, processors, financiers, and suppliers of agricultural inputs. Organic agriculture has been farmer-driven and farmer-oriented since its inception. Farmers are leaders, planners, and innovators in the organic movement. It is not surprising that in the early stages of organic seed system development there has been a

trend toward participatory research and investment in which farmers are highly engaged. Similarly, farmers have had a historically important role in guiding the vision and policies of organic agriculture. Any policies or activities to further organic seed systems must take into account the impact on farmers from field to marketplace. Organic seed systems must serve organic farmers.

State of Organic Seed had a high level of farmer participation starting with the conception of the project. This project will continue to rely on organic farmers' experience, perspective, attitudes, concerns, and priorities in organic seed as we move forward in implementing the action plan.

Farmer Survey

OSA received input from more than 100 participants who attended the February 2010 State of Organic Seed Symposium. We also received responses to the Farmer Seed Survey from 1,027 organic farmers in 45 states. Following the publication of this report, we will host a series of listening sessions with farmers at various farm conferences asking for their input and encouraging their involvement in the implementation of an action plan. If your organization has annual meetings or conferences and is interested in hosting an SOS listening session with organic producers, please contact Organic Seed Alliance. To improve on future iterations of this report, we will strive to host these sessions in regional venues as funding allows.

Role of Public Organizations and Universities: State of Organic Seed gathered input and had participation from dozens of public sector educators and researchers. There is a growing interest in organic agriculture in the Land Grant University (LGU) system. New plant breeding and testing initiatives such as the Northern Organic Vegetable Improvement Collaborative (NOVIC), the U.S. Testing Network, and Breeding for Organic Plant Systems (BOPS) at North Carolina State University exemplify positive momentum in participatory, farmer-driven, organic research. Researchers who participated in SOS heard input and criticisms aimed at LGUs and the USDA-Agricultural Research Service, and provided insight into the administrative, funding, and intellectual property issues that restrict innovation and slow scientific understanding of organic systems. They also provided invaluable scientific expertise on the potential of breeding in organic systems, and helped identify research questions that remain unexplored. These researchers will stay involved through implementation of actions to attain SOS goals via participation in the Organic Plant Breeding Working Group.

It is no exaggeration to say that in the early decades of the organic movement there was a strong distrust of our LGU system. This distrust was in part due to a perception that the LGU system was increasingly serving private interests over public interests, and therefore innovation pursued with public tax dollars was not adequately responding to organic systems and instead was serving dominant agrichemical concerns.

Much has changed in the last decade, and much remains the same. As early as 2003, Organic Farming Research Foundation's (OFRF) State of the States report showed increases in organic land and transitional land at LGUs.[3] For example, the University of Florida and Washington State University have minor and major degree programs focused on organic agriculture, courses with an organic focus are offered at dozens of programs nationally,[4] and over 29 states have universities or colleges with student farms.[5] Researchers at LGUs are applying for grants focused on organic agriculture as organic research funding increases, and research in organic plant breeding and seed systems has received higher priority due to the advocacy work of organizations such as OFRF, National Sustainable Agricultural Coalition (NSAC), National Organic Coalition (NOC), Rural Advancement Foundation International (RAFI), Michael Fields Institute, and Organic Seed Alliance. As shown in this report's Public Initiatives section, almost nine million dollars in federal funding have gone to organic seed system research in ten years, with additional funds coming from foundations such as OFRF.

Yet, with all of these gains, there remains a strong perception among stakeholders involved with SOS that LGUs are still not serving the needs of organic farmers and consumers, and that their primary clients remain the agrichemical and genetics firms that are often their largest donors. There is also a strong perception that there are researchers who would direct greater research to sustainable systems but who have their hands tied by administrators who demand they work in "profitable" research areas (i.e., research that can be patented and that LGUs can earn royalties from to help fund programs). That public universities are now selling their work to pay for additional public research is a relatively new development in the history of LGUs,[6] and one that is of deep concern for many stakeholders who participated in SOS.

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[3] Organic Farming Research Foundation. 2003. *State of the States, 2nd Edition: Organic Systems Research at Land Grant Institutions, 2001 – 2003*, Retrieved at http://ofrf.org/publications/sos.html.

[4] USDA. 2009. "Educational and Training Opportunities in Sustainable Agriculture," Retrieved at http://www.nal.usda.gov/afsic/pubs/edtr/EDTRCollegesA.shtml.

[5] Rodale Institute. 2010. "A Directory of Student Farms," Retrieved at http://newfarm.rodaleinstitute.org/features/0104/studentfarms/directory.shtml.

[6] Jones, Stephen S. 2003. "A System Out Of Balance - The Privatization Of The Land Grant University Breeding Programs," *Seeds and Breeds for 21st Century Agriculture*, Retrieved at http://www.rafiusa.org/pubs/Seeds%20and%20Breeds.pdf.

SOS participants feel strongly that public research programs should be reinvigorated. They also call for reform of funding mechanisms to decrease dependency on funds from the private sector. Seeds and Breeds for 21st Century Agriculture, a coalition of organizations and public breeders, have already developed strong arguments that lay out the need for an audit of the Bayh-Dole Act to assess its impact on public research.[7] Passed in 1980, the law allows universities to patent publicly funded research and products, including allowing researchers to gain personal royalties beyond their public salaries. Since the passage of the act through 2006, industry supported research grew 8% nationally per year.[8] State schools also began to allow for their faculty and administrators – paid public employees – to accept stock and serve as officers for companies for which they also conduct research at the school.[9]

In plant breeding, these trends have accelerated the privatization within our public institutions of important plant genetics that would otherwise be publicly available to other public and private breeders. Public sector breeding is often focused on the needs of Monsanto, Syngenta and DuPont rather than public needs, such as reducing the environmental impact of agriculture. Other consequences resulting from the privatization of public research include restrictions on the free exchange of basic research, less public analysis of new varieties, and diminished innovation, including a reduction of public variety releases.

As the privatization of our public research occurs, we experience five negative impacts:

1. *The loss of the independent public service voice:* University researchers were traditionally parties with no personal financial gain in their work beyond their salaries, and as such could be trusted to evaluate assumptions without bias. Allowing public researchers to receive personal royalties, private stock gains, and serve on boards of corporations funding public research is a conflict of interest.

2. *Diminished benefits:* Private investment in public programs calls into question who benefits from this research. Shareholder earnings are often the target outcome over true public good. As a result, opportunities for scientific discoveries and their applications are lost. Potential benefits that may not have immediate commercial appeal are neglected.

3. *Loss of directive*: The direction of our public institutions is at risk. Private interests create research priorities where what is considered the corporate good is automatically considered the public good. This is not what Congress intended in the passage of the Morrill Land-Grant College

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[7] Leval, Kim. 2003. "Ownership and Legal and Public Policy Frameworks for Reinvigorating a Federal Public Plant and Animal Breeding System," *Seeds and Breeds for 21st Century Agriculture*, Retrieved at http://www.rafiusa.org/pubs/Seeds%20and%20Breeds.pdf.

[8] Rice, Mabel L. and Sally Hayden, Eds. 2006. *The Privatization of Public Universities: Implications for the Research Mission*, Advanced Studies Center, University of Kansas: Lawrence, KS, Retrieved at www2.ku.edu/~masc/publications/2006whitepaper.pdf.

[9] Priest, Douglas and Edward St. John. 2006. *Privatization and Public Universities*, Indiana University Press.

Act (7 U.S.C. § 301) or in any subsequent revisions of this and other laws pertaining to agriculture. Congress has ceded direction of public research to private interests.

4. *Duplication of efforts*: If a university's agricultural research goals mirror those of private industries, then there is duplication and the loss of innovative ideas that are needed to keep U.S. agriculture vibrant and successful. There is also co-optation of public resources for private gain. This includes breeding, research and development, and staff time that is all supported by tax dollars, with an outcome of patented, privately owned seeds.

5. *Diminished value of social sciences*: Humanities and social sciences – areas not easily commoditized – will lose their voice in the public sector debate regarding the social impacts of research and technologies. Research and technological developments always have ethical and public policy considerations, and private sector investment can influence discussion of these issues. As Robert Berdahl, Chancellor of University of California, Berkeley, asked, "Who will guide us through the moral and policy thicket of this new age if the humanists and social scientists are weakened by the overwhelming drive of market forces in a university-industrial complex?"[10]

The assumption that what is good for private global corporations is good for everyone is questionable at best. The public university mission is to serve society, of which industry is but one part. We need agricultural research from public programs that will improve the overall well-being of rural and urban communities, assure an equitable sharing of knowledge, reflect farmers' needs, balance the public-private breeding relationship, reduce impacts of resource use, and maintain and enhance the classical breeding education and competency of our future public plant breeders.

Role of the Seed Industry: The perspective that the seed industry is "broken" is understandable given the issues farmers face. The seed industry is highly concentrated and subsequently offers decreased varietal options. Organic farmers and consumers are, as a generality, very familiar with the ills of the modern seed industry as presented in the media such as Monsanto purchasing and patenting seed resources at the cost of competition and innovation, investigators sneaking into rural communities to seek evidence of farmers suspected of saving seed, and the uncontainable nature of products derived from genetic engineering that outsource liability and risk to farmers and consumers.

There is reason for concern in the industry, but the seed sector is much more than the bad behavior of a handful of dominant companies. There are companies and individuals working to improve the quality of seed with honest intentions of improving our agricultural systems. We have the opportunity to create an organic seed sector that is less burdened by problems affecting the dominant, concentrated, conventional-biotechnology sector. Seed companies need to be engaged as partners in the process of breeding and delivering new varieties for organic systems.

Trust needs to be built on all sides. Critics have said that organic seed is only a way for seed companies to make more money by charging a premium for a certified organic

[10] Berdhal, Robert. 2000. "The Privatization of Public Universities," Speech given at Effer University, Germany, May 23, Retrieved at http://cio.chance.berkeley.edu/chancellor/sp/privatization.htm.

product. There have been concerns that the seed trade is negotiating back door deals to impose an abrupt deadline that would end any and all allowances to use conventional untreated seed. Alternatively, there are seed companies who do not trust some farmers to follow the NOP rule, and fear that organic inspectors at worst will look the other way on the use of conventional seed, and often have varying guidelines on seed from certifier to certifier. And the seed sector is understandably highly critical of the NOP for not responding to the National Organic Standards Board (NOSB) guidance documents on organic seed (see Historical Context section of this report).

However, the overwhelming response we received from seed industry representatives who attended the symposium, returned input forms to us, agreed to interviews, and otherwise engaged in this process, was one of willingness to keep working to improve seed quality, to work with regulators and certifiers, and to be more open and transparent in sharing information such as skills in production techniques. Their engagement and perspective is critical to the success of organic food and farming.

The assumption that what is good for private global corporations is good for everyone is questionable at best.

Role of Organic Food Companies: In the early development of organic food systems there were no "big players" with deep pockets to invest in organic research. As organic has matured, a number of larger conventional food companies have entered the organic arena through acquisitions of well known brands. Early organic innovators such as Organic Valley had sales over half a billion in 2008, and distributor United Natural Foods, Inc. (UNFI) and retailer Whole Foods have sales in the billions.[11] Annual sales of organic food and beverages increased from just over $1 billion in 1990 to almost $25 billion in 2009.[12] Many of the companies that have grown with the rise in demand for organic are reinvesting in organic systems through donations to OFRF for research grants and/or have their own corporate foundation that provides grants to organic farmers and researchers to further our understanding and improvement of organic systems.

Unlike the conventional sector, organic agriculture does not have state or federal organic check-off programs to assist in funding public research. Such programs in the conventional model often fund breeding at the university level. For example, state wheat commission check-off programs fund wheat breeding at many state agricultural institutions. There was strong resistance from organic farmers to pay into the national check-off programs and Congress gave organic producers an exemption from doing so. Organic check-off programs have been discussed over the years in the context of developing organic systems, and were brought up again during the SOS Symposium.

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[11] Howard, Phil. 2007. "Organic Distribution and Retail Structure," Michigan State University, Retrieved at https://www.msu.edu/~howardp/organicdistributors.html.

[12] Organic Trade Association. 2010. "Industry Statistics and Projected Growth," Retrieved at http://www.ota.com/organic/mt/business.html.

There are still concerns that these programs are a mixed blessing, and there needs to be additional stakeholder discussion and deliberation to determine if such funding models could be developed to fit the values and needs of organic systems.

During the SOS Symposium the importance of organic retailers, distributors and brands in moving organic seed systems forward was often noted. Clearly, research funding is needed from the private sector. If not commodity check-off programs then new innovative partnerships. At the SOS Symposium one large produce distribution firm called for their industry to put a "penny box tax" on produce, the funds from the tax to be managed by a nonprofit-university board that would allocate funds for variety trial and crop improvement networks for fruits and vegetables. Recommendations also included local retail stores funding farmer-breeder clubs and variety trials. University breeders encouraged processors to help in the commercialization process when new varieties are developed. And many stakeholders from varying sectors implored the organic food sector to be more unified and vocal in addressing issues of GMO contamination in organic systems, including greater lobbying for federal protection. The organic trade sector was identified as having a more direct information pipeline with consumers, and can therefore raise public awareness around the urgency in building organic seed systems.

Large organic food brands have the power to encourage investment in seed systems simply by pushing down the supply chain for the use and development of organic seed.

Food companies can also influence the usage of organic seed. Seed industry representatives pointed out that large scale processors tend to require producers to grow a single variety, or at times a small handful of varieties. Often these options are only conventional varieties, because there were no organic options available when the processors went into business. This is an opportunity. If, for example, an organic tomato sauce brand requests that all of their producers use hybrid tomato Variety X, and then went to the conventional seed company that produces X and requested that a large volume of that seed be produced organically, the company would likely listen. Seed industry professionals we spoke to could not give an example of this occurring. Large organic food brands have the power to encourage investment in seed systems simply by pushing down the supply chain for the use and development of organic seed.

Overall Findings & Priorities: The Public Seed Initiatives section of this report and the farmer surveys show that organic seed systems are developing. Farmers report increased attempts to source organic seed and more pressure from certifiers to do so. Research in organic breeding has increased slightly over a fourteen-year period. Nonetheless, the complexity of challenges and needs can seem immense. Stakeholders provided us with a laundry list of needs, well beyond the scope of any one organization or sector to accomplish. We cannot sit back and say this is solely a seed industry issue. Nor can we say that the seed sector will eventually catch up because the challenge of not enough seed is an opportunity for them to produce more. This attitude, which ignores the regulatory and market conditions in seed, will result in organic seed systems continuing to fall behind, even as more and more acreage is certified organic. We heard clearly from stakeholders that the largest risk is not

whether organic seed is used from a regulatory perspective, but that farmers have access to appropriate and diverse organic seed choices that fit their needs. Yet this will not happen if organic seed usage is not encouraged at the NOP level. The answers are complex and interwoven, and few priorities can move forward independently.

We heard clearly from stakeholders that the largest risk is not whether organic seed is used from a regulatory perspective, but that farmers have access to appropriate and diverse organic seed choices that fit their needs.

While this process captured an array of priorities that varied with crops, regions, and perspectives of different professional sectors, there were overarching priorities that were identified by working groups at the SOS Symposium with additional input from industry and farmers.

Priorities include the need to:

1. **Develop organic seed systems that are responsive to the diverse needs of organic producers through increased public-private collaboration.**

2. **Refine understanding of organic plant breeding principles and practices.**

3. **Reinvigorate public plant breeding with an emphasis on the development of cultivars that fit the social, agronomic, environmental, and market needs of organics.**

4. **Protect the natural resource of seed from threats of concentrated ownership of plant genetics.**

5. **Protect the natural resource of seed organic seed systems from threats of contamination from genetically engineered traits.**

6. **Improve sharing of information in the areas of organic seed availability, lack of availability for specific varieties and/or traits, and field trial data.**

7. **Create opportunities for organic farmers to work with professional breeders through trialing networks and on-farm plant breeding to speed the development of regionally adapted organic cultivars.**

Historical Context for Need of State of Organic Seed

History of Seed in Organic Movement: In any history of seed we have to first recognize the 12,000 years of farmer and plant breeder innovation that existed before the advent of 21st century agriculture. We have been bequeathed an incredible living resource that is beyond economic valuation. We have no modern food crops, only modern variations on crops from the centuries before. From the diversity of grains, to the broad array of brassicas, we have been the beneficiaries of more than we can ever give back. That said, it is our responsibility to leave this seed inheritance better than when we received it. The authors want to recognize the diversity of cultures, individuals, breeders clubs, and early scientists who observed, recorded, studied, and selected. They have left us with much to appreciate, protect, and improve.

Organic seed has developed slowly, at a pace behind many other innovations in the organic movement. Modern U.S. organic farming can be traced back to the early work of the Rodale Institute in the 1940s. Organic farming gained proponents and practitioners throughout the next two decades, but it was not until the early 1970s that formal organizations developed, including California Certified Organic Farmers, Maine Organic Farmers and Gardeners Association, Tilth Association, and many other regional groups. In the early years these organizations focused attention on farmer education, certification standards, and research (e.g., field trials), but have left no public record of specific programs focused on seed system development.

From the diversity of grains, to the broad array of brassicas, we have been the beneficiaries of more than we can ever give back.

In fact there is little formal historical documentation of the development of US organic seed systems prior to the 1990s. Certainly organic farmers from the 1940s through the 1970s were engaged in seed saving and basic breeding, but we have no record of commercial organic seed development in this period. We know that the early back to the land movement, which valued a "do it yourself" approach, supported the seed saving movement. Backing up this idea, Rob Johnston, founder of Johnny's Selected Seeds, said that his motivation in starting the company and publishing a seed saving guide was to promote the "hand crafted aspect of seed work."[13]

The first Johnny's Selected Seeds catalog was published in 1974. Johnny's became a mainstay for organic gardeners and farmers, and was very likely the first seed company with its own certified organic research farm

[13] Johnston, Rob. Personal interview, July 2010.

(1979). In 1975, two organizations with missions of conserving and distributing heirloom seed launched: Abundant Life Seed Foundation published its first seed catalog, and Seed Savers Exchange (originally "True Seed Exchange") published its first yearbook annual newsletter (which became the yearbook). These organizations, along with companies such as Peace Seeds (1975), Fedco (1978), and Territorial (1979) were suppliers to many organic farms, and indeed worked with organic farmers to produce some of their seed.[14]

While no studies from this period indicate farmer preferences or behavior in purchasing seed, it is likely that organic farmers in the 1970s and 1980s used heirloom varieties much more than their conventional counterparts. This preference was likely tied to a philosophical response to the conventional agricultural industry, as organic farmers were opposed to the negative environmental, economic, and social justice impacts of industrial conventional agriculture, while valuing diversity,[15] local systems, and the sovereignty that comes with a "do it yourself" approach to life. Along with concerns about genetic diversity, early organic advocates were also concerned about the taste and nutritional value of their crops and expressed concerns that conventional breeding systems favored the development of crops with heavy chemical inputs.[16]

The focus in the organic movement on open-pollinated (OP) and heirloom varieties is apparent in that many of the first seed companies serving the organic vegetable market primarily sold heirloom seed. Seeds of Change (1989) is considered by many to be the first seed company that only offered 100% certified organic seed, and it was nearly twenty years before the company offered hybrid varieties. A scan of commercial organic vegetable seed catalogs in 2010 continues to show more OP and heirloom varieties than hybrid varieties.[17] In conventional seed catalogs, the majority of options are hybrids, with few if any OPs available (for crops in which hybrids are available.)[18] Interest in using hybrid vegetable varieties has increased among organic farmers, yet the market offers very little in hybrid options. The corn seed market is an exception to the OP-Hybrid ratio, with major organic corn seed dealers offering primarily hybrid seed. These dealers are even breeding new parent lines specifically for organic systems.[19] There is talk of U.S. vegetable seed

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[14] Personal experience of author, Matthew Dillon, and interviews with founders and employees of these companies.

[15] Certainly the epidemic of Southern Corn Leaf Blight that began in 1970, severely reducing corn yield for several years in the U.S., was an awakening for many farmers regarding the importance of maintaining genetic diversity in seed stocks. The epidemic was also a factor in the launch of many of the aforementioned seed projects in the early part of the decade.

[16] New Alchemy Institute. Personal interview, 2009.

[17] The 2010 commercial catalogs examined include organic dealers High Mowing Organic Seeds and Seeds of Change, conventional dealers Rupp and Harris Moran, and Johnny's Selected Seeds (a mixed market catalog).

[18] There are exceptions, such as lettuce and green beans, which do not lend themselves to hybrid production.

[19] Organic hybrid seed production has primarily come from foreign seed companies that serve U.S. markets as a wholesaler, such as Bejo, Genesis, and Enza Zaden.

companies developing organic parent lines and experimenting with hybrid production, but the small U.S. market at present comes primarily from European firms.

The majority of organic breeding projects funded through USDA programs are also focused on OP development (see Public Initiatives section). This may in part speak to a "do it yourself" value that remains among organic farmers, as well as a desire to decentralize seed systems and increase farmer involvement. However, organic farming is diverse, and requires varied approaches to seed. Not all farmers want to or could save seed, and not all favor OPs. The seed saving movement has pointed out that the shift toward hybrid varieties resulted in a reduction in crop and genetic diversity, and was a by-product of the monoculture approach to agriculture. We do not contest this, or that the seed industry dropped OP varieties in favor of hybrids to have customers who had to return for the next generation of seed. However, hybridization in and of itself is only a tool, one used often in creating OP populations. Many organic farmers rely on and are strong proponents of hybrid varieties. If organic seed systems are to move forward and provide high quality organic seed to meet the needs of diverse organic farmers, then we will need diverse varietal offerings, including both OP and hybrid seed.

While the appreciation of seed saving and heirloom varieties by early organic vegetable farmers may have been a factor in the slow development of certified organic hybrid varietals, the factors that continue to slow development today in organic hybrids likely has more to do with investment and access to germplasm. The development of breeding lines for organic systems requires time and significant resources, and seed industry professionals who gave input for this report have stated that they have been slow to make such investment due to concerns that they will not be able to recoup costs. These financial risks are real not only for hybrid development but for improvements or breeding of new OP varieties, which also require large amounts of time and resources to deliver a finished product. One factor that has slowed investment in organic breeding is uncertainty regarding the implementation of the National Organic Program (NOP) rule as it pertains to seed. In particular, there is concern that allowing organic farmers to use conventional untreated seed has been, and will continue to be, a loophole without sufficient auditing, oversight, and metrics to determine if or when allowances should be denied, or the allowance itself removed from the rule.

The lack of investment from the private seed sector in organic seed is directly related to this regulatory quagmire around seed. It is not the only reason for inadequate investment, but one that must be addressed for the seed sector to gain confidence in delivering varieties appropriate for organic agriculture. The seed sector fears the cost of unsold organic seed due to farmers claiming a lack of equivalent variety and requesting allowances for conventional untreated seed. In this scenario, seed companies stand to lose huge investments in breeding, production, and marketing expenses.

In a 1994 interview, NOSB founding Chair Michael Sligh said, "We recognize currently there is not enough untreated organic seed of every variety necessary to say this is required tomorrow. At the same time, we don't want to discourage companies from making this type of progress."

Farmers also fear they will be forced to purchase organic seed that is not equivalent or does not meet quality standards. The NOSB attempted to give guidance in addressing these concerns and others, but initially it gained no traction at the administrative level of the NOP. Fortunately there are signs that the new NOP leadership will provide more clarity. Still, the lack of clarity has damaged organic seed systems as well as organic stakeholders' confidence in the public process. These are difficult but important issues, and at stake is not simply a regulatory rule or the development of a niche seed industry.

Regulatory History of Organic Seed in National Organic Program: Prior to the NOP in 2002, farmers who purchased organic seed did so based on philosophical or agronomic reasons, as there was no federal regulatory requirement to do so. A brief review of the development of organic standards shows that, from the start of the federal program, there was recognition that seed systems needed investment and action if organic producers were ever going to use 100% organic seed.

The first federal codification of organic occurred in the 1990 Farm Bill with the passage of the Organic Food Production Act (OFPA), which gave the federal government authorization to create national organic standards and initiate a National Organic Standards Board. From the outset of the discussions on national standards, there was recognition of the importance of requiring the use of organic seed, but also the lack of availability – pointing to a need for allowing conventional seed to be used. OFPA recognized the importance of organic seed in stating, "For a farm to be certified under this title, producers on such farm shall not apply materials to, or engage in practices on, seeds or seedlings that are contrary to, or inconsistent with the applicable organic certification program."[20]

In a 1994 interview, NOSB founding Chair Michael Sligh said, "We recognize currently there is not enough untreated organic seed of every variety necessary to say this is required tomorrow. At the same time, we don't want to discourage companies from making this type of progress."[21]

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[20] Organic Foods Production Act of 1990 (7 U.S.C. 6508)

[21] Greene, Robert. 1994. "Federal Panel Winnowing Rules for 'Organic' Crops," Associated Press, June 12, http://articles.latimes.com/1994-06-12/news/mn-3200_1_organic-farming.

When the NOP rule was published in December of 2000 it included the seed section as it exists today, requiring the usage of organic seed except that *"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."*[22]

In the public response to the published rule, the federal register noted that the "seed and planting stock practice standard in the proposed rule generated a very diverse array of responses that, while largely favorable, highlighted a potentially disruptive impact on organic producers." [23]

The NOP responded that while some comments identified the seed and planting stock requirement as unreasonable, they had chosen not to change the standard, stating:
"*The objectives of spurring production of organically grown seed and promoting research in natural seed treatments are compatible with the OFPA's purpose of facilitating commerce in organically produced and processed food. We designed the practice standard to pursue these objectives while preventing the disruption that an ironclad requirement for organically produced seed and planting stock may have caused."*

The NOP rule became effective in October of 2002. There was an immediate backlash from farmers on certain aspects of the rule, including the price of organic seed. Some farmers protested that their seed bills would triple, and that the certifying fee was not as expensive as the extra cost of organic seed.[24] Within the first few years of the seed requirement, farmers also began to voice concerns about the quality of organic seed, with complaints in the media and at conference discussions about germination rates and varietal off-types.[25]

Complaints from the seed industry also emerged almost immediately. The American Seed Trade Association's Organic Seed Committee noted these issues fourteen months after the rule became law. The following are direct quotes of their concerns:[26]

- *Organic growers are reluctant to use organically produced seed because of the higher cost over conventional seed.*
- *While some certifiers are imposing the organic seed requirement on their clients when there are equivalent varieties available, other certifiers hesitate to do so. Some of these certifiers have said they would not force growers to use organic seed if the price difference was over a*

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[22] National Organic Program (7 CFR 205.204 (a) (1)).

[23] Federal Register, Volume 65, Number 246 (December 21, 2000).

[24] "Farmers Cool to Organic Regulations," *The Daily Gazette*, October 26, 2002 (Saratoga, NY).

[25] This conclusion comes from reviewing numerous online discussions and articles, including from agricultural resources like Rodale Institute and ATTRA, as well as from feedback received at OSA-hosted seed sessions at EcoFarm, Tilth Producers Conference, Organic Seed Growers Conference, and other organic farming conferences.

[26] Minutes from ASTA Organic Seed Committee meeting (January 25, 2004).

certain amount—even though the NOP has confirmed in a letter that price is not a factor in determining whether an organic seed is "commercially available."

- *Most organic certifiers are not well informed on the varieties of organic seed that are currently commercially available. Many certifiers are calling for a central database to tell them what varieties are available in organic form.*

- *When a grower claims to a certifier that he needs a particular variety for which there is no equivalent organic seed, most organic certifiers are not well equipped to evaluate the grower's position. Thus there is a danger of haphazard decisions by certifiers, and no third party oversight of these decisions.*

American Seed Trade Association (ASTA) members also issued a statement to the NOSB on the equivalency issue with a deadline for the usage of organic seed: "ASTA believes equivalence should be measured by 'species' when the transition period is over and organic producers will be required to select the most suitable variety [within the same species] for their production location and time. ASTA's proposed transitional deadline for variety and species certification and equivalence is October 2004."

NOSB did not recommend this deadline to the NOP, and if they would have it is likely that many organic farmers would have protested given the wide range of diversity within a species, versus the more localized adaptation of varietals. But the NOSB was hearing from enough stakeholders for them to create a joint committee to address the varying concerns over how the seed rule was being interpreted, implemented, and enforced.

NOSB Recommendation on the Commercial Availability of Organic Seed: In August of 2005 the NOSB presented the NOP with their "Recommendation on the Commercial Availability of Organic Seed." This statement received so much public feedback that in 2006 the Crops Committee of the NOSB began a new round of discussions and public comment periods to further develop a guidance statement on organic seed. The final document – "Further Guidance on Commercial Availability of Organic Seed" – was approved in November of 2008 with the intent of having an "increased level of compliance with Title 7 Part 205 National Organic Program (§205.204)" (the seed section of the rule). The introduction states: *"This Joint Committee acknowledges that only a small proportion of the seed currently used by organic farmers is certified organically grown seed. Also that, many certifying agents do not believe they have been given viable guidelines for their role in verification procedures concerning organically grown seed availability. The Committee now offers adjusted guidance that we hope will bring clarity to the issue and accelerate the utilization of organic seed in all sectors of organic crop production."*

The document goes on to give specific guidance to the NOP, Accredited Certifying Association (ACA) and to certified growers for their specific "role in increasing organic seed usage."

The development of the guidance statements received mostly favorable comments from

the seed industry, mixed comments from accredited certifying agencies (with some very opposed and others supportive), and no comments directly from farmers.

Particularly polarizing was the following recommendation to the NOP: *"Emphasize to ACA's that organic seed usage by clients must be monitored and improvement in percentage usage is expected and must also be monitored. Documentation of the levels of organic seed usage and evidence of improvement in the percentage vs. total seed usage by the ACA's clientele should be audited as part of the NOP accreditation reviews."*

Also controversial was this recommendation to ACAs: *"Maintain and submit upon request to the National Organic Program documentation of the organic seed usage status (current percent levels as compared to historical levels of usage by acreage) of each certified operator."*

Comments made by the National Association of State Organic Programs (NASOP) were emblematic of those ACAs who responded negatively to the guidelines. Miles McEvoy, NASOP President at the time (now director of NOP) wrote in his comment letter, *"The suggestion that organic growers and certifiers maintain records on the percentage of organic seed usage by acreage is unworkable. The additional recordkeeping requirements will not increase the availability of organic seeds."*

The letter points out a burden in both record keeping and increased cost in certification. Going into further detail in a breakdown of the guidance document by sections, McEvoy writes: "*There are problems with determining compliance with the commercial availability of organic seed requirement by the percentage of organic seed used. The standards require the use of organic seeds if they are commercially available. The percentage of organic seed usage could decrease from one year to the next because the producer is planting different seed varieties that are not available organically. On the other hand if organic seeds are available then the producer should be using 100% organic seeds. A producer may be increasing the percentage of organic seed used but still be in violation of the organic seed requirement if they do not use organic seeds that are commercially available. Another complicating factor is that many diversified direct marketing operations do not calculate the acreage planted to their various crops. Calculating the percentage of organic seed used could be a recordkeeping nightmare and not lead to any greater adoption of organic seed usage. Organic seeds can only be used if they are commercially available."*

These NOSB recommendations – with hundreds of volunteer hours in research and writing, review, revisions, and further review and input from stakeholders over a three-year period – were approved and presented to the NOP in November of 2008. And yet, two years later, there has been no formal response from the NOP.

The goal from the perspective of SOS is not to move as quickly as possible to 100% usage of organic seed, but to move as quickly as possible to 100% usage of high quality organic seed that is optimal for organic farming systems.

Current Situation with National Organic Program: Many of the certifiers we spoke with during the course of this project expressed a positive opinion that the NOP, under new leadership as of 2009, is taking actions to strengthen the integrity of the organic label, including encouraging greater enforcement of the use of organic seed and that they expect additional input on seed from the NOP in 2011. Several ACAs report that they are strengthening their own policies and procedures regarding commercial availability of seed.

Oregon Tilth is one example of a certifying organization that has changed its approach to the seed issue. If a new farming operation applies for certification and has not performed a commercial availability search (contacting or searching through a minimum of three seed company lists/catalogs), Oregon Tilth's previous practice was to give the producer "a reminder of the requirements for using organic seed and demonstrating commercial availability." Beginning in 2010, Tilth started to issue a notification of noncompliance, asking the operator to demonstrate that the seed was not available in organic form. If the operator fails to demonstrate this, Tilth now denies certification of that specific crop.

Kristy Korb, Certification Director of Oregon Tilth, states, "If it happened the next inspection there would most likely be denial of [certification for that particular] crop or suspension [of certification] if it was all crops or a pervasive problem. In a renewing client situation if it moves to suspension there would have to be ongoing issues from year to year, as otherwise we would simply deny that specific crop."[27]

NOP staff recently said they were in a "new age of enforcement."[28] The USDA Agricultural Marketing Service reports of "adverse actions" taken on organic producers and handlers provide examples of this commitment. In August of 2010, suspension of organic certification was issued to producers in Georgia and Oregon for "failure to use organic seeds or demonstrate absence of commercial availability." In July, a New York producer was issued a suspension for using "seeds treated with a prohibited substance."[29]

While some may be encouraged by signs that ACAs are tightening procedures, we caution

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[27] Korb, Kristy (Oregon Tilth). Email correspondence, September 16, 2010.

[28] Perkowski, Mateusz. 2010. "USDA leans on organic producers," Capital Press, September 23, Retrieved at http://www.capitalpress.info/content/mp-organic-crackdown-092410.

[29] We reviewed NOP's "Adverse Actions" list in September 2010. This list is updated monthly, and only reflects notices provided by accredited certifying agents that specify non-compliance resulting in suspension or revocation.

that regulatory enforcement will only be as good and fair as the information that all stakeholders have regarding commercial availability of seed. **The goal from the perspective of SOS is not to move as quickly as possible to 100% usage of organic seed, but to move as quickly as possible to 100% usage of high quality organic seed that is optimal for organic farming systems.** Certifiers, farmers, seed companies, researchers and the NOP itself all need more information. The development of a pubic database that allows all parties to search for seed availability, track allowances of conventional seed (including variety name or characteristics, volume of seed, and crop type), verify certifiers, and provide seed suppliers with information to promote and market their varieties was one of the highest priority actions requested by multiple stakeholders involved in this project (see "Priority Actions, Information-Perception" in section seven). Developing this public database is also in line with NOSB recommendations. Good regulation requires good information, and we do not have that at present.

Risks of Transgenic Contamination

It is important for us to assess the risk factors that threaten the natural resource of agricultural seed as we also work to expand, develop, and enhance organic seed systems. The following sections on contamination and concentration underline that while we make investments, engage in education and conduct research in organic seed, we must also take a more unified and focused approach to addressing these unchecked threats. To fail to do so would be to build on sand. Without a strong foundation of seed policies and regulatory management, organic seed systems will lack stability and be at risk of degradation. If seed is contaminated, contaminated crops follow.

Contamination Risks from Genetically Engineered Crops: Because genetic engineering is an "excluded method" under the National Organic Program (NOP), and a method to which organic consumers were vocally opposed when the organic rules were in development, genetically engineered (GE) crops – also referred to in this document as genetically modified organisms (GMOs) – pose one of the biggest threats to organic integrity. Contamination of organic seeds and crops by GE material is well documented.[30] Although biotechnology corporations promote "co-existence" as a reality, the evidence is that transgenic traits cannot be contained.[31] Therefore, there is no co-existence without a loss of organic integrity. Biological factors (e.g., cross-pollination), human error (e.g., mismanagement of genetic resources), and weak regulatory frameworks all contribute to the unwanted spread of GE pollen and seed into organic agricultural systems. Seed is a particularly critical entry point for GMO contamination given that crop production that begins with contaminated seed will inevitably result in a final organic product with GMO contamination. To maintain the integrity of organic food and feed, we have to maintain the integrity of the seed.

[30] GeneWatch UK and Greenpeace International. 2005. *GM contamination report, A review of cases of contamination, illegal planting, and negative side effects of genetically modified organisms*, Retrieved at http://www.greenpeace.org/international/en/.

[31] Marvier, M. & Van Acker, R.C. 2005. Can crop transgenes be kept on a leash? *Frontiers in Ecology and the Environment*, 3(2): 99–106, Retrieved at http://www.esajournals.org/esaonline/?request=get-abstract&issn=1540-9295&volume=003&issue=02&page=0093.

For crops with GE counterparts, such as canola, corn and soybeans, GE material turns up in fields where GE seeds were not planted (i.e., crops with GE counterparts, specifically canola, corn and soybeans). This reality is compromising the credibility and economic viability of non-GE markets, including organic. For example, organic corn consistently tests positive for transgenic material.[32] Fedco Seeds has zero tolerance for GE material in the seed it sells and routinely tests seed at risk of GMO contamination. In 2008 and again in 2009, Fedco dropped varieties of sweet corn due to GMO contamination.[33] Organic rice companies were impacted by contamination when an unapproved GE variety escaped open-air field trials and turned up in the U.S. rice supply, half of which is exported.[34] And contamination in canola is so extensive that organic farmers in Canada sued Aventis and Monsanto arguing GE canola has destroyed their market.[35]

Organic producers use both organic seed and conventional non-treated seed as allowed by the NOP rule. Genetic testing shows that seeds of conventional varieties of canola, corn, and soybeans are pervasively contaminated with DNA sequences derived from transgenic varieties.[36] Organic seed has also been contaminated. Seed companies producing organic seed report that they struggle to find uncontaminated foundation seed, and that even when they start with clean seed they cannot maintain purity through production in a veritable "sea of GE pollen."[37] While organic farmers overwhelmingly want organic seed companies to test for GE material and report findings,[38] seed companies are hesitant to do so, or if they do test, they are hesitant to report the results for fear that customers will not purchase their seed.[39] Conventional seed companies selling to organic farmers likewise do not report contamination. This is largely because there is no recourse for compensating their loss. The GE technology/ patent owner is currently not held liable for economic damage.

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[32] Thottam, Jyoti. 2007. "When organic really isn't organic," TIME, March 14, Retrieved at http://www.time.com/time/health/article/0,8599,1599110,00.html; Organic & Non-GMO Report. 2010. "Organic farmers report increasing contamination with corn," April, Retrieved at http://www.non-gmoreport.com/articles/apr10/organicfarmers_gmocontamination.php.

[33] Fedco Seeds. 2010. Online catalog at http://www.fedcoseeds.com/seeds/Changes.htm.

[34] The Organic & Non-GMO Report. 2006. "Organic rice companies impacted by GM rice contamination," November, Retrieved at http://www.non-gmoreport.com/articles/nov06/gm_rice_contamination.php.

[35] Saskatchewan Organic Directorate. 2002.Organic farmers sue Monsanto and Aventis, January 10, Retrieved at http://www.saskorganic.com/oapf/news.html#pr-rel-8nov04.

[36] Union of Concerned Scientists. 2004. *Gone to seed: Transgenic contaminants in the traditional seed supply,* Retrieved at http://www.ucsusa.org/food_and_environment/genetic_engineering/gone-to-seed.html.

[37] State of Organic Seed Symposium. Participant input form and corn working group discussion notes. February 11, 2010.

[38] Organic Producer Survey, Question 22: 74% of organic producers agreed or strongly agreed to the statement: "Seed companies should conduct testing and report rates of GE (GMO) contamination in organic seed."

[39] Westgate, Megan (Non-GMO Project). Personal communication, May 28, 2010.

In cases where non-GE crop seed is also sold as a GE variety, organic farmers may unknowingly plant seeds that contain GE material – even when the seed is certified organic. This ensures a contaminated harvest before the crop is even sown. This represents not only potential economic loss to farmers who have contracts stipulating non-GE or low levels of GE material in crops, it also puts the integrity of the "USDA Organic" label at risk of losing consumer confidence. Furthermore, these farmers derive no benefit from GE traits. Our experience from presenting at dozens of public presentations on this issue is that consumers, retailers, distributors, and even processors are shocked, and then outraged, to learn that organic farmers could be using seed that contains GE traits, when GE is explicitly listed as an "excluded method" in the NOP rule. These stakeholders believe that "excluded" means excluded.

National Organic Program and Genetic Engineering: When the USDA published its proposed rule for the NOP in 1997, the rule allowed for the use of many controversial inputs, including GMOs. Members of the organic industry and consumers were outraged by the proposed rule. To date, the USDA has never received more comments on a proposed rulemaking than it did on its first proposed NOP rule.[40] The agency received more than 275,000 comments in opposition to the rule, most of which abhorred the inclusion of GE organisms on the National List of Active Synthetic Substances Allowed.

Seed is a particularly critical entry point for GMO contamination given that crop production that begins with contaminated seed will inevitably result in a final organic product with GMO contamination. To maintain the integrity of organic food and feed, we have to maintain the integrity of the seed.

When asked in an interview about the public's response to the proposed rule, former Secretary of Agriculture Dan Glickman replied: "There was an absolute firestorm."[41] Speaking of the more than 275,000 comments, Glickman said: "It was the most this department has ever received on any rule and maybe one of the most the government has received in modern history." This large consumer outcry showed how important sound organic principles were to

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[40] Federal Register, Volume 65, Number 49 (March 13, 2000); Cummings, Claire. 1997-1998. "Undermining organic: How the proposed USDA organic standards will hurt farmers, consumers, and the environment," *Pesticides and You*, Vol. 17 No. 4, Retrieved at www.beyondpesticides.org/infoservices/.../Undermining%20Organic.pdf.

[41] Lambrecht, B. 1999. "A biotech warrior stresses subtlety," *Post-Dispatch Washington Bureau*, June 6, Retrieved at http://www.cnr.berkeley.edu/~steggall/24Apr99-22Jul99.html.

the public, and that among other controversial practices, genetic engineering held no place in the organic movement's collective vision of what constituted an organic production system.

The crux of many of the controversies surrounding the proposed rule was that the USDA had ignored many of the NOSB's recommendations, including the recommendation to exclude the "big three," as they came to be known: GMOs, sewage sludge, and irradiation.[42] In fact, many of the comments "angrily called on the agency to obey the NOSB."[43] The USDA is still criticized today for not responding to NOSB recommendations.[44]

Why was the USDA permissive of genetic engineering under the organic standards to begin with? In an internal memo acquired by Mother Jones magazine, the USDA highlights its concern about excluding GE material from organics: "The Animal and Plant Health Inspection Service and the Foreign Agricultural Service are concerned that our trading partners will point to a USDA organic standard that excludes GMO as evidence of the Department's concern about the safety of bioengineered commodities."[45]

Still, the USDA could not ignore the huge public response it received against the proposed rule. In the end, the final rule better reflected consumer and organic industry preferences.[46] The final rule was published on December 21, 2000. The NOP became effective on February 21, 2001, but the program itself was not fully implemented until October 21, 2002.

Regarding genetic engineering, perhaps the most important aspect to remember about the NOP is that it provides production standards only, and does not serve as a certification of the end product. Because NOP regulations are process-based and not product-based, they focus on how a product is grown, harvested and prepared, rather than characteristics of the end product.

The final rule does not allow for *the use of* products derived from genetic engineering in certified organic systems. Section 205.105 of the NOP rule specifically prohibits GE crops from certified organic production systems: *"To be sold or labeled as '100 percent organic' . . . the product must be produced and handled without the use of excluded methods. 'Excluded methods'* are *'methods used to genetically modify organisms or*

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[42] "NCSA urges Gore to insure 'strong, credible' organic rule." 1998. ATTRAnews Digest, September, Retrieved at http://attra.ncat.org/newsletter/news0998.html#orgrule.

[43] Sligh, Michael. 2002. "Organics at the crossroads: The past and the future of the organic movement, " *Fatal harvest: The tragedy of industrial agriculture*, San Francisco, CA: Island Press.

[44] Center for Food Safety. 2004. "Threats to the National Organic Standards," Retrieved at http://www.centerforfoodsafety.org/wp-content/uploads/2010/10/Threats-to-the-National-Organic-Standards.pdf; Scott, C. 2006. "Organic http://centerforfoodsafety.org/ProtectingNOS.cfm milk goes corporate," *Mother Jones*, April 26, Retrieved at http://www.motherjones.com/news/update/2006/04/organic_milk.html.

[45] Schmelzer, Paul. 1998. "Label loophole: When organic isn't—organic foods labeling," *The Progressive*, Retrieved at http://www.findarticles.com/p/articles/mi_m1295/is_n5_v62/ai_20527633.

[46] Guthman, Julie. 2004. *Agrarian dreams: The paradox of organic farming in California*, Berkeley and London: University of California Press.

influence their growth and development by means that are not possible under natural conditions or processes and are not considered compatible with organic production.' Such methods include *'cell fusion, microencapsulation and macroencapsulation, and recombinant DNA technology (including gene deletion, gene doubling, introducing a foreign gene, and changing the positions of genes when achieved by recombinant DNA technology)."*

On the surface it may seem that the NOP rule clearly addresses agricultural biotechnology by not allowing the use of GE seeds and feed in certified operations. However, as explained above, GE material can enter a farmer's field and products through means completely out of the farmer's control, complicating the issue of "excluded methods" as they pertain to the NOP rule. Genetic engineering is listed as an "excluded method," but GE material that has drifted from neighboring fields is treated as a prohibited substance, not an excluded method.

The rule defines "drift" as "the physical movement of prohibited substances from the intended target site onto an organic operation or portion thereof." A "prohibited substance" is a substance "which in any aspect of organic production or handling is prohibited or not provided for" in the regulations. Thus, "prohibited substances" include "excluded methods," including GE material.

There is no set level of tolerance for GE material contamination in organic products in the NOP rule. Several countries have set tolerance levels for GE material in non-GE conventional crops and food. These vary widely, from the European Union (0.9 percent) to Japan (5 percent).[47] A GE crop variety must be approved for import into a country before any level of contamination by that GE crop variety will be acceptable. For example, if a GE corn variety not approved for import by the European Union is discovered in a large shipment of corn that is approved for import, the whole shipment would likely be rejected because there is zero tolerance for unapproved GE crop varieties.

The NOP organic rules do, however, establish a tolerance level for pesticide residue. "Residue testing" is defined as "an official or validated analytical procedure that detects, identifies, and measures the presence of chemical substances, their metabolites, or degradation products in or on raw or processed agricultural products." "Tolerance level" is "the maximum legal level of a pesticide chemical residue in or on a raw or processed agricultural commodity or processed food." When organic products test for more than five percent residue of the Environmental Protection Agency's (EPA) tolerance level for a specific contaminant, the agricultural product cannot be sold, labeled or represented as organic.

Because the NOP does not establish a tolerance level for GE material in organic products, the rule governing the exclusion of

[47] Ronald, P. and Fouche, B. 2006. "Genetic engineering and organic production systems," Retrieved at www.indica.ucdavis.edu/publication/reference/r0602.pdf.

products exceeding tolerance levels from being labeled as organic do not apply to GMO contamination, as it only applies to contaminants for which there is an established EPA or FDA tolerance level. In the Federal Register announcing the final rule, the USDA explains why a tolerance was not established in response to comments for setting a "threshold" for GE material in organic products:

> We do not believe there is sufficient consensus upon which to establish such a standard at this time. Much of the basic, baseline information about the prevalence of genetically engineered products in the conventional agricultural marketplace that would be necessary to set such a threshold—e.g., the effects of pollen drift where it may be a factor, the extent of mixing at various points throughout the marketing chain, the adventitious presence of genetically engineered seed in nonengineered seed lots—is still largely unknown. Our understanding of how the use of biotechnology in conventional agricultural production might affect organic crop production is even less well developed.[48]

This response points to a lack of data and tools regarding the presence and measurement of GMOs in organic and conventional fields and products. While this may have been true in 2000, it is clearly not the case in 2010. Contamination in the organic seed supply creates a broken system where organic seed companies are selling organic seed that has GE traits to organic farmers, likely knowing that the seed contains excluded methods. Since it is never overtly stated that the seed contains GE traits, the planting of such seed is allowed. Organic farmers are therefore using GE seed – using an excluded method – whether they intend to or not. Questions remain as to how often GE seed is being planted, how much of any seed lot has GE material, and to what degree the seed sector knows it is selling GE seed to organic producers. What's clear is that the integrity of the organic label is at stake.

Seed is both an agricultural product and an input – a special case in all of agriculture. The USDA's inaction on the seed contamination issue is a large gap in the NOP, especially when farmers' crops are contaminated by factors completely out of their control. Protecting the integrity of organic seed cannot, however, fall only on the shoulders of the organic community and the USDA. The patent holders and manufacturers of seed technologies must be held liable for negative impacts to the organic community – be it harm to an organic seed company's reputation or direct economic damage.

Regulatory Framework: In addition to the issues at the NOP level regarding excluded methods, the federal government has a seriously inadequate regulatory framework for GE crops. The lack of a strong regulatory system to protect farmers' rights, domestic and export markets, and the maintenance of the natural resource of seed is at the root of GMO contamination of organic crops. No new law has been created to address the

[48] Federal Register, Volume 65, Number 246 (December 21, 2000).

multiple risks of agricultural biotechnology. The U.S. government instead relies on a patchwork of laws (most of which predate the technology) and three government agencies' subjective interpretations of their role under these laws to regulate GE crops. Government reports cite serious regulatory shortfalls, especially during the field trial stage, concluding that the USDA's oversight of experimental field trials is "inadequate."[49] In fact, the judicial system has had to step in to correct regulatory and legislative deficiencies. Two federal judges have pointed out that the USDA failed to follow federal law by not conducting a full Environmental Impact Statement for GE alfalfa and sugar beets, specifically citing the impacts on farmers' ability to choose GE-free seed and consumers' ability to choose GE-free food. Once a GE crop is approved for commercial sale and planting ("deregulated") it is not subject to post-market surveillance or reporting, and does not have to be segregated from conventional crops and products.

Confronting Contamination: Organic farmers depend on organic and other non-GE seed varieties to meet organic standards and consumer demand. Seed contamination places an unfair burden on organic farmers by hindering their ability to find GE-free seed. The organic community is responding to the challenges contamination poses in a number of ways, including best practices in seed production; testing and labeling; and litigation and legislation.

In 2010, the National Organic Coalition outlined "Principles to Drive GMO Contamination Prevention Strategies" (see Box 1). Only when decision makers take these principles seriously will we make progress toward protecting the integrity of organic seed and feed sources.

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[49] U.S. Department of Agriculture, Office of Inspector General. 2005. *Audit report: Animal and Plant Health Inspection Service controls over issuance of genetically engineered organism release permits*, Retrieved at www.usda.gov/oig/webdocs/50601-08-TE.pdf.
Government Accountability Office. 2008. *Genetically Engineered Crops: Agencies Are Proposing Changes to Improve Oversight, but Could Take Additional Steps to Enhance Coordination and Monitoring*, Retrieved at http://www.gao.gov/products/GAO-09-60.

Box 1: Principles to Drive GMO Contamination Prevention Strategies

Consumer choice Consumers have the right to choose non-GMO food.

Consumer right to know Consumers have the right to know where and how their food was grown.

Farmers Entrepreneurial Choice Farmers must have the right and opportunity to grow food, feed, fiber, livestock, and fish that serve important and lucrative domestic and foreign markets.

Fairness Personal and corporate responsibility must be upheld. If you own it and are profiting from it you are responsible for the costs associated with contamination prevention and any resultant damage from contamination.

Liability Testing for contamination, establishing buffers, reimbursement for lost sales, loss of organic product premiums, clean-up and removal are the costs of doing business that must be borne by the GMO patent holder.

Precaution The pre-market burden of proof of safety is on the patent holder. This includes comprehensive evaluation of health, socio-economic, and environmental impacts of GM crops and technologies.

Sustainability Agricultural technologies and systems must be assessed for sustainability and those that facilitate further declines in family farming or erode the human and environmental foundations of American agriculture must not be allowed.

Health, Environmental and Economic Evaluation Technologies that pose environmental, economic, and health risks should be evaluated before commercialization and tough choices must be made about whether their overall societal benefits outweigh their costs.

Parity There must be a long-term commitment to supporting the vitality of diverse agricultural enterprises, including parity of public investment, infrastructure, marketing, technical assistance, research, and funding.

Transparency Ongoing documentation, tracking and labeling systems must be established to monitor the movement of GMOs in the environment, seed banks, on-GMO seed stocks, and food.

Diversity Society and agriculture will greatly benefit from the rapid reinvigoration of public cultivars and breeds to restore genetic diversity on farms, ensure greater farmer seeds/breeds choices, and to enhance national food security.

Best Practices There is at least one corn seed company working on best production practice standards for non-GE seed crops that would be managed similar to other forms of seed certification.[50] Such standards would be an attempt to mitigate the rate of contamination in corn seed production. While this may reduce contamination rates, it will not give 100% protection, and adds additional cost and burden to organic seed producers – a cost that will be carried by organic farmers paying higher prices for seed.

Testing Even though the NOP does not require testing for GE material, some farmers, seed companies, food companies,

[50] Charles Brown (Brownseed Genetics). Personal communication, January 24, 2010.

and consumer/environmental groups are investigating the extent of GE contamination through testing.[51] Testing remains limited, as PCR tests for each seed lot would be financially prohibitive. In addition, when contamination is found there is no easy recourse for collecting compensation for contamination damages, the ongoing costs of testing, contamination buffers, and potential clean-up.

Labeling Legislative efforts to require labeling, including the Genetically Engineered Food Right to Know Act (H.R. 6635), have been unsuccessful.[52] Still, polls show that the majority of consumers want GE foods labeled.[53] Absent labeling requirements for GE food ingredients, consumers continue to view the organic label as a legitimate alternative given the USDA's rule excluding the use of genetic engineering. New labels have been introduced, but none that guarantee inputs or products that are free of GE material.[54]

Litigation Because the USDA is not following environmental laws, and regulations are failing to protect organic and other non-GE markets, farmers and non-governmental organizations have been forced to use the courts to slow or stop contamination by challenging the approval of specific GE crops, and with some success:

- GE alfalfa A precedent-setting court decision in 2007 found that the USDA failed to address concerns that GE alfalfa will contaminate conventional and organic alfalfa. The court issued a permanent injunction, barring further planting of GE alfalfa pending the results of an EIS. A court had never before vacated a USDA decision to approve a GE crop. Although the Supreme Court reversed part of the lower court's ruling in June of 2010, it left in place the ban on planting GE alfalfa pending completion of the EIS and future regulatory decisions.

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[51] Union of Concerned Scientists. 2004. *Gone to seed: Transgenic contaminants in the traditional seed supply*, Retrieved at http://www.ucsusa.org/food_and_environment/genetic_engineering/gone-to-seed.html; Organic & Non-GMO Report. 2010. "Organic farmers report increasing contamination with corn," April, Retrieved at http://www.non-gmoreport.com/articles/apr10/organicfarmers_gmocontamination.php.

[52] Congressman Dennis Kucinich, "Issues: Agriculture," Retrieved at http://kucinich.house.gov/Issues/Issue/?IssueID=1459.

[53] Hallman, W. K., Hebden, W. C., Aquino, H.L., Cuite, C.L. and Lang, J.T. 2003. "Public perceptions of genetically modified foods: A national study of american knowledge and opinion," Retrieved at www.foodpolicyinstitute.org/docs/reports/NationalStudy2003.pdf. (finding that 94% of respondents favor labeling of foods containing GE ingredients); Langer, G. 2001. "Behind the label: Many skeptical of bio-engineered food," ABCNews, June 19, Retrieved at http://abcnews.go.com/sections/scitech/DailyNews/poll010619.html (finding that 93% of respondents favor labeling of foods containing GE ingredients).

[54] The Non-GMO Project. 2010. "Understanding Our Seal," Retrieved at http://www.nongmoproject.org/consumers/understanding-our-seal/. The Non-GMO Project label does not guarantee that products are free of GMO presence, but rather that companies have followed testing protocols as outlined in the projects guidelines.

- GE sugar beets Following the landmark alfalfa case, a similar lawsuit was filed challenging the USDA's approval of GE sugar beets. Plaintiffs, including Organic Seed Alliance, argued for a thorough assessment of environmental, health, and associated economic impacts of deregulating GE sugar beets, as required by federal law. Once again, the court ordered an EIS for the GE variety. At the time of this report's completion, the USDA was seeking partial deregulation of GE sugar beets while the EIS is being completed (i.e., allowing GE sugar beet production under permits).

- GE pharmaceutical crops A federal court found that the USDA violated environmental laws in permitting four companies to plant pharmaceutical GE crops in Hawaii absent preliminary environmental reviews.[55]

Litigation involving GE crops is time-consuming and expensive. However, in the face of weak regulatory frameworks, the courts appear to be farmers' only recourse in protecting themselves from irreparable economic and environmental harm resulting from the widespread planting of GE crops.

Public Comment Opponents of GE crops largely rely on public comment periods and legal petitions to voice concern and influence GE crop regulatory decisions.[56] As previously mentioned, when the USDA first released a draft of the proposed organic rules that allowed genetic engineering as a method in organic production, over 275,000 consumers responded; submitting the highest number of comments the agency has ever received. All but three of these comments were opposed to GE usage. GE was excluded, but there have been no protections for organic farmers and companies when GE material is introduced into their production systems.

State Legislation Local initiatives focused on protecting organic farmers and their markets from undue risks associated with GE crops have popped up across the U.S. with some success. These local and state initiatives seek to address the shortcomings of federal regulations governing GE crops in order to avoid contamination. These initiatives range from outright bans on planting GE crops to establishing sampling protocols in cases of alleged seed patent infringement.

Five counties in California have passed initiatives that place limitations on agricultural biotechnology, most of which ban growing GE crops. Dozens of New England towns have also passed resolutions regarding GE crops, almost a quarter of which call for moratoriums on planting GE seeds.[57]

In 2006, the Vermont legislature passed the most comprehensive farmer protection bill in history. The bill was the first to include language that held manufacturers of patented seed liable for economic damage in

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[55] *Center for Food Safety v. Johanns*, 451 F.Supp.2d 1165 (D. Haw. Sept. 1, 2006).

[56] For example, in March 2003, five farm organizations and two state senators filed a citizen petition asking USDA to require an Environmental Impact Statement concerning the deregulation of GE wheat. See http://worc.org/userfiles/WheatUSDApet.pdf.

[57] "Background: Industry aims to strip local control of food supply." 2006. Environmental Commons, Retrieved at http://environmentalcommons.org/seedlawbackgrounder.html.

cases of contamination. Despite passing both houses, and even after thousands of phone calls to the Governor's office, he still vetoed the bill.

The organic community fought hard for standards that reflect strong organic principles during the beginning phases of the NOP, and excluding GE products was an important component of this value system.

Other states have had success, but their successes have been limited to less comprehensive legislation. California passed a bill in 2008 that offers farmers some protections from mistakenly being targeted by biotechnology firms for patent infringement. The law levels the playing field by establishing a mandatory crop sampling protocol to prevent patent owners from sampling crops without the permission of farmers.[58] The law also protects farmers from liability resulting from unwittingly acquiring patented traits through such processes as GE pollen drift. Maine passed a similar bill the same year.[59] Other states have passed related legislation (North Dakota, South Dakota, and Indiana) while others have tried but been unsuccessful (Illinois, Montana, New Mexico, and Washington).

Other examples of state legislation include:

- Minnesota's 2007 legislature passed a bill that required an Environmental Impact Statement for the release of GE wild rice.[60]
- The Arkansas State Plant Board banned for the 2007/2008 growing season two GE rice varieties that were involved in GE rice contamination events and mandated testing of all seed stocks.[61]
- The California Rice Commission established a moratorium on GE rice field trials until safeguards are in place.

And two regulatory/legislative actions, though not GE-specific in language, prohibited and/or restricted the planting of a crop based on the risk of genetic contamination to seed producers. The crop

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[58] Genetic Engineering Policy Alliance. 2008. "California's first law protecting farmers from the threats of genetic engineering signed by Governor," Retrieved at http://www.gepolicyalliance.org/action_alert_support_ab541.htm.

[59] "New laws passed for GE crops." 2008. Maine Today, April 10, Retrieved at http://news.mainetoday.com/updates/025169.html.

[60] Minnesota Legislative Session 85 (2007-2008). H.F. 1663, Retrieved at http://www.leg.state.mn.us/.

[61] Environmental Commons. 2007. "Food Democracy Legislation Tracker," Retrieved at http://environmentalcommons.org/tracker2007.html.

that was restricted, canola, happens to also primarily be a GE crop.

- Oregon's Department of Agriculture restricted plantings of canola to protect vegetable seed production from genetic contamination. [62]

- Washington's Governor signed legislation to create "brassica seed production districts" to protect the vegetable seed industry from contamination of canola. [63]

Conclusions: The organic community has long been concerned about the integrity of its products, and GMO contamination has been an ongoing risk point in the integrity of organic production systems. Although genetic engineering is an "excluded method," its presence in organic products shows it is not totally excluded. It is time for the organic community to confront a problem that was only partially dealt with at the time the organic standards were written. Seed is an essential place to take a stand.

The NOP was built on transparency, and not addressing the contamination issue now will lead to future problems that may prove irreversible, including a loss of consumers' confidence in the organic label. The organic community fought hard for standards that reflect strong organic principles during the beginning phases of the NOP, and excluding GE products was an important component of this value system.

As a federal ban on genetically engineered crops is unlikely, policies must be adopted that address issues associated with the unwanted contamination of organic products by GE material.

The USDA's oversight of GE crops must improve, starting with field trials. To begin, recommendations given by the Inspector General of Agriculture (2004)[64] and Government Accountability Office (2008)[65] should be adopted. Both organic and conventional crops risk contamination by GE crops not approved for commercial use. Strengthening field trial oversight could include more involvement of state agriculture departments. For deregulated crops, a monitoring program should be implemented as a way to identify risks not identified in risk assessments during field trials. Most significantly, the USDA should require growers of GE crops to establish buffer areas and other containment measures to mitigate pollen flow from GE crops to neighboring fields.

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[62] Oregon Department of Agriculture. 2005. Canola Growing Regulations, Retrieved at http://www.oregon.gov/ODA/PLANT/canola_summary.shtml.

[63] Washington State Legislature. 2007. Brassica seed production, 15 RCW 15.51, Retrieved at http://apps.leg.wa.gov/rcw/default.aspx?cite=15.51&full=true.

[64] U.S. Department of Agriculture, Office of Inspector General. 2005. *Audit report: Animal and Plant Health Inspection Service controls over issuance of genetically engineered organism release permits*, December, Retrieved at http://www.liebertonline.com/doi/pdf/10.1089/blr.2006.25.186.

[65] Government Accountability Office. 2008. *Genetically Engineered Crops: Agencies are proposing changes to improve oversight, but could take additional steps to enhance coordination and monitoring*, November 5, Retrieved at http://www.gao.gov/products/GAO-09-60.

Additionally, a federal Farmer Protection Act would protect farmers against GMO contamination in five ways, ensuring that (1) in cases where GE companies claim patent infringement from farmers saving seed, the venue and choice of law is the state where the farmer resides; (2) an independent third party participates in patent infringement investigations; (3) farmers are not held liable for patent infringement when small amounts of GE content is discovered on their property and the presence provides no economic benefit; (4) the manufacturer of GE crops is held strictly liable for economic damage caused by contamination, and (5) a "pay-out" compensation mechanism is funded by the patent owner.

Please see Priority Goals in section 7 of this report for additional actions and policy recommendations regarding GMO contamination of organic seed systems.

Risks of Concentration in Seed Sector

Concentration in the Seed Industry: Implications for Organic Agriculture Seed is not only an input for crop production, it is a natural resource that demands management in a manner that is ethical, sustainable, profitable, and effective in delivering agronomic adaptations for the diverse agricultural systems and markets within the U.S. Plant genetic resources were once managed and maintained as a public commons with intellectual property rights in the form of Plant Variety Protection Act certificates that were adequate to compensate private innovators, while allowing both farmers and other researchers to save seed, sell seed and further adaptation and the development of new characteristics within the crop. Diversity and competition thrived through most of the twentieth century with public and private breeding programs delivering improved genetics to a broad array of farming systems. This changed dramatically when the Supreme Court upheld the use of utility patents on living organisms.[66] Large corporations that had little to no previous investments in seed and genetic traits rushed into the market to take advantage of this powerful intellectual property tool. This trend led to the highly concentrated seed industry that we face today.

Concentration in the seed industry has a negative impact on organic farming. It has resulted in decreased public and private research and development of varieties and breeding populations for minor markets, such as organic. As the industry consolidates, farmers have seen varieties sold in smaller volumes, often those that serve organic farming systems. In 2000, the world's largest vegetable seed company, Seminis (prior to being bought by Monsanto), acquired several smaller international seed companies. The mergers resulted in a decision by Seminis to drop over 2,000 varieties from production in a single season, a trend that continues.[67] The result has been fewer options for organic farmers, and for the researchers and seed companies trying to serve them.

Seed Industry Concentration: The seed industry stands out as one of the most concentrated in agriculture. Once comprised of mostly small, family-owned companies, the industry is now dominated by a handful of transnational biotechnology/chemical firms. The top three firms, for example, account for more than 75% of U.S. corn seed sales.[68] One firm's patented genetic traits are in nearly all corn, soybean, and cotton

[66] Diamond v. Chakrabarty, 447 U.S. 303, 308 (1980).

[67] Rural Advancement Foundation International. 2000. Earmarked for Extinction? Retrieved at http://www.etcgroup.org/en/node/318.

[68] Hubbard, Kristina. 2009. *Out of Hand: Farmers Face the Consequences of a Consolidated Seed Industry*, National Family Farm Coalition, Retrieved at www.farmertofarmercampaign.org.

acreage planted in the U.S.[69] Vegetable seed is following a similar consolidation trajectory and is dominated by a single player – Seminis (Monsanto) – that dwarfs any competitor.[70]

Rapid and extensive consolidation is a consequence of the following factors:

- Weak antitrust law enforcement allowed large firms to acquire and merge with a significant number of competitors;
- Supreme Court decisions paved the way for firms to patent plant parts, including seeds, traits, and described plant characteristics (and Congress has not acted to clarify the intent of the Plant Variety Protection Act);
- Federal legislation (1980 Bayh-Dole Act) encouraged the privatization and patenting of public research; and
- Funding for public plant breeding and cultivar development has dramatically reduced.

These factors have led not only to fewer choices in the seed marketplace, but also concentrated control over important plant genetics needed for research and development for all agricultural systems. This level of concentration has severe consequences for the organic community.

Impacts to Organic: Organic farmers are underserved in genetics specifically adapted to their cropping systems, regions, and market niches, and experience a basic lack of availability of organic seed, with an even greater gap in varieties specifically bred under certified organic conditions. As private concentration and intellectual property control of plant genetics expand, the public sector weakens, innovation stagnates, and minor markets such as organic do not receive needed investments in seed system development.

Other consequences of seed industry concentration on organic agriculture are clear:

- *Dominant firms do not serve organic interests:* This is because the organic community embraces ecological alternatives to biotechnology and has deemed genetic engineering an excluded method in the National Organic Program (NOP). The organic and biotechnology sectors are generally in conflict with each other's goals, objectives, practices, and values.[71]
- *Loss of regional independent seed companies:* Companies that for decades served the regional needs of farmers by breeding varieties with agronomic traits adapted to very specific environments – including some that were serving or preparing to serve the organic market – have been lost with seed industry consolidation. What regional companies exist often struggle to get access to

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[69] Monsanto Company. 2010. *Supplemental Toolkit for Investors*, http://www.monsanto.com/investors/.

[70] Tomich, J. 2009. "Seeds grow Monsanto's business," St. Louis Post-Dispatch, September 20.

[71] Altieri, Miguel A. 2005. *The Myth of Coexistence: Why Transgenic Crops Are Not Compatible With Agroecologically Based S*ystems of Production, Bulletin of Science, Technology & Society, Vol. 25, No. 4, August 2005, 361-371, Retrieved at www.odg.cat/documents/formacio/7juny_Rosa_Binimelis.pdf.

optimum parent lines, or when they can access them they are expensive with cost-prohibitive and restrictive licensing agreements. Firms such as Monsanto have a clear strategy of purchasing independent seed companies, many of whom once served the organic market with untreated conventional seed and certified organic seed.[72] In general, these smaller regional independent companies have greater flexibility in serving local markets and minor markets such as organic. The loss of regional companies has limited the number of seed companies investing in conventional and organic, limiting not only availability but also the continued research and development that all markets need to evolve and thrive.

- *Public breeding programs are increasingly privatized:* Private funding of industry research surged after 1980 as public funding declined.[73] This coincided with passage of the Bayh-Dole Act, which allows the patenting of publicly funded research. Land grant universities and other public breeding programs now find themselves financially dependent on a concentrated industry sector to fund infrastructure, graduate students, and breeding programs. As a result, research goals narrow to meet the needs of larger industries, such as agricultural biotechnology, rather than the diverse needs of farmers. The influence these companies have on Land Grant Universities (LGU) impacts not only innovation, but distorts objective research and education, and weakens the mission of public institutions. While the private and public sector should and can be mutually supportive, agricultural research is currently imbalanced and tipped toward benefiting a few corporations and their shareholders. Ideally the public research sector would add competition to the market by continuing to release significant volumes of finished public cultivars, with an increase in innovative germplasm for emerging agricultural markets such as organic.

- *Patents lock up important genetics:* Patents hinder innovation by removing valuable plant genetic material from the pool of public resources breeders rely on. Breeders are restricted or prohibited from using patented varieties, traits, or tools unless onerous licensing agreements are signed and expensive royalties paid. The result is a public sector that lacks an ability to provide for – and an understanding of the underlying values and needs of – the organic market. For example, in field corn a utility patent was filed and granted to Hoegemeyer Hybrids (now owned by DuPont-Pioneer) for a trait they call PuraMaize.[74] This trait has been bred and recorded in public research for decades, yet the flawed patent system has provided a single company the proprietary rights. This is a trait that the organic seed market is very interested in using, as it creates a characteristic in corn crops to accept only pollen from genetically similar plants. Such a trait can significantly reduce cross-pollination of organic corn crops from GE

[72] For example, the company NC+ served the organic market before it was purchased by Monsanto in 2004.

[73] Heisey, P.W., C.S. Srinivasan, and C. Thirtle. 2001. Public sector breeding in a privatizing world. ERS Agriculture Information Bulletin, 772, August, Retrieved at http://www.ers.usda.gov/Publications/AIB772/.

[74] U.S. Patent No. 6875905.

corn crops. Yet seed companies report that restrictive licensing fees make it cost-prohibitive for them to lease the trait from Hoegemeyer.

Conclusions: The trends described above put the integrity of organic agriculture at risk and hinder the success of this growing sector. Organic farmers already find it difficult to access quality certified organic seed. Varieties they once relied on have been abandoned as the industry consolidates. Seed companies looking to serve organic markets do not have access to genetic traits tied up by patents, or parent lines that are proprietary and held by larger firms. Public breeders looking to serve smaller markets such as organic are not encouraged to work on these projects, as they do not return high royalties on intellectual property to their universities. Concentration and the misuse of patents also have global impacts, as they encourage biopiracy -- where indigenous knowledge of nature is exploited for commercial gain with no compensation to the indigenous people -- of public resources and threaten food security. The system is broken.

Confronting industry concentration must be coupled with efforts to create an environment in which new innovators, private and public breeders, and entrepreneurs interested in organic seed systems have an opportunity to thrive. Investments need to be made both at the public and private (e.g., food industry) level. See Priority Goals in section 7 of this report for additional actions and policy recommendations regarding seed concentration.

Public Initiatives Supporting Organic Seed

Overview: It is important to assess the state of past and ongoing public initiatives that have contributed to the success of organic seed systems to review what work has been done as well as give us a better understanding of future priorities. The following assessment is based on research into publicly funded organic seed and breeding initiatives. It details their durations; funding sources and funding levels; their successes and challenges; and the needs for new infrastructure and new initiatives to support organic breeding and organic seed.

Methods: To locate public organic seed and breeding initiatives, we examined lists and databases of the following programs and foundations: the USDA Organic Research and Education Initiative (began as Integrated Organic Program (IOP) and became OREI), the USDA Sustainable Agriculture Research and Education program (SARE), the federal Risk Management Agency (RMA), the USDA Value Added Producer Grants program (VAPG), the Organic Farming Research Foundation (OFRF), and the Farmers Advocating for Organics fund (FAFO). Additionally, we searched the USDA Current Research Information System (CRIS), past Organic Seed Alliance grant proposals, and a thesis from Theresa Podoll (2009) on "Participatory plant breeding's contributions to resilience and the triple bottom line of sustainability -- healthy ecosystem, vital economy, and social inclusion."[75]

Search terms included: "organic breeding," "organic breed," "organic seed," "organic variety," "organic," "seed," "variety," and "breed."

List of Initiatives: We identified 57 projects directly related to organic breeding or organic seed funded either by publicly available government or foundation grants.

[75] Podoll, Theresa. 2009. *Participatory plant breeding's contributions to resilience and the triple bottom line of sustainability -- healthy ecosystem, vital economy, and social inclusion*, Unpublished master's thesis, Iowa State University, Ames, Iowa.

Project Name	*Recipient Organization*	*Year(s)*	*Source*	*Funding Amount*
Breeding / Variety Trials				
Identification Of Management Practices And Cultivars For Organic Hard-Winter Wheat Production	Utah State University	1996-1999	SARE, Other Non-Federal Funds	$155,611
Methods to breed field corn that competes better with weeds on organic farms.	Michael Fields Ag Institute	2000	OFRF	$12,000
Support to develop open-pollinated corn varieties for organic farmers	Michael Fields Ag Institute	2000	OFRF	$8,800
Small-grain cultivar selection for organic systems	North Dakota State University	2001	OFRF	$7,706
Corn Variety Performance Trials For Ohio Organic Farmers	The Ohio State University	2001-2002	OFRF	$8,280
Whole System Seed: Crop Breeding For Sustainable Agriculture	Shoulder To Shoulder Farm	2001-2002	OFRF	$15,578
Public Seed Initiative	Cornell	2001-2004	OFRF	$23,636
Bringing Small-Grain Variety Development and Selection onto Organic Farms	North Dakota State University	2002 - 2004	SARE, Other Non-Federal Funds	$106,022
Development of wheat varieties for organic farmers	Washington State University	2002-2004	OFRF	$33,472
Evaluation of glandular-haired, potato leafhopper resistant alfalfa for organic farming systems	Ohio State University	2004	OFRF	$9,418
Organic Seed Partnership	Cornell	2004-2008	IOP/OREI, SARE, Other Non-Federal Funds	$1,195,883
Organic Breeding Populations: Tomato Late Blight Resistance	Organic Seed Alliance	2005	OFRF	$10,068

Farmer-Led Development and Commercial Release of Improved Hard Red Spring Wheat Variety	Farm Breeder Club	2005-2007	SARE	$17,995
Developing A Public Domain Seed Bank For The Ozark Bioregion	Elixir Farm	2006-2008	SARE	$17,095
Development Of Corn Borer-Resistant Corn For Organic Farming Systems.	Seed We Need	2006-2008	OFRF	$37,875
Evaluating Corn Varieties In Pure And Mixed Stands For Organic Crop Production Across Three States In The Corn Belt	The Ohio State University	2006-2008	SARE	$138,252
Northeast Organic Wheat	Heritage Wheat Conservancy	2006-2009	SARE, Other Federal Funds, Other Non-Federal Funds	$246,445
Developing Wheat Varieties For Organic Agricultural Systems	Washington State University	2006-2010	IOP/OREI	$690,557
Establishing Breeding Populations In Corn, Broccoli, And Kale	Organic Seed Alliance	2007	OFRF	$11,834
Integrating Cultivar, Soil And Environment To Develop Regional Value-Added Wheat Crops With Enhanced Nutrient Value.	Washington State University	2007	OFRF	$11,500
Developing Small Grains Cultivars And Systems Optimally Suited For Organic Production	University Of Nebraska	2007-2011	IOP/OREI	$775,937
Evaluation of day-neutral strawberries	Washington State University	2008-2010	OFRF	$38,640
Facilitating Compliance With National Organic Program Standards Through Organic Variety Trials	Oregon State University	2009	Other Federal Funds	$24,690

Participatory Plant Breeding To Improve Sweet Corn.	University Of Wisconsin	2009	OFRF	$14,795
Superior Cover Crop Varieties for Organic Seed Production in the Maritime Northwest	Multiple	2009	OFRF	$14,884
Trialing And Seed Increase Of Promising New Vegetable Varieties For Organic Systems	Cornell	2009	OFRF	$14,953
Northern Organic Variety Improvement Collaborative (NOVIC)	OSU, OSA, UW, Cornell	2009-2010	IOP/OREI	$522,108
Farmer Driven Breeding: Addressing The Needs Of Southeastern Organic Field Crop Producers	North Carolina State University	2009-2012	IOP/OREI	$1,174,942
Plant Breeding And Agronomic Research For Organic Hop Production Systems	Washington State University	2009-2012	IOP/OREI	$410,077
Practical Perennials: Partnering With Farmers To Develop A New Type Of Wheat Crop	Michigan State University	2009-2013	IOP/OREI	$1,049,674
Enterprise Development				
Yellow Dent Organic Hybrid Seed Corn	Michael Jasa	2002-2005	SARE	$6,000
Siskiyou Sustainable Cooperative	Siskiyou Sustainable Cooperative	2003 and 2005	Other Federal Funds	$42,085
Family Farmers Seed Cooperative	Organic Seed Alliance	2008-2009	Other Federal Funds	$120,000
Specialty Organic Seed Marketing And Cooperative Development Project	Organic Seed Alliance	2008-2009	Other Federal Funds	$33,000
Specialty Seed Producers Cooperative (NOGN)	Organic Seed Alliance	2009	Other Federal Funds	$84,000

Seed Production Research and Education				
Saving Our Seed	Carolina Farm Stewardship Association	2003-2006	SARE	$204,500
Seed Growers' Handbook: Producing Vegetable Seeds For Sustainable Agriculture	Seed movement	2003-2007	SARE	$62,925
Trial of beneficial microbial seed treatments in organic farming systems	Multiple	2004	OFRF	$5,429
Producing Organic Vegetable Seed	Organic Seed Alliance	2004-2007	SARE	$154,293
Weather-Related Risk Reduction Guidelines For Vegetable Seed Growers	Organic Seed Alliance	2005	Other Federal Funds	$9,269
Microbial Seed Treatments	Multiple	2005-2006	OFRF	$23,340
Hybrid Seed Production Techniques For Cucurbita Pepo In Organic Agricultural Systems	High Mowing Seed Company	2007-2008	Other Federal Funds	$80,000
Non-GMO Parent Lines	Brownseed Genetics	2008	FAFO	$45,000
Organic cover crop seed production as a sustainable enterprise for the Southeast	Multiple	2009	OFRF	$2,536
Organic Seed Production Guides	Organic Seed Alliance	2009	OFRF	$13,614
Seedling Diseases And Seed Treatments	Multiple	2009	Other Federal Funds	$40,000
Systems Development				
Sustainable And Organic Roundtable	Center For Rural Affairs	2006	Other Federal Funds	$3,000
Organic Seed Producer Database	Organic Seed Alliance	2006-2007	SARE	$15,960
Organic Seed Production: Materials, Training, And A Seed Database	OMRI, OSU, OSA	2006-2008	SARE	$98,755

Hua Ka Hua - Restore Our Seed; A Symposium To Develop A Hawaii Public Seed Initiative	The Kohala Center	2009	IOP/OREI	$47,500
The Seed We Need - Working Group, Symposium, And Action Plan For The Advancement Of Organic Seed Systems	Organic Seed Alliance	2009-2010	IOP/OREI, FAFO	$56,281
Multi-Topic				
Farm Breeder Club	North Dakota State University	2002-2004	Other Non-Federal Funds	$33,069
Restoring Our Seed	Heritage Wheat Conservancy	2002-2006	SARE, Other Federal Funds, Other Non-Federal Funds	$204,000
On-Farm Variety Trials: Guidelines And Field Trainings For Organic Vegetable, Herb And Flower Producers	Organic Seed Alliance	2006-2007	Other Federal Funds	$115,059
Organic Seed Growers Conference	Oregon State University	2007-2008	SARE	$3,615
Organic Certified Seed Potato Production In The Midwest	University Of Wisconsin	2009	IOP/OREI, OFRF	$570,656
Seed Matters	OFRF	2010-2014	Other Non-Federal Funds	$250,000

[76]

[76] Project funding was divided in five ways: by year, by funding source, by project type, by crop type, and by region. When calculating funding for multi-year projects, we considered total funding to be evenly distributed into all of the years in the project's term. Funding sources were divided into 6 categories: IOP/OREI, SARE, OFRF, FAFO, Other Federal Funds, and Other Non-Federal Funds. The projects were split by topic into Breeding / Variety Trials, Seed Production Research and Education, Systems Development/Policy, Enterprise Development, and Multitopic. Projects were also split into five regional categories: West, Midwest, Northeast, Southeast, and Multiregion. Projects were divided by crop type into Corn, Wheat, Multiple Small Grains, Multiple Field Crops, Potato, Vegetables, Multiple Crops, and Hops. Some projects that involved wheat were included in the Multiple Small Grains category, and some projects that involved corn were included in the Multiple Field Crops.

Seven additional projects are listed below that were identified as either peripherally connected to organic breeding or organic seed, or that were funded by private sources. Because information on private funding is not always easily accessible, it is likely that there are more projects than those listed here.

Other Projects		
Project Name	*Recipient Organization*	*Year(s)*
Breeding Pest Resistant and Stress Tolerant Corn for More Environmentally Sound Production Systems	Cornell University	2006-2009
Corn Breeding and Sustainability	South Dakota State University	2003-2008
Evaluating OP Corn in the Northeast	Cornell University	2002
Providing Farmers the Technology Required to Efficiently Breed Corn Varieties Specifically Adapted to Alternative Cropping Systems	University of Nebraska	2003-2006
Enhancing Farmers Capacity to Produce High Quality Organic Bread Wheat in Vermont	OREI	2009-2013
Seeds and Breeds for the 21st Century	RAFI	2003-2009
United States Trialing Network	Practical Farmers of Iowa	2009

Funding: Overall, projects received around $9,100,000 in support from federal and state agencies and public foundations. The levels of funding have increased in recent years, with projects in 2009 receiving by far the most support (Table 1). The largest individual source of funds has been the USDA's Organic Research and Education Initiative (IOP/OREI, Table 2), although SARE has funded the greatest number of project-years. Most of the funding has gone to breeding and variety trials, with less support for farmer education, enterprise development and systems work (Table 3). Wheat and vegetables were the two crop types that received the most funding (Table 4). Regionally, the largest share of funds has gone to the Midwest (Table 5).

Table 1. Funding by year		
Year	Funding amount	
1996	$	38,903
1997	$	38,903
1998	$	38,903
1999	$	38,903
2000	$	20,800
2001	$	18,446
2002	$	111,782
2003	$	191,459
2004	$	471,869
2005	$	441,888
2006	$	783,835
2007	$	916,702
2008	$	904,951
2009	$	2,076,207
2010*	$	1,251,563
2011*	$	811,377
2012*	$	656,190
2013*	$	259,935
2014*	$	50,000
*Current funding. Levels expected to increase		

Table 2. Funding by source		
Source of funds	Funding amount	
FAFO	$	55,000
IOP/OREI	$	6,152,698
OFRF	$	347,842
Other Federal Funds	$	581,103
Other Non-Federal Funds	$	614,183
SARE	$	1,371,787

Table 3. Funding by project type		
Project Type	Funding amount	
Breeding / Variety Trials	$	6,798,727
Enterprise Development	$	285,085
Multi-Topic	$	1,176,399
Seed Prod. Research and Education	$	640,906
Systems development	$	221,496

Table 4. Funding by crop type		
Crop Type	Funding amount	
Alfalfa	$	9,418
Corn	$	256,207
Wheat	$	2,409,254
Multiple small grains	$	922,734
Multiple field crops	$	1,174,942
Potato	$	570,656
Strawberries	$	38,640
Vegetables	$	2,117,122
Multiple	$	1,213,563
Other	$	410,077

Table 5. Funding by region		
Region	Funding amount	
Midwest	$	2,820,944
Multiregion	$	917,950
Northeast	$	1,746,710
Southeast	$	1,399,073
West	$	2,237,936

Analysis of Past Project Successes, Challenges and Needs: To determine the successes, challenges and needs in public organic seed and breeding initiatives, report abstracts from all available project reports were reviewed and project primary investigators were contacted.

Successes Project successes were reported or observed in networking and stakeholder participation in research, education and enterprise development, organic variety development, and the expansion of funding.

A large number of projects had strong farmer involvement, with some being farmer led. Many breeding projects and trials also included input from users throughout the production stream (e.g. wheat trials involving farmers, millers, and bakers). Additionally, many project leaders reported that their projects led to stronger connections between researchers, farmers, and seed companies, paving the way for further work.

There were several education and enterprise development projects that succeeded in responding to seed producers' needs. Some projects have made seed production information more accessible and increased seed producers' knowledge and use of best practices. Others have supplied seed producers with necessary equipment. *At least one project created business relationships between farmers and seed companies.*

Breeding and trialing projects have begun to find or create varieties for organic agriculture. A number of projects have identified varieties that perform well in organic systems. Many projects have improved germplasm for organics, *and at least three projects succeeded in bringing organically bred material to the market*. A number of projects reported that their efforts have resulted in increased attention to, and funding prioritization for, organic breeding and seed production.

Challenges Project leaders have reported a number of challenges facing the organic breeding and organic seed community. These challenges are related to breeding, participatory research, variety commercialization and organic seed production.

Many project leaders felt they lacked access to the best available germplasm, especially international germplasm.

At least one project struggled with what seemed to be negative correlations between important breeding traits (such as presence of some nutrients) and yield. The environmental variability in some organic research sites created challenges when selecting for some traits. Many project leaders reported that they had to overcome skepticism about the need and ability to breed for organics – skepticism from farmers, from other researchers, and from seed companies.

Although many projects had success using farmer participatory research, a number of projects reported challenges with involving farmers. Some project leaders reported that farmers do not always stay engaged in the projects over time. One report suggested that farmers may not stay engaged in breeding projects when a superior variety is not produced quickly. The coordination of breeding sites at multiple farms – at times in multiple states – has also been reported as challenging. Additionally, it appears (with notable exceptions) that many university or non-profit personnel, not farmers, initiated most of the organic seed projects. Farmers were also at times volunteers, and not paid partners in a project. At other times farmers were not compensated at a level commensurate with what they would have earned for their typical crop production. Literature suggests that in participatory research, projects initiated by formal researchers as opposed to farmers are more likely to experience the challenges reported.[77]

A theme repeated in reports is the challenge of commercializing varieties. Many of the breeding projects began variety development, but few produced finished varieties. This can be at least partially explained by the fact that the increase in organic breeding funding is relatively new, and most grants cover a single year to at most four years of funding. Yet breeding projects often take five to ten years to reach a final product ready for release. In projects with advanced breeding material, the reports

[77] Lammerts van Buren, Edith T. 2002. "Organic Plant Breeding and Propagation: Concepts and strategies," Louis Bolk Institute, Retrieved at www.leafyvegetables.nl/download/04_017-022_Lammerts.pdf.

cite the challenge of bringing that material to market, and this was also discussed at the SOS Symposium. Additionally, some project reports imply that breeders and seed farmers may not always have a clear understanding of the marketplace.

A number of challenges were found for organic seed production. Some project leaders were interested in increasing regional seed production but found that not all seed crops can be successfully grown in all regions. Some projects had concerns about the unknown extent of genetically modified organism (GMO) contamination in organic seed and breeding materials. Concerns about organic seed quality were raised by a number of projects. Some projects reported feedback from farmers who distrusted organic seed quality. Variety trial projects to assess potential varieties for organic farmers reported that the varieties identified as superior in organic systems were not always available as organic seed by the companies who own the varieties.

Needs Needs reported by project leaders included funding systems that would better suit organic breeding and seed production; better training and methods for conducting organic seed and breeding research; infrastructure to improve variety trialing; infrastructure to move organically bred varieties to market; and infrastructure to improve organic seed yields, profitability and quality.

Reports identified a number of ways that funding systems could be changed to improve organic breeding and seed research. Organic breeding requires better access to long-term funding and funding that encourages project continuity, and more investment in "pre-breeding" or germplasm development.

Projects reported needing better methods for conducting organic seed and breeding research. As more organic trialing data accumulates, the best methods for interpreting genotype by environment effect will need to be determined and disseminated. Both breeders and seed producers desire more research on the needs, demographics, and supply and demand of the organic seed market.

To improve on-farm research, four needs were identified:

1. As on-farm projects become larger and require greater land and time management, there needs to be sufficient compensation for farmers for their participation in the research.
2. More grants need to have rolling application windows or approval before spring in order to avoid the lag between applications and planting.
3. Grant application processes need to be simplified to encourage farmer-led projects.
4. Farmers need more training in on farm research and the basics of plant breeding to develop their skills as project partners.

Project leaders repeatedly called for infrastructure to support variety trialing. Reports state the need for large-scale, multi-region testing.

Better systems are needed for sourcing materials such as market standards, international germplasm and advanced breeding lines for trials. A standard system for reporting and preserving trial data was also reported as necessary.

Organic breeding requires better access to long-term funding and funding that encourages project continuity, and more investment in "pre-breeding" or germplasm development.

Project reports pointed to a need for infrastructure to bring new organically bred varieties to market. A "breeding to bag" pipeline needs to be developed to facilitate seed increases, involve seed companies in testing advanced materials, and establish intellectual property standards.

For seed production, the project reports contained information on many infrastructure needs. Growers need better contact with seed companies to improve their enterprises. Infrastructure is needed to improve the following production and quality issues: hybrid vegetable seed production, seed cleaning, seed storage, seed-borne disease and GMO testing, and labeling for value-added traits. Organic standards need to be developed for specialized seed and breeding technologies to address certain issues, such as allowance of plant hormones for hybrid seed production or tissue culture media for isolation and propagation of clonally reproduced crops.

Organic Farmer Seed Survey

The organic farmer seed survey is one of the input tools used to create the 2010 State of Organic Seed Report and Action Plan. The purpose of the survey was to better assess certified organic farmers' attitudes and perceptions regarding organic seed; identify obstacles restricting their use of organic seed; and provide the organic community information to improve the quality and integrity – and increase the use of – organic seed. While various organizations and companies have made claims about organic seed usage and issues, and there is an endless body of anecdotal information, we felt that hearing directly from farmers (with anonymity) would assist our understanding of how to move organic seed forward.

The data below is what farmers reported, and was not verified by a third party audit or crosschecked with farmers' Organic Systems Plans. As such, it is important to note that, for example, we state, "Nineteen percent of producers who grew vegetables reported using all *organic seed* while 7% percent used none," and not that 19% of all organic vegetable acreage in the U.S. is grown with organic seed. This is an important distinction, as this survey is a useful discussion tool but not an exact measurement. As reviewers of this report pointed out, farmers who took this survey at the very least show enough interest in organic seed to take the time to respond, and so may be more willing than others in attempting to use organic seed.

We envision a revised and updated survey occurring every three years in order to track changes in attitudes and experiences, and will be seeking partnerships and funding to accomplish this.

Approach – Crafting the Survey Questions: The survey questions were designed to get information in four areas: (1) farm demographics; (2) use of organic seed; (3) challenges in using organic seed; and (4) need for and potential of organic seed.

In creating the survey we received input from people representing organic certification agencies, the seed and food industries, non-governmental organizations, farmer associations, and individual farmers. We conducted a test-run of the survey with 20 farmers and incorporated their comments and feedback into the final survey.

In order to not overwhelm farmers with a time-consuming survey, and to keep the survey manageable with a limited budget, we made decisions to not go into fine detail on crop specific questions, or to include questions on minor crops grown from seed that do not fit any of the major categories. Also, we focused on true seed rather than vegetatively propagated crops that use bulbs, tubers, roots or corms. This may be an area of expansion for future surveys if stakeholders express interest.

Dissemination: Surveys were disseminated electronically via Survey Monkey, an online survey tool, and when necessary in paper format through certification agencies, state and regional farm associations, and through

two cooperatives. Some organizations conducted the survey over the phone. To gather responses from individuals who do not use computers and/or phones, some organizations sent representatives to farms to conduct the survey in-person. Of the 1,027 responses, 712 were internet-based and 315 were paper responses. For electronic responses, we limited the potential of repeat responses by allowing only one survey submission per computer (i.e., tracking distinct Internet Protocol addresses and not allowing survey to be submitted from same address).

In order to reach the highest possible percentage of certified organic farmers, and to have a broad regional distribution, we contacted all USDA accredited organic certification agencies listed on the Agricultural Marketing Service's National Organic Program (NOP) website in September of 2009. We gave the agencies assurances that we would not publish or share with others any information specific to their agency or farmers. Some agencies offered us their email and mailing lists, and others solicited their producers on our behalf – sending out either electronic links through their list serves or when necessary mailing printed versions of the survey with self-addressed and stamped envelopes that we provided. Several agencies resisted participation, refusing to respond to emails or phone calls. Others responded and simply pointed us to the listing of the farms they certified as shown on the NOP website (which are often a year behind in listings). However, the majority of the largest agencies responded and supported the survey.

In addition to outreach through organic certification agencies we also contacted two of the largest producer cooperatives in the U.S. and three non-governmental organizations with farmer memberships. A total of 25 agencies, organizations and businesses conducted outreach for the survey. This method of dissemination (via certifying agencies and organic association lists) was the primary filter to ensure that only certified organic farmers responded, along with a bold font statement on each survey.

We opened the survey process on October 18, 2009, and closed the surveys on May 10, 2010. During that time we received distinct responses from 1,027 certified organic farmers in 45 states. According to the USDA-National Agricultural Statistics Service (NASS) 2008 Organic Production Survey, there are 10,903 certified organic farms in the U.S. This includes farms that likely do not use seed (e.g., farms that produce only fruit or livestock), and as such the number of certified organic farms using seed is under 10,000. Therefore we feel comfortable claiming that 10% of certified organic farms in the U.S. responded to this survey.

Summary and Key Points: The potential for comparative analysis of responses is immense. Given limited funding, we took a more selective approach – primarily comparisons by crop type. This does not rule out the possibility for deeper analysis that would certainly provide valuable data to the seed industry. This deeper analysis goes beyond the scope and purpose of the SOS project and therefore is not included in this summary. Please see Appendices for the

complete survey questions and data charts referred to in the summary as "Q and Figures." Please note that averages are means unless otherwise indicated.

There are four distinct sections of the survey:

1. **General farm demographics**: location; years certified organic; acreage by crop type; and primary crops.
2. **Organic seed usage**: percentages by crop type and primary crops; sourcing of seed; guidance from certifier; steps taken to increase usage.
3. **Challenges in using organic seed**: factors inhibiting using organic seed; quality issues; contamination concerns.
4. **Need for and potential of organic seed and breeding**: importance of organic seed for organic integrity; breeding for organics (generally and crop specific); interest in breeding and/or seed production.

1. General Farm Demographics

Our goal was to have a range of survey responses that accurately reflect the diversity of certified organic farmers in the U.S. – geographically, by crop type, and scale or size of acreage. We received 1,027 responses from organic farmers in 45 states and two territories. The top 10 states we received the most surveys from include: Wisconsin (223), California (105), Minnesota (101), Washington (86), Oregon (54), Indiana (42), Ohio (38), Illinois (34), Iowa (32), and Maine (27). Seven of the top ten states with the most certified organic farms – as listed by USDA-National Agricultural Statistics Service (NASS) data – are represented in the seed survey response top ten. The three states in the top ten of NASS data that are not represented in the top ten of the survey are New York, Pennsylvania, and Vermont.

"Number of years certified" could become an interesting point of comparison in overall use of organic seed, but was primarily solicited as a second filter to ensure that only certified organic farmers completed the survey. It is worth noting, however, that over 50% of the farmers who responded have been certified for five years or less.

We did not ask farmers to define themselves as only a "vegetable" or "forage" crop grower. Rather, they were asked to answer affirmatively or negatively as to their engagement in any amount of production for vegetable crops, field crops, and forage crops. We did filter the data post-survey and the analysis supported our pre-survey thinking that farmers would belong in multiple crop categories.

When asking farmers for their "top three" crops by acreage we allowed them to write in a response rather than attempt to have dozens of check box responses. Some farmers responded generally – "greens" and "tomatoes" – whereas others were specific, such as "Romaine lettuce," "collards," and "paste tomatoes." We grouped responses into generalizations in the summary below.

Key findings

VEGETABLE CROPS: Forty-three percent of respondents grew some vegetables on as little as 0.1 acre to as much as 1,000 acres, with an average of 27 acres. Fifty percent had three acres or less, and only 8% had 40 acres or more. Tomatoes,

squash, and greens (including lettuce, mustards, and salad greens) were, respectively, the crops with the highest acreage.

FIELD CROPS: Sixty percent of respondents grew some field crops on as little as 0.1 acre to as much as 6,342 acres, with an average of 188 acres. Fifty-nine percent produced over 50 acres. Corn, soybeans, and wheat were the crops with the highest acreage.

FORAGE CROPS: Forty-eight percent of respondents grew some forage crops on as little as 0.12 acre to as much as 1,746 acres, with an average of 103 acres.

2. Organic seed usage

Twenty percent of farmers reported that they have been using 100% organic seed for at least three years. For those farmers who have not been using all organic seed for at least three years, 71% of them indicated they have increased their usage of organic seed over three years.

Sixty-one percent of farmers who have not used 100% organic seed for three years or more indicated that their certifiers requested they take "greater steps to source organic seed." Of those farmers whose certifier had recommended that they take "greater steps to source organic seed," the most common additional step was "researching more than three catalogs."

Furthermore, farmers whose certifiers requested they take more steps to source organic seed were more likely to increase their use of organic seed. However, even farmers whose certifiers did not request additional steps still, on average, increased their use of organic seed. Of the farmers whose certifiers requested they take more steps to source organic seed, 78% increased their use while only 22% did not increase use over a three-year period (Figure 65).

There were also clear differences across crop types in the percentage of organic seed used. Some of these differences are likely attributed to diversity of varieties in vegetable cropping systems compared to other crops. Again, farmers only responded to these crop specific questions if they had previously indicated that they grew these crops.

Key findings

VEGETABLE CROPS: Nineteen percent of farmers who grow vegetables reported using all organic seed while 7% percent used none. This represented the lowest usage across crop types. Twenty-five percent of vegetable producers used 0-10% organic seed (herein referred to as "minor usage") and 26% used 91-100% organic seed (herein referred to as "major usage"). This indicates that the survey captured data from vegetable farmers who are successfully sourcing organic seed as well as those who are experiencing challenges.

FIELD CROPS: Forty-seven percent of respondents who grow field crops reported using all organic seed (the highest percent across cross types) while 10% used none. Thirteen percent were minor users (0-10%) of organic seed, while 49% were major users (91-100%).

FORAGE CROPS: Forty-four percent of respondents who grow forage crops reported using all organic seed while 25%

used none. Twenty-nine percent of the producers were minor (0-10%) users of organic seed, while 47% were major users (91-100%).

COVER CROPS: Thirty-six percent of respondents who grow cover crops reported using all organic seed while 38% used none (the highest percent of zero usage across crop types). Forty-two percent were minor users (0-10%) of organic seed, while 37% were major users (91-100%).

Contracts requiring specific varieties that are proprietary to conventional seed companies with little or no interest in organic seed production is a major issue, particularly for farmers producing for companies that do pre-packaged salad mix, frozen or canned vegetables, and vegetables used in processed food.

3. Challenges in using organic seed

We asked a series of questions to assess reasons farmers were not using organic seed, including quality issues with organic seed and perceptions of risk regarding contamination by genetically engineered (GE) traits.

Reasons for not purchasing organic seed (Q10, Figure 22) were surprisingly similar when viewed collectively across crop types. Varietal availability was the most common factor with 58% of the producers – across all crop types – indicating that varietal availability was a significant factor and 79% indicating it was a moderate or greater factor in not purchasing organic seed.

Lack of varietal availability was noted in vegetables more than any other crop type. While initially we thought this was likely related to the diversity of varietal needs for small-scale, diverse fresh market farmers, filtering by scale showed that it was in fact the larger scale farmers who struggled to use organic seed. Farmers with 40 acres or more in vegetable crops (large for the organic vegetable industry) on average use less than 30% organic seed. These larger scale vegetable farmers also responded the most with zero percent usage. Eighty-four percent of the larger farmers listed lack of varieties as a significant factor versus 58% overall.

Sixty-four percent of the larger farmers also indicated that “buyer demands” (contracts) were a moderate to severe factor for not sourcing organic seed. This was an issue for other farmers only 27% of the time. Contracts requiring specific varieties that are proprietary to conventional seed companies with little or no interest in organic seed production is a major issue, particularly for farmers producing for companies that do pre-packaged salad mix, frozen or canned vegetables, and vegetables used in processed food.

According to NOP rules, the cost of seed is not a valid reason for not purchasing organic seed if the variety is available in commercial quantities. Still, 41% of farmers indicated that

"price" was a moderate to significant factor.

Distrust of organic seed quality was not a major reason for not purchasing organic seed, with only 21% indicating it as a moderate to significant factor (10% indicating it was a moderate factor, 6% indicating it was more than moderate, and 6% indicating it was a significant factor).

Farmers were asked to rate the degree of problems they have had with organic seed quality (Q11, Figure 24, and Figures 53-64). None of the problems were rated as severe, which might be expected when the previous question showed little distrust of quality. However, several problems are notable. The biggest quality issue was "germination/ emergence" with 17% of respondents indicating it was a "moderate" problem, 11% indicating it was "more than moderate," and 4% indicating it was a "severe" problem**.** This was more often the case with farmers who grew some vegetable crops. Varietal integrity was the second most noted problem with 10% indicating it was a "moderate" problem, 17% indicating it was "more than moderate," and 4% indicating it was a "severe" problem. Again, this was indicated in vegetables more than any other crop type.

Distrust of organic seed quality was not a major reason for not purchasing organic seed, with only 21% indicating it as a moderate to significant factor (10% indicating it was a moderate factor, 6% indicating it was more than moderate, and 6% indicating it was a significant factor).

Farmers were asked to indicate if they had "more, less or about the same" degree of quality problems in organic seed versus conventional seed. The majority (73%) had "about the same" in each and 23% had more problems with organic seed. Farmers who grow vegetables indicated problems with organic seed slightly more often than other crop types.

Regarding GMO contamination, 74% of respondents agreed or strongly agreed that seed companies "should conduct testing for GE contamination in organic seed" and only 6% disagreed or strongly disagreed. In regard

to the regulatory framework protecting crops from contamination, 41% disagreed or strongly disagreed that it was adequate, while 27% agreed it was adequate and 32% were neutral.[78] As to perceptions of risk from GE crops, 41% of respondents indicated that they agreed or strongly agreed that their farm was at risk, while 29% disagreed or strongly disagreed, and 31% were neutral.

74% of respondents agreed or strongly agreed that seed companies "should conduct testing for GE contamination in organic seed."

4. Need for and potential of organic seed and breeding:

The final series of questions were intended to assess opinions, priorities, and interests in the further improvement of organic seed systems. Overall, farmers who responded to the survey were very positive about the need for and potential of organic seed and breeding.

Seventy-eight percent of farmers agreed or strongly agreed with the statement that "organic seed is important in maintaining the integrity of organic food production" and only 9% disagreed or strongly disagreed.

As for breeding, eighty-three percent of respondents agreed or strongly agreed with the statement: "varieties bred for organic system management are important to the overall success of organic agriculture." Only 5% disagreed or strongly disagreed. Farmers were also asked to prioritize organic breeding by crop type and traits:

> VEGETABLES: tomatoes (disease resistance, flavor, yield); brassicas (uniformity, general improvement, disease resistance), and squash (disease resistance, flavor, general improvement)
>
> FIELD CROPS: corn (yield, quality, emergence); soybeans (yield, pest resistance, quality); and alfalfa (pest resistance, adaptation, yield)

We tracked specific crops and traits, but had to group and generalize our findings for reporting purposes. For example, "general adaptation" includes traits related to adaptation to climate and soils. Examples of specific farmer responses grouped into "general adaptation" include: "hardiness," "winterkill resistance," and "able to produce well without excessive NPK."

The final series of questions gauged farmers' interest in growing organic seed and conducting on-farm breeding or crop improvement. These questions were primarily asked for public sector breeders interested in participatory plant breeding, as well as for seed companies. We have heard

[78] There was some confusion on this question. Farmers responded that "they didn't want any more regulation on their farms" or that "they were forced to do enough already" – indicating that they may have thought we were suggesting organic farmers needed to be regulated more to stop contamination (i.e., they needed to be responsible for creating adequate isolations). In fact, we were asking if the federal and state agencies were doing enough to protect organic farmers.

anecdotally from seed companies that they need additional locations and experienced farmers for organic seed production. We also see a trend in increased on-farm partnerships in organic research -- breeding in particular – in Europe and the U.S. These questions were meant to assess interest in these areas, and responses indicate that farmers have strong interest in both seed production and on-farm breeding for organic systems.

Seventy-eight percent of farmers agreed or strongly agreed with the statement that "organic seed is important in maintaining the integrity of organic food production."

Conclusions: This survey aimed to capture a snapshot of several moving parts as they relate to organic seed systems, specifically farmers' experiences and perceptions. Our findings are instructive as we work toward building an organic seed sector that better meets farmers' diverse needs.

For starters, 80% organic farmers who responded to this survey are having some degree of difficulty sourcing (or resist using) organic seed, given that only 20% report that they are using all organic seed. There are broad discrepancies between farmers who use a majority of organic seed and those who use a minor amount of organic seed. What is limiting those farmers who are using less than 10% organic seed? If it is truly varietal availability, as the survey would indicate, we need to know the varieties so that we can encourage companies to produce them organically. Or, in the case of proprietary varieties, we need to know the group of traits that could be bred into organic varieties to provide equivalency. Information is needed, and we need to develop a system for gleaning this information from farmers and getting it into the hands of public plant breeders and seed companies. A database of varieties for which farmers were given allowances to use conventional seed would provide such a tool. Additionally, variety trials would appear to be an essential tool to provide farmers with a look at alternative varieties available organically that could address equivalency issues.

According to this survey, certifiers are requesting that farmers take additional steps in sourcing organic seed, and when encouraged to take additional steps, farmers respond by using more organic seed. The NOP should provide certifiers with education and information that will assist them in further guiding farmers in sourcing organic seed. Certifiers should continue to request trialing and researching more than three sources, as well as encouraging additional steps be taken to increase use of organic seed. This is especially important for farmers who continue to be minor users of organic seed.

We also found that distrust of organic seed is not as severe as we expected given the number of anecdotal accounts in media, from opinions written or voiced at conferences by farmers, and heard from certifiers. Farmers with a positive outlook on organic seed may have been more likely to

complete the survey. Still, farmers who use both organic and conventional seed do rate organic seed as having more quality problems than conventional seed. This could be tied to a lack of experience in organic seed production (by the company or by their contract growers). Problems with germination/emergence could be a sign of needing additional research into allowable seed treatments and protections that would enhance germination and emergence. Additionally, breeding for increased vigor and early emergence is possible and presents a competitive opportunity for public and private breeding sectors.

Farmers have strong interest in both seed production and on-farm breeding for organic systems.

Across crop types, farmers want seed companies to test organic seed for GMO contamination. Testing has potential for adding marketing value to companies that do test, and yet also poses a significant risk to seed companies when seed tests positive. Seed companies that test and find positive contamination could not sell seed that has a relatively high percentage of GMO presence since genetic engineering is an "excluded method" in the NOP. Certified organic farmers cannot knowingly plant seed with GMOs. The companies would suffer financial loss on contaminated crops, without any recourse for receiving damages from crop insurance or a regulatory liability regime. It is likely this risk is preventing seed companies from testing and reporting contamination rates to their customers. The authors believe this underlines the need for the organic community to address contamination as an economic risk to the success of our market. Creating thresholds of "low-level presence" of GMO contamination in the organic seed market, or organic in general, without liability or other safety nets to cover incidences of high contamination, will only increase the financial burden and risk of organic seed companies, and discourage investment and growth in this sector.

Lastly, organic farmers want organically bred varieties. This is true across crop types, and the data to date is very strong on this issue. Additional studies on traits important to organic agriculture would further our understanding of these needs. Fortunately, farmers are interested in being a part of this breeding process. Participatory plant breeding and on-farm trialing networks have much potential if done with competent professional organic breeders. We will gain greater efficiency in addressing the diversity of regional needs within the organic market when more skilled farmers are working with skilled plant breeders.

SOS Symposium: Clarifying Challenges and Creating Priorities

Process: The symposium provided an opportunity to discuss the initial findings of the organic farmer survey, input forms from certifiers, researchers and industry, and to break into crop specific working groups to prioritize needs and collaborative actions to promote and protect organic seed systems. Invitations were sent to targeted stakeholder groups, including organic farmers, organic food companies, accredited certifying agencies, researchers, seed companies, and representatives from farm associations and non-governmental organizations.

Prior to the symposium, participants responded to an input form with questions regarding organic seed challenges and solutions. A total of 134 input forms were returned, but due to several scheduling conflicts, symposium attendance totaled 106.

Input form responses were grouped and a document was sent back to participants listing and describing challenges. Participants also received preliminary farmer survey results. Participants were asked to self-identify which stakeholder group and crop they would represent. The groups were then broken down by crop type: field corn (36 participants), vegetable A & B (45 total participants in two groups) and grains, soy, and forage (25 participants). Each group had two facilitators and a note taker, and reported back to all participants at the end of the day.

Participants examined preliminary results from the organic farmer survey, discussed past and ongoing seed initiatives, and then broke into working groups by crop type. Working groups spent the morning discussing, refining, and prioritizing challenges in organic seed systems (based on their pre-symposium input forms) in the categories of breeding, production, information & perception, and policy and regulatory macro issues. They spent the afternoon brainstorming both existing and new solutions to these challenges.

Issues often overlapped, and therefore groups looked for integrated solutions that would address improvement of organic seed systems as a whole. Similarly, crops overlapped. While we expected crops to have their own specific challenges, there was much more overlap among crops than distinctive differences in needs. There was even less differentiation in solutions than in challenges. In general, all groups reached similar conclusions about the priority needs and activities in moving organic seed systems forward.

Challenges and Needs: In exercises like this, “not enough money” is often the first challenge identified by individuals. We encouraged participants to be more articulate, to specify the challenges that are urgent, prioritize existing needs, and consider funding opportunities in the solution part of the process. Below is a list of challenges and needs organized by breeding, production, information and perception, and policy.

BREEDING

- **Seed industry alone cannot respond to diverse needs** Organic seed companies are primarily newer, regional, and smaller companies that do not have funds for established breeding programs. For the larger conventional seed companies entering the organic market, the volume of sales is too low to justify investment in breeding specifically for organic systems.

- **Diminished public breeding programs** There is a lack of innovation from Land Grant Universities (LGU) and concern for future capacity in terms of next generation of formally trained plant breeders.

- **Access to breeding germplasm** Restrictive intellectual property agreements, such as contracts afforded through utility patents, slow innovation. Current restrictions and licensing costs are adding financial and administrative burden, especially for public breeders.

- **Lack of participation in breeding** Breeders don't have access to enough certified organic field sites, greenhouses, winter nurseries, and trial grounds, which slows the breeding process.

- **Lack of trialing data** Across crop types, there are breeding populations and conventionally bred varieties that may be useful in organic systems. Yet these resources remain untested, or if tested, the data is not readily available. This slows innovation.

- **Diverse approaches to breeding** The conventional seed industry's approach to breeding – often to meet the needs of agriculture's largest operations – is not working and will not work for organic. The diverse needs of organic farmers – diversity of crops, scales of production, and regional needs – require greater diversity in approaches to breeding. These approaches include developing decentralized, participatory approaches between the private sector, public researchers, and farmers.

- **New organic breeding approaches** We need to better understand the science of breeding in organic systems. New organic breeding approaches need to be developed and tested. These approaches would reflect the ways in which organic agriculture differs from conventional, including different inputs, more environmental heterogeneity, and restrictions on breeding technologies.

- **GMO-free breeding resources** Access to breeding and parent lines free of GMO contamination is increasingly difficult in certain crops. There is a need to test at this initial stage of varietal development to ensure integrity. Still, there are concerns that even with pure stock to start, contamination will occur during development. Strong policies are needed to protect organic breeding, foundation seed stock, and the National Plant Germplasm System.

PRODUCTION

- **Lack of experienced organic seed producers** There is a need to train more farmers in organic seed production, particularly in hybrid vegetable crops.

- **Lack of education and research on seed production** Particular research needs include seed-borne diseases and organic treatments and methods for hybrid seed production. Expanding research will improve the quality of organic seed.

- **Lack of sufficient quantities of foundation seed for trialing** In addition to cost, foundation or parent seed is often conventionally treated seed that cannot be planted on organic acreage. This is particularly an issue for grains, corn and forage.

- **Lack of access to conventional cultivars that work well in organic systems** Seed companies that already produce proprietary or hybrid non-treated conventional seed and sell it to organic growers refuse to lease their materials to companies wanting to produce it organically. Organic farmers would likely be required by certifiers to use the organically produced variety, substantially diminishing the sales of conventionally untreated seed. Yet these companies have no incentive to produce this seed organically, as farmers are allowed to purchase non-treated conventional seed if their specific variety is not available organically.

- **High cost of producing organic seed** Costs associated with producing organic seed remain a constraint in the acceptance and use of organic seed. There are often greater agronomic risks and at times lower yields in organic seed production. Farmers who are contracted to produce organic seed must be paid a price that is competitive to other organic crops that receive premiums. Organic farmers complain (often to certifiers) about seed costs and at times choose non-treated conventional seed over similar organic varieties to save money, even though price is not a valid reason to avoid buying organic varieties. Without volume of sales, seed companies and seed farmers can't invest in efficiencies to lower costs, and seed companies can't increase prices they pay to seed farmers. This threatens to further reduce the capacity of organic seed production. (Please see "Information and Perception" below.)

- **Seed contracts place burden on seed farmers** Seed production contracts often place risks in production on seed farmers without premium payment or available insurance or assurances from seed companies. These risks include managing hybrid production with inbreds developed in conventional systems without access to chemicals normally used to support these inbreds, weed contamination, GMO contamination, and poorly maintained foundation stock. This compounds contract prices that are marginally profitable, with pressure from companies to lower prices, and results in overall diminished seed production capacity in organic systems.

- **Maintaining standards of high quality seed** Given the pressure to keep prices down, it is difficult for seed companies to invest in quality assurance systems, the most innovative equipment, and the seed grower education and management that are required to produce high quality organic seed. Certifiers reported quality issues that farmers express to them with regularity, such as lack of varietal purity, poor germination, low vigor and small seed size.

- **GMO contamination** Seed production led to even greater discussion on contamination concerns, particularly in corn, but also in other crop types, as participants believed that the trend toward biotech will only increase in all crop types. Concerns include lack of isolations for seed production from genetically engineered crops; co-mingling during harvest and cleaning when contracting for these services; unfair cost burden on organic seed companies for GMO testing; financial liability to seed farmers who cannot meet

seed company testing thresholds for contamination; impact of positive tests on customer confidence; and a lack of government protection.

INFORMATION AND PERCEPTION

- **Lack of information** Farmers lack information on conducting variety trials and accessing variety trial data from others. They also lack information on producing organic seed and improving open-pollinated varieties for local adaptation.

- **Lack of farmer education** Organic farmers need more education on the value of organic breeding and the importance of using organic seed, especially in relationship to the cost of organic seed. Seed should not be regarded as a cheap input.

- **Lack of policy maker education** Policy makers and funders need to be educated on the potential environmental and health benefits of investing in breeding for organic systems.

- **National seed database** The organic community needs an organized data system that is easy to update. Such a database would help certifiers and farmers assess organic seed availability and track gaps in equivalency based on conventional seed allowances given to farmers by certifiers.

- **Variety trial System** An organized trial system would help screen existing and available conventional varieties, breeding populations, and material in a National Plant Germplasm System to assess traits useful in organic systems. A trial system could communicate useful information to other researchers, seed companies, and farmers.

- **Definition of organic plant breeding** The values, approach, methodology and principles of organic breeding need to be articulated and promoted to all stakeholders.

- **Response to GMO contamination** A clear message based on thoughtful scientific analysis and organic market values is necessary for challenging the biotech industry's ongoing campaign to allow GMOs in organic.

Policy and Regulatory Issues

Policy and regulatory issues are complex, institutional, and interrelated. Symposium participants pointed to the complexity and depth of issues. Comments ranged from "everything must be worked on simultaneously" to "the problems are overwhelming" to "the seed industry is broken."

Participants pointed out that our policies related to organic seed impact farmers internationally. We must create policy that strengthens biodiversity, farmer choice, and farmers' right to save seed both domestically and abroad. And we must pay special attention to smaller scale farmers whose needs are often the last to be served, if at all. Restrictive seed registries, such as those in Europe, do not work for the diversity of farmers here in the U.S. or to meet international needs.

Participants noted the need to address the looming challenges of concentration in seed

systems and the problem of GMO contamination. (See Concentration and Contamination sections of report for full description of these challenges.)

A number of challenges and needs were identified in the context of the National Organic Program (NOP), including the:

- Lack of responsiveness from NOP to NOSB Guidelines on Commercial Seed Availability.
- Lack of confidence from seed sector that NOP is interested in enforcing the organic seed rule.
- Need for NOP investment in tracking data on seed.
- Need for NOP to develop systems that create more consistency among certifiers for procedures to determine commercial availability of varieties.

Two primary challenges and needs were identified regarding intellectual property protections:

- Utility Patents on plants, parts of plants, and genetics are restricting innovation. This was discussed in detail at the symposium. The most repeated example of this issue was the PuraMaize trait that many researchers and organic seed producers would like access to and believe came from the public domain. The trait is now protected by a patent. (See Concentration Section of report for more information on PuraMaize.)
- Organic seed would benefit from alternative benefit-sharing models. Many breeders working in the organic seed sector believe an ideal intellectual property, royalty, or benefit-sharing model does not yet exist in plant breeding. Utility Patents are unattractive to many in the organic community, as patents do not support transparency, farmers' right to save seed, and increased innovation in seed. Plant Variety Protection certificates, as awarded under the Plant Variety Protection Act of 1970, are workable, but expensive and therefore not an appropriate model for minor crops. Many participants mentioned "open-source" models used in the software community and "Creative Commons" models used for creative arts and writing. While these models may or may not translate into ideal protections for seed, there is general agreement that we need to develop alternative models along these lines.

Priority Goals: The top priority goals established through the State of Organic Seed Symposium (and surveys and input forms conducted beforehand) are listed below. They are not listed in order of priority. As you'll read in the next section, working groups will prioritize and carry out preliminary action items.

Breeding Goals

- Increase federal support for organic breeding projects.
  - Increase overall funding within USDA-OREI and maintain priority for organic seed and breed related projects.
  - Improve the National Institute of Food and Agriculture and Agriculture and Food Research Initiative plant breeding programs to prioritize breeding for publicly released cultivars and breeds that contribute to more resource-efficient, environmentally-sound,

sustainable farming systems. This includes breeding for greater nutrient efficiency; stress, disease, and pest resistance; and improved nutritional value.

- Improve federally funded programs to encourage project continuity and the release of publicly developed cultivars.
- Expand the involvement of researchers at the Agricultural Research Service to engage in organic research.

- Greater support and education for farmers to engage in plant breeding.
  - Expand the Conservation Security Program to develop a seed stewardship program with payments for farmers to reinvigorate the National Plant Germplasm System collection while assessing collection for varieties and traits that are supporting organic and other resource-efficient farming systems.
  - Develop participatory plant breeding guidelines and support workshops to train more farmers in on-farm breeding. Incorporate mentorships and "training the trainers" models to increase outreach.
  - Petition federally funded programs to require farmer compensation for on-farm research with Land Grant Universities and other public institutions.
  - Support organized and educated farmer breeder clubs to expand collaboration on breeding projects. This is particularly useful in grains and soy for great efficiency in pre-testing and increasing small seed quantities to adequate amounts for larger evaluations.
- Greater integration of organic breeding and seed research into university programs and curricula.
  - Petition Land Grant Universities and other public colleges to commit to certified organic research grounds and greenhouses.
  - Develop increased capacity at Land Grant Universities to train the next generation of classical plant breeders with strong field and on-farm research components.
  - Encourage further support and development of eOrganic (online university extension tool) seed and breeding information.
  - Integrate education on organic systems and research into curricula for undergraduate students in agricultural programs to familiarize them with organic and improve their understanding of research opportunities in the organic field.

- Improve and refine organic and participatory breeding methods and goals.
  - Improve the methodology for interpreting genotype by environmental effects in organic systems with greater environmental variability.
  - Increase understanding of and focus on breeding for local adaption, climate instability, multiple stress traits, and value-added traits, such as nutrition and quality in processing.
  - Develop principles, practices, and standards that formalize the definition of organic breeding.

- Increase investment in organic breeding from private food sector and general public.
    - Work with larger organic firms to encourage their sponsorship and support of organic breeding initiatives.
    - Work with distributors, retailers, and farmers markets to fund local variety trial and crop improvement efforts that serve their customers.
    - Educate organic food company executives as to the urgency in developing organically bred varieties that will improve the quality of their products.
    - Raise awareness on the value of an "organically bred" label, but only if it follows organic breeding methods and protocols.
    - Encourage organic seed companies to have a check-off that allows gardeners and farmers to make a donation to public organic breeding initiatives.

- Develop an integrated, standardized, large-scale, and multi-region variety trial network that includes international material and advanced breeding material.
    - Improve communication and feedback nationally among researchers to create trial partnerships, plan supportive trials, and reduce redundancies.
    - Create an accessible national database of trial information and results that is available publicly for farmers, certifiers, and the university and private sectors.
    - Develop a public record of traits, varietal characteristics, and other genetic information to keep these genetic resources accessible, in the public domain, and free of restrictive patents.

Seed Production Goals

- Improve our understanding of the organic seed market, including farmer needs, seed industry limitations, prices, and supply and demand.
    - Conduct a seed industry survey. The survey would include those already producing organic seed, those who have produced organic seed in the past, and those who are considering future investment. This survey would provide better understanding of the industry's obstacles and concerns; technology and infrastructure needs; and volumes of seed being produced by crop type (with as much regional information as possible).
    - Encourage seed companies to be more transparent in sharing production volume and sales in order to stimulate new players to enter the market. The market is currently suffering from a lack of competition.
    - Encourage seed companies to work with the NOP and certifiers to develop and fund a national seed database.

- Greater infrastructure to support seed growers.
    - Improve training and educational information for organic seed producers, particularly hybrid seed production, including more crop specific publications.
    - Increase the availability of seed harvesting and cleaning equipment that is dedicated for organic use only.
    - Explore a fair trade approach and label to organic seed contracts to maintain fair contracts and pricing in seed production; stimulate and encourage farmers to produce organic seed; and educate users of the true cost and value of organic seed.

- Improve organic variety commercialization pipelines and feedback loops.
    - Encourage all regional and national organic farm conferences to host regular listening sessions that involve the seed industry, public breeders, organic food companies, and farmers.
    - Encourage grant programs to prioritize funding for publicly bred cultivars with private sector partnership to increase availability of organically bred varieties.

- Improve genetic integrity during production.
    - Encourage seed companies and state foundation programs to test foundation seed and production seed in at-risk crops to develop a baseline for current levels of contamination.
    - Encourage the seed industry to develop and adopt "best management practices," specifically for reducing contamination from GE crops, while tracking additional costs of such practices to educate lawmakers on this burden to the organic seed industry. Consider a variety purity certification for corn that includes GMO testing, possibly through the Association of Official Seed Certifying Agencies.
    - Petition the Patent and Trademark Office to repeal the patent on PuraMaize, a trait that blocks pollen from dissimilar populations, effectively reducing contamination.

- Improve access to foundation and parent-line seed, as well as conventional varieties that work in organic.
    - Develop the capacity of state foundation seed programs to maintain untreated stock seed for organic production.
    - Encourage universities to create variety release Material Transfer Agreements that give rights of production to organic seed producers if the conventional companies leasing material have no interest in organic seed production.

- Develop organic standards for specialized seed and breeding technologies, such as plant hormones for hybrid seed production and tissue culture media. The seed industry should work with certifiers, regulators and the Organic Materials Review Institute to identify acute issues and develop plans to address them.

Information and Perception Goals

- Develop a central and publicly accessible seed database funded by the NOP with matching support from the seed industry.
    - Include regular updated listings of organic seed availability.
    - Include non-organic seed allowances, and research best way to collect this information.
- Push NOP to respond to the NOSB's Guidelines on Organic Commercial Seed Availability.
    - Encourage more information and training for certifiers on organic seed. This includes working collaboratively – the NOP, seed industry, and farmers -- to ensure certifiers have enough information on organic seed and that they are following the NOP rule.
- Create a variety and breeding trial database.
    - Examine Organic Seed Alliance's vegetable model being developed on eOrganic.
    - Expand model nationally for all crop types and create standards in methodologies and data reporting.
    - Engage farmers in sharing on-farm trial data.
    - Organize forums for breeders and seed producers to discuss technical questions.
- Create a campaign to promote the value of organic plant breeding and seed.
    - Look at existing campaigns such as "Know Your Farmer."
    - Showcase positive stories and social values.
    - Draft a white paper on why genetic engineering is not needed in organic.
    - Encourage the seed industry to communicate the true costs and benefits of organic seed.
    - Support the Clif Bar Family Foundation's Seed Matters initiative, which aims to promote the value of seed to a sustainable food future. Encourage organic food companies to get behind "seed to shelf" claims and not simply use it as a marketing phrase.
- Expand the State of Organic Seed project.
    - Work with regional farm conferences to host ongoing SOS listening sessions to get feedback from stakeholders and incorporate feedback into next SOS report.
    - Conduct additional surveys to gather data on farmers' breeding needs and the seed industry's technical and capacity challenges, among other issues.

Policy and Regulatory Goals

- Intellectual Property practices must be reviewed, analyzed, and reformed, particularly at the public institution level.
    - Encourage the federal government to engage in a full review and discussion of restrictive laws and practices in the seed industry, including: a cost-benefit

analysis of the Bayh-Dole Act; federal workshops and hearings on the impacts of privatizing public research; and an analysis of the role patents play in seed industry consolidation.

- Educate Congress on why the Plant Variety Protection Act should be re-established as the sole protection for developers of sexually reproducing plants.

- Research the feasibility of alternative intellectual property models for organic breeding. Engage economists, intellectual property experts, breeders and others in this research. Examine "open-source" and/or "creative commons" models.

- Develop a legal fund and working group to raise the standards for patentability or research. Challenge patents, particularly for traits, varieties, or techniques that have long existed in the public domain (PuraMaize was repeatedly mentioned as a top priority).

- The Departments of Justice and Agriculture should continue their examination of competition problems in the seed industry, including anticompetitive conduct and the consequences of concentration. Their investigation must include the impacts of concentrated market power on the organic industry.

- Review the "Public Plant and Animal Breeders Pledge" developed by Seeds and Breeds for 21st Century Agriculture. Have alumni of Land Grant Universities and citizens in these states petition breeders and administrators to sign onto it.

- Create incentives for farmers to conserve, assess, and develop diversity in germplasm, and engage in participatory plant breeding initiatives.

  - Develop Conservation Security Program, or develop new program, to provide training and incentives for farmers to maintain, assess for beneficial characteristics, and increase seed of foundation seed organizations, national germplasm collections, and breeders' seed at Land Grant Universities and the Agricultural Research Service.

  - Require OREI, the National Institute of Food and Agriculture, and other federal programs to have minimum land-resource and/or hourly payments to farmers engaged in on-farm research with formal breeders.

  - Push the USDA to rebuild public plant breeding and public cultivar development programs to ensure that the needs of farmers and the general public are met and that research is conducted in an open and honest way.

- Stakeholders must engage in a more unified and focused effort to address GMO contamination.

  - Work with conventional farm policy sector to develop a Farmer Protection Act for the 2012 Farm Bill that ensures: (1) the venue and choice of law for contamination or patent infringement lawsuits is in the state where the farmer lives; (2) an independent third party participates in patent infringement investigations; (3) farmers are not held liable for patent infringement when small amounts of GE content is discovered on their

property and the presence provides no economic benefit; and (4) the manufacturer of GE crops is held strictly liable for economic damage caused by contamination.

  - Research risks and benefits of an indemnity fund for GMO contamination that patent holders pay into. These funds would be used for testing foundation seed and compensating those harmed by contamination.

  - Overhaul the federal regulatory framework for GE crops. Strengthen government oversight by creating greater public transparency and mandating independent research and testing, including a full environmental and economic impact assessment.

  - Push the USDA to require farmers who grow GE crops to establish buffer areas and other containment measures to mitigate pollen flow from GE crops to neighboring fields.

- Improve definitions, standards, values, methods, and practices that are appropriate for organic breeding systems.

  - Draft a white paper on "What is organic breeding?" based on the principles of organic agriculture.

  - Draft a position paper on the use of patents in organic breeding.

- Congress and the USDA should strengthen public plant breeding.

  - Create a new program area for both the Agricultural Research Service and the National Institute of Food and Agriculture's competitive grants that focus on breeding for organic and other sustainable agricultural systems. These projects would result in varieties that have improved nutritional value for animals and humans, multiple stress resistance, and resilience in the face of climate change.

  - Double funds for OREI and maintain high priority grants for organic seed systems, including production and breeding, with strong focus on increasing regional capacity and adaptation.

  - Prioritize Value-Added and Enterprise Development grant programs to fund the development of local seed systems, both increasing varietal choices for farmers and expanding economic opportunities for farmers interested in seed production.

  - Fund NOP to develop a national organic seed database in order to close the gap in organic seed availability, assist breeders and industry in developing new materials, and provide farmers with optimal genetics for organic systems.

Moving Organic Seed Systems Forward: Next Steps

It is time for a broader coalition of organic stakeholders to address the issues and priorities identified in this report and move organic seed forward. As we have learned, the issues are complex and cannot be addressed independently by government regulations or the seed industry acting alone. A cohesive and inclusive grassroots approach to organic seed issues is needed to further refine and implement the priorities outlined within this report. This collaborative approach will directly benefit research, education, and advocacy activities in the organic seed sector, and organic farmers and the communities they serve.

To this end, OSA is hosting several listening sessions to talk about the findings of this report and to gather ongoing feedback and ideas moving forward. OSA is also working with seed industry representatives to collect additional data about organic seed usage and quality, and the industry's role in collaboratively building the organic sector. Most significantly, OSA is launching working groups in five categories to initiate the implementation of the preliminary priorities identified in this report. The five categories are: Organic Plant Breeding; Information and Production; Concentration; Contamination; and Intellectual Property. Each working group will include diverse stakeholders that collaboratively and systematically address concerns, obstacles, and opportunities in the implementation and success of organic seed systems.

The working groups are more than forums for discussion. They are each a focused group of partners committed to refining strategies for action items identified in this report, and engaging in ongoing dialogue and research where there are gaps in information. The SOS project laid fundamental groundwork for these working groups. Through this project we identified partners with capacity and expertise to participate effectively, and have started to outline initial priorities and objectives. The next step will require the development of strategies and tactics to reach both short-term objectives and make long-term transformative change.

Working group activities will range from participating in discussions with federal decision makers to influence national policy to coalition work on timely issues in need of research and discussion, such as alternative intellectual property protections. Below is a short description of each working group.

Concentration Working Group: The goal of this working group is to influence policy decisions that enhance competition in the seed industry and support decentralized, farmer-oriented, organic seed systems.

Contamination Working Group: The goal of this working group is to establish collaborative actions and policies that protect the integrity of organic breeding systems and organic seed from contamination by genetically engineered species, and the rights of farmers to access organic seed free of genetically engineered material.

Intellectual Property Working Group:
The goal of this working group is to develop intellectual property models for participatory variety improvement and plant breeding that ensures sharing, continual innovation, and varietal improvement in the public domain.

Organic Plant Breeding Working Group:
The goal of this working group is to develop methods, systems and infrastructure to support and increase public plant breeding programs focused on organic systems.

Organic Seed Information, Availability and Production Working Group: The goal of this working group is to collaborate on efforts that improve organic producers' ability to meet the National Organic Program requirement for use of certified organic seed.

Looking Ahead

State of Organic Seed is the first comprehensive assessment of the successes and challenges in developing healthy, organic seed systems across the U.S. Through diverse stakeholder involvement, we provided a snapshot of the organic seed sector – from organic seed usage to public breeding initiatives to risks to organic integrity – as a necessary starting point for convening larger and longer term discussion on the opportunities before us in building organic seed systems.

The purpose of this report – and the motivation behind the collaborative work to follow – remains rooted in the founding tenets of the organic movement: principles, as outlined in the introduction, that acknowledge and honor farmers' roles and rights in seed stewardship; protect genetic and biological diversity; ensure ecological and human health of future generations; and encourage competition and shared benefit from crop improvements.

Another principle we adhere to is the importance of using seed that is bred and produced in organic systems. That is, to stay true to the values of the organic community and support the success of organic farmers, seed needs to be bred and produced for the agronomic system it is grown in and the market it supplies. This may be self-evident to most in the organic community, but for others it is still a lingering question of debate. Still, we cannot deny that much of the progress in agriculture over the last thousands of years is due to the adaptation of plant genetics combined with improved management practices.

Optimal seed is the foundation of achieving success, be it agronomic, marketing, or otherwise. Organic farmers use a mixture of modern conventional varieties and older heirlooms, mostly produced by conventional seed companies. Many of these modern conventional and heirloom varieties work in organic systems, but are they optimal? Are they optimal in their genetics and in meeting overall goals and values of organic systems? If we purchase conventional seed from conventional companies that are not investing in organic, how can we expect to build an organic seed sector that has the necessary funding and infrastructure to serve the organic community with optimal genetics? Given the increased acceleration by conventional companies toward genetically engineered traits, what will future seed options look like if we remain dependent on the conventional sector? And, given the consolidation of that industry, what level of diversity can we expect?

While this report attempts to provide a snapshot of the state of organic seed, we also challenge the organic community with these questions. It is our belief that organic agriculture should develop and use organic seed, not because a regulation requires it or we fear GMO contamination, but because the spirit of the organic movement has, at its core, the principle of constant improvement. Seed holds the potential for improvements in crop quality, nutrient density, responses to biotic and abiotic stress, and increases in

yield, color, and flavor. The communities we feed desire this diversity.

The organic seed working groups have a long list of priorities. Seed issues are many and complex, and these groups will only succeed if they have the support of a broad stakeholder base. Many in the organic community are already a part of solutions identified in this report. Some of the ways success will be measured is through an increase in:

- Voices calling on our regulatory agencies to protect our seed;
- Food companies and retailers valuing and investing in organic plant breeding;
- Entrepreneurs innovating and investing in organic seed sector development;
- Public researchers investigating organic systems and public plant breeders breeding finished cultivars for organic agriculture;
- Farmers understanding that conventional seed is not optimal in the long-term vision of organic success, and who trial and experiment with new varieties; and
- Farmers having a role and investment in seed – as plant breeders, seed producers, participants in research, and owners of seed enterprises.

We need to continue this conversation with all stakeholders, and strengthen feedback loops to expand our understanding of the issues and potential for organic seed. If the state of organic seed is uncertain, it is also exciting. We have the opportunity to develop a new approach to seed as a natural resource, an approach that values ecological complexity, ethics, regionalism, sustainability, resiliency, farmers' roles and rights, biological and genetic diversity, and the historical crop development contributions of all cultures. We have great momentum toward meeting these goals. Organic agriculture continues to expand in our landscapes and marketplaces, bringing ecological and human health benefits. An organic food future – one that feeds more people with fewer negative impacts while providing greater stability and success for family farms – is possible only if we protect and improve our organic seed.

Looking forward, your input at listening sessions, through working groups, on new surveys, and in future revisions of this report is critical to making this future a reality. We hope you will stay engaged in this invaluable work.

List of Acronyms

ACA	Accredited Certifiers Association
ASTA	American Seed Trade Association
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FAFO	Farmers Advocating for Organics
FDA	Food and Drug Administration
GE	Genetically Engineered
GMO	Genetically Modified Organism
IOP	Integrated Organic Program
LGU	Land Grant University
NASS	National Agricultural Statistics Service
NOP	National Organic Program
NOSB	National Organic Standards Board
NOVIC	Northern Organic Vegetable Improvement Collaborative
OFPA	Organic Foods Production Act
OFRF	Organic Farming Research Foundation
OP	Open-pollinated
OREI	Organic Agriculture Research and Extension Initiative
OSA	Organic Seed Alliance
RAFI	Rural Advancement Foundation International (USA)
RMA	Risk Management Agency
SARE	Sustainable Agriculture Research and Education
SOS	State of Organic Seed
UNFI	United Natural Food Incorporated
USDA	United States Department of Agriculture
UW	University of Washington
VAPG	Value Added Producer Grants