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Making Organic Research Count

Outcomes from the 2017 Organic Confluences Summit

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SUMMARY

The success of organic production systems in providing economic opportunity for farmers in a sustainable manner has been driven by scientific research. The most effective and adoptable research has included fluid communication among multiple groups of stakeholders to set research priorities and drive communication of results.

The 2017 Organic Confluences Summit: Making Research Count sought to improve the impact of organic agricultural research by uniting diverse stakeholders to explore approaches for connecting research results with target audiences. Through a series of panels, case studies and discussions, Summit participants assessed the state of research communication and identified barriers that constrain the organic sector from utilizing research results and adopting new technologies.

Despite growing consumer demand, the organic system continues to face a variety of challenges that constrain growth. Among the most pressing barriers are agronomic considerations—soil health, weed and pest management—and agro-economic challenges—such as yield constraints, crop failure and supply chain shortages. In addition, organic farmers must use techniques that decrease the use of off-farm inputs, reduce resource consumption, increase biodiversity, and preserve productivity. To successfully address these challenges, there must be clear lines of communication among researchers, farmers, policymakers, regulators, and educators.

This report is based on presentations and discussions that took place at the **2017 Organic Confluences: Making Research Count**. It covers four case studies that were presented at the meeting, discusses challenges to the effective design, implementation and dissemination of organic agriculture research, and provides recommendations to increase both the significance and reach of results.

The main challenges identified included improving communication among all stakeholders, addressing inadequate engagement of underrepresented groups, ensuring that research design is relevant to the needs of end-users, making research results accessible, and improving access to research funding. Addressing these challenges will ensure that organic agriculture research contributes to the success and growth of organic agriculture in the U.S.



Dr. Tracy Misiewicz and Dr. Jessica Shade at 2017 Organic Confluences

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INTRODUCTION

Organic sales have skyrocketed over the past decade, increasing from \$3.1 billion in 1997 to \$39.1 billion in 2014.¹ Despite growing consumer demand, the organic system continues to face a variety of challenges that constrain growth. Among the most pressing barriers are agronomic considerations—soil health, weed and pest management—and agro-economic challenges—such as yield constraints, crop failure and supply chain shortages.²⁻⁴ In addition, organic farmers must use techniques that decrease the use of off-farm inputs, reduce resource consumption, increase biodiversity, and preserve productivity.

Institutional research aimed at developing new methods to address the diversity of obstacles faced by organic farmers has increased over the last decade. However, research results are often slow to reach growers, and widespread adoption of new methods and technologies can be limited. For scientific research to benefit the organic system, there must be clear lines of contact among a complex web of stakeholders to set research priorities, develop practical recommendations and drive the dissemination of results. Yet, barriers to communication are occurring on a number of levels.

A lack of clear communication channels among participants in the organic system may limit the relevance of research to stakeholders. For instance, if funding sources are not consistently prioritizing the research most needed by organic

producers, researchers will not address those needs. Even when relevant research has been conducted, a lack of communication among researchers, extension agents and educators, and producers may mean that research results are not translated into actionable recommendations.

Scientific data are also needed to develop meaningful policies and regulations that affect the organic sector. When those data are lacking or escape consideration, rules may be enacted to the detriment of the organic production system. Policy and regulatory decisions can suffer when informative data are available but unknown or inaccessible to policymakers due to lack of communication with scientists. Alternatively, there may be a lack of meaningful data to guide policymakers if scientists were unaware of the need to collect such data.

In cases where researchers are making efforts to translate and disseminate research results to end-users, adoption may be limited if the recommendations are not being communicated through the best channels to reach their intended audiences. Even when researchers are utilizing the best channels to reach organic producers, existing outlets for research dissemination may not be sufficient to meet the needs of organic farmers.

To ensure that organic research prioritizes questions that meet the most important needs of the organic community and that results are being effectively communicated, it is imperative that a wide variety of stakeholders are engaged



throughout the process from the conception of research projects through the distribution of results. **The Organic Confluences Summit: Making Research Count (May 22–23, 2017, in Washington, D.C.)** brought together scientific experts, farmers, policymakers, industry and other organic stakeholders to assess the state of research communication and address barriers that constrain the adoption of new technologies. Conference participants engaged with and learned from a wide variety of case studies and panel discussions before breaking out for small group discussions.

Panel discussions **(1)** identified attributes that made research impactful to farmers, **(2)** evaluated the importance of research in guiding the development of regulations and policies that affect organic stakeholders, **(3)** determined effective methods for involving stakeholders in research and outreach, and **(4)** assessed the effectiveness of both public and private sector organic research. Information from these sessions was crucial to the creation of this White Paper, and provided the basis for the Challenges and Recommendations (Page 9) detailed in this paper.

CASE STUDIES

Case studies at the Organic Confluences Summit took a deep look at a wide variety of topics that highlighted real life successes and ongoing challenges to research communication and stakeholder adoption in the organic community. The case studies highlighted here focused on **(1)** the National Organic Program's new Natural Resources and Biodiversity Guidance, **(2)** the development of the Natural Resources Conservation Service's Organic Farming Handbook, **(3)** the interface of farmer needs, consumer safety, and development of regulations regarding manure use in light of the Food Safety Modernization Act-Produce Safety Rule, and **(4)** ongoing progress to grow organic grain breeding programs.

Biodiversity

A consistent, growing body of literature suggests that organic farming systems can help conserve biodiversity. For instance, common organic farming practices such as crop rotations, use of cover crops and prohibition of synthetic pesticides have been shown to positively affect a wide range of organisms. Compared to their conventional counterparts, organic farms generally have a greater number of species and greater abundances of those species for a wide range of organisms including insects, spiders, earthworms, beneficial parasitoids, vascular plants, birds, bees and other native pollinators, soil microbes and fungi, and small rodents.^{5–12}

Conserving and promoting biodiversity on farms can also provide significant benefits to the surrounding environment and the farm in the form of ecosystem services. Researchers estimate that the global value that these ecosystem services provide to humans exceeds 125 trillion dollars per year.¹³ Moreover, numerous studies demonstrate that increased on-farm biodiversity often translates into direct benefit for farmers. On-farm biodiversity has been linked to services such as pollination, biological control, soil quality, and runoff reduction.^{14–18} Such ecosystem services reduce the need for external inputs and increase yields—improving profits and sustainability.

Biodiversity and natural resource conservation are some of the basic principles on which the National Organic Standards were built. While the Organic Foods Production Act of 1990 has always included underlying language that emphasizes this principle, only now have guidelines for practical implementation and enforcement come into play. This change was made possible in part by the surge in scientific research examining best agricultural practices for biodiversity conservation, and provided the basis for the National Organic Program's new Natural Resources and Biodiversity Conservation Guidance.¹⁹

Organic represents an incredibly diverse assembly of farming operations, and the Natural Resources and Biodiversity Guidance was developed with the knowledge that there can be no one-size-fits-all recommendation for on-farm conservation. What works for one farmer may not work for another, and there is likely to be high variation in the success, risk and trade-offs associated with different conservation practices based on geography, surrounding habitat, climate, local biodiversity, and the type of commodity being grown. As such, the guidance seeks to provide farmers with flexibility in how they meet the standards. While the adaptable nature of the guidance is largely considered to be positive, it has created a new set of challenges that must be tackled.

The release of the guidance has intensified the need for research to further develop best practices and increase

our understanding of the links between biodiversity and profitability—both in terms of economic gain through enhanced ecosystem services as well as costs associated with implementation. Moving forward, the organic community will face empirical challenges in the spheres of regulation, certification and agronomy as it seeks to ensure continual improvement without unduly increasing the burden on farmers. The practical implementation of the Natural Resources and Biodiversity Conservation Guidance will continue to provide an important case study on how policy goals are embodied in regulations that require scientific data for appropriate implementation. Farmers and certifiers are now working in collaboration with the National Organic Program, non-profits and scientists to ensure that the implementation of on-farm conservation practices and their outcomes are included in Organic Systems Plans.

An example of one such collaboration is between The Organic Center and Dr. John Quinn of Furman University to design and disseminate a calculator allowing farmers to document their practices and track their progress in increasing biodiversity on their farms. This project will directly facilitate compliance with new NOP guidance by providing a farmer-friendly tool with an interactive front-end interface that includes the mandates released by NOP to aid farmers in technical decisions to increase on-farm biodiversity. Farmers will be able to enter specific information associated with their farming operations to evaluate numerous conservation techniques to maximize biodiversity and ecosystem services while providing a simple and organized way to report actions and results to certifiers.

Best Practices in Organic: NRCS National Organic Farming Handbook

Integrating multiple lines of research that test and develop solutions to challenges in organic farming are key to developing best practices. Research efforts examining focused aspects of farming techniques are continually being conducted. Unfortunately, as with almost any topic area, there have been gaps between empirical work, the translation of those results into practical findings for growers, and their ultimate adoption on the farm. Furthermore, the aggregation and synthesis of many different results from related research projects to determine what exactly to consider a “best practice” are uncommon.

The National Resource Conservation Service’s (NRCS) National Organic Farming Handbook²⁰ sought to address this gap to improve conservation practices on organic farms. The Handbook was developed as a resource for NRCS planners and staff in the field to assist organic farmers even if those planners and staff lacked previous experience in or knowledge about organic farming. Information contained in the handbook ranges from general information about the

organic program to very detailed information about organic farming practices such as nutrient management, crop rotations, livestock grazing, pest management and conservation practices. It also includes a long list of additional resources. The handbook is a notable example of a document that utilizes the breadth of research examining the agronomic, environmental and economic impacts of different farming practices to develop a best-practices manual.

The National Organic Farming Handbook also stands out as a comprehensive resource for agency staff and organic farmers due to the collaborative approach the agency took in its creation. A team of 29 people including NRCS staff, experts in agronomy, soil health, wildlife biology and water quality, and a diverse network of partner organizations from across the country worked together to create the handbook. The group evaluated existing science to determine what makes a best practice a best practice for a wide range of topics. It was also able to draw on the diverse wealth of knowledge brought to the table by so many stakeholders to ensure accurate and comprehensive coverage of both information and additional resources. Created specifically with organic farmers in mind, the NRCS Organic Handbook provides information about practices that can be adopted by any farmer, and is one of the most comprehensive resources available on organic farming.

Outreach and dissemination for the handbook have also been particularly successful. In collaboration with Oregon Tilth, the handbook has been disseminated both regionally and nationally. Workshops and trainings for the more than 10,000 NRCS staff positioned across the country enable conservation planners to work with and deliver information to organic farmers. NRCS also leverages the reach of its partner organizations to disseminate the information contained in the handbook even further.



Perhaps what is most notable about the National Organic Farming Handbook is that it represents a fundamental shift in approach for NRCS. For example, previous NRCS practices surrounding soil health focused primarily on the use of engineering to halt the movement of soil, while the Organic Farming Handbook bases information and practices on the complex biological, chemical and physical interactions that constitute soil health. The publication of the Handbook also signifies the permeation of USDA organic into the obligations and expectations of the agency with significant implications for how NRCS staff interact with organic farms and farmers now and into the future.

Manure Safety

One area that is important to consider when discussing organic research development and communication is the development of governmental policy and regulation. Agricultural issues are debated by legislators and translated into policy by executive agencies. Scientific data are needed at every step to develop meaningful regulations, yet communication among scientists and policymakers is often lacking. As a result, policymakers may not have access to existing information, and scientists may not be aware of knowledge gaps needing to be filled. The 2015 provisions associated with the manure safety in FDA's *proposed* Produce Safety Act highlights how the lack of an understanding of stakeholder needs and adequate science has the potential to result in substantial hardship for farmers. It also highlights the importance of stakeholder input as a first step towards a resolution.

Certified organic producers use animal manure to improve soil fertility and quality. Manure and compost applications can improve soil health including characteristics such as nutrient availability, water retention, drainage, aeration, and structure. While manure is of particular importance to organic farmers because they are prohibited from using synthetic fertilizers, untreated manure may be a source of pathogens. This means regulations are needed to help reduce the potential for contamination, such as through the implementation of time-interval criteria between manure application and harvest. However, at the time of the proposed Produce Safety Rule, little comparative scientific data existed regarding the efficacy of these waiting times in minimizing the risk of microbial contamination.

This knowledge gap created a serious conflict for organic producers when the proposed FSMA Produce Safety Rule initially included a 270-days-to-harvest wait time. This time interval could have created a substantial hardship for organic farmers, as the NOP regulations only require that untreated animal manure be applied at 90- to 120-day intervals prior to the harvest of crops. The organic community came together to submit substantial public comments on the initial



proposed rule to reflect this concern. They also addressed concerns regarding adverse effects on soil ecology, disruption of current cropping cycles, and negative economic impacts. In response, the FDA has reserved any such time interval in the final Produce Safety Rule associated with the use of untreated biological soil amendments of animal origin (e.g. raw manure) until more science-based research related to food safety and the use of raw manure in fresh produce production is conducted. During the interim, farmers can comply with the NOP standard.

While it behooves all stakeholders to maintain open lines of communication with FDA and the U.S. Department of Agriculture (USDA), it is particularly important for organic farmers to make their voices heard. Organic represents only a small fraction of U.S. farms. Without participation and engagement from the organic community, federal agencies rely on the input and information available to them—which primarily comes from conventional farming operations and, as in the case of any future requirement associated with raw manure, may not reflect the realities and needs of organic farmers.

Furthermore, this case study underscores the importance of scientific data in developing sound and effective regulations. The lack of comparative scientific data supporting a time interval (or intervals) in ensuring food safety led The Organic Center to convene a team of researchers, non-profits and farmers to fill this knowledge gap. An initial planning study gathered information nationwide from a diversity of organic stakeholders including regulators, farmers, academics and other professionals to design a research project to investigate risk mitigation of foodborne pathogens for organic and sustainable operations. This work ultimately led to a large-scale, multi-institutional research project to explore current practices used by the organic industry related to soil amendments (untreated manure and compost) use and food safety risks in fresh produce production. That research project is underway with funding from the USDA National Institute of Food and Agriculture's (NIFA) Organic Agriculture Research and Extension Initiative (OREI).

Over the next decade, this policy resolution will likely prove to be a key arena in which processing research data into practical measures and effective science communication have high stakes implications for the organic community. Data on pathogen contamination and persistence on both conventionally and organically produce will be generated. What remains to be seen is how the underlying approach for determining the final standards and their enforcement will be linked to empirical data, and which data.

Organic Grain Breeding Programs

The challenges faced by organic grain breeding programs highlight the interconnectedness of the organic system and the importance of collaboration across the supply chain to develop solutions that are economically sustainable and scalable. Organic growers face many of the same large-scale challenges as conventional growers, but the lack of investment in research has left them with a limited number of agronomic tools. As the seed industry consolidates and narrows its focus, organic farmers are not served by most new research and development. As a result, organic growers often have no choice but to plant crop varieties developed for different growing conditions and not optimized for organic systems. This leads to decreased competitiveness in the form of lowered crop yield and reduced performance compared to highly bred crops. Furthermore, the seed system is complex, and requires the integration and success of multiple players, including plant breeders, seed producers, seed sellers, seed buyers, farmers, processors and seed users, for the system as a whole to succeed.

Meanwhile, the organic grain supply is a bottleneck for value-added processes. Growth in grain production lags behind other organic commodities and remains a negligible amount of total U.S. cropland. However, U.S. companies have a vested economic and reputational interest in sourcing their grain from U.S. farmers, closer to processing facilities, while passing on organic profitability and environmental benefits to the U.S. farmer and consumer. As such, both organic grain farmers and the organic industry will receive clear benefits from research that expands organic grain production. The challenge is coordinating so many moving pieces to improve productivity, profitability, and market access of organic grains.

To establish successful grain breeding programs, there must be an integration of partners and techniques. Universities, farmers, federal research programs and industry each play an important role in the development and success of successful grain breeding programs. Universities house public breeding programs, are continually optimizing agronomics and genetics, and provide the primary source of training for the next generation of organic breeders and consultants. Farmers are needed to identify important traits and participate



in breeding, trials and evaluation. Finally, industry plays an important role by providing resources to aid in genetic development, seed cleaning, and nursery access. Research to develop solutions also requires integration of many different management techniques. There is no silver bullet solution for challenges in organic systems. Thus, a combination of agronomics, economics and genomics is necessary to meet the needs of organic grain producers.

Ultimately, investment in organic breeding is the first step toward increasing domestic organic grain supply, improving opportunities for farmers, and creating opportunities for value-added businesses while supporting the needs of larger processors. Over the past decade, investment in organic seed breeding programs has been growing—increasing from slightly under one million dollars in 2007 to about 4.6 million dollars in 2014.²¹ USDA National Institute of Food and Agriculture's Organic Agriculture Research and Extension Initiative (OREI) provides a critical portion of this funding and a path forward to successfully meet the needs of organic producers. While this increase is encouraging, more investment is needed to create an economically and environmentally sound system that meets the needs of the industry.

CHALLENGES AND RECOMMENDATIONS: MAKING ORGANIC RESEARCH COUNT

Research funding devoted to organic agriculture remains low compared to the investment in conventional sector agriculture. Accordingly, it is imperative that the research that is funded be disseminated broadly and intentionally to ensure that it reaches its target audience. Additionally, research topics must be relevant to farmers and policymakers, and information must be disseminated in a form that is understandable and useful. Here we present the results of panel discussions and participant breakout groups that assessed the state of research communication and barriers that constrain the adoption and use of research results and technologies.

Improving Communication

One of the greatest challenges that hinder the design, implementation, dissemination and adoption of organic research is a lack of constant and open dialogue among stakeholders in the organic community. Clear lines of communication among scientists, farmers, policymakers, regulators, non-profits and industry are essential to ensure that the existing organic agriculture research establishment is effectively and efficiently meeting the needs of the organic community. This also includes disseminating results from research through appropriate outlets and in a form that is easily understandable and implementable by the intended audience—often times farmers but also industry, policymakers and regulators. For example, researchers should work closely with extension agents not just to disseminate the results but to determine if and how those results may impact practical decisions on the farm and results. Results should also be disseminated via documents, manuals, or websites designed to be quickly and easily understandable to farmers.

Organic farmers represent a range of diversity demographically, geographically, in the commodities that they produce, and in their overall experience as farmers. Not surprisingly, research has shown that organic and sustainable farmers also seek educational materials from an incredibly wide variety of sources. Today's organic farmers are likely to utilize traditional sources of information as well as an entirely new suite of educational tools including websites, webinars, social media and e-mail list serves provided through diverse organizations including non-profits, universities, and governmental agencies.²²⁻²⁴ As such, research should be accompanied by a multifaceted plan to disseminate results via a diversity of venues and media in a manner that is understandable, digestible and intuitive. For example, results can be disseminated via websites such as eOrganic or YouTube and social media platforms such as Facebook for younger or tech savvy farmers, as well as by traditional forms of

information dissemination including presentations at farmer conferences, field days, printed manuals, publication articles and mailed documents for those who do not have access to or who choose not to utilize media via the web.

Exchange among academics and policy influencers is equally important. Communication of challenges that can be addressed through scientific research and solutions that can be applied are key to ensuring that research is shaping regulations and policies that affect organic stakeholders. Furthermore, research results cannot be incorporated into any policy (non-organic-specific or organic) unless they have been appropriately translated and conveyed to policy officials. For example, in the proposed FSMA produce safety rule case study, communication among researchers and policymakers will be key in determining the final ruling on wait time intervals between raw manure application and crop harvest. Results from research that is underway will need to be presented to policy makers in a manner that is clear and directly helps answer the question of pathogen persistence and manure use for it to successfully shape future rulemaking. Additionally, government agencies are regularly reaching out to stakeholders to set program priorities. While some of these programs are organic-specific (OREI and ORG research grants through USDA NIFA, for example), the majority are not. However, agricultural programs that are not organic-specific may still consider organic and sustainable farming, particularly when organic approaches may provide solutions that result in sustainable and economical farming for conventional farmers. Although organic stakeholders may be less inclined to invest time via comments or communication in programs that traditionally have not served the organic community, these interactions are necessary to increase the consideration of the challenges faced by organic farmers.

Finally, industry communication must be considered. In addition to its own set of research-worthy challenges, many industry players occupy an intermediary position in the supply chain that requires collaboration and communication with both farmers (at the head of the supply chain) and consumers (the end point). Industry with close ties to their farmers and suppliers often have an in-depth understanding of the challenges faced in the organic system, particularly when those challenges ultimately affect the outcome of their product (such as ingredient shortage, low domestic supply, reduction in quality). The organic industry also has its finger on the pulse of the consumer, whose behavior is one of the key drivers of growth in the organic sector. This connection can be used to support research priorities and improve communication to the public.

RECOMMENDATION:

Clear lines of communication must be maintained among farmers, academics, industry and policy influencers to ensure that results are accessible to the end-users they were intended for and to ensure that policy priorities and regulations adequately take into account the needs and challenges faced by the organic community.

- » Organic stakeholders must participate in federal and state research program reviews and stakeholder workshops where they can share challenges and research questions including specific direct research needs.
- » More venues are needed to bring together a variety of stakeholders that allow for informal communication among groups.
- » Researchers must involve farmers in the development of research questions.
- » Industry and non-profits must work to close communication gaps by developing partnerships with farmers and researchers.

Engaging Underrepresented Groups

While improving communication across different sectors in the organic community is necessary to drive useful organic agriculture research, underrepresented groups such as minorities, transitioning farmers and farmers must also be included to ensure that all stakeholder needs are taken into account. For instance, compared to today's conventional farmers, organic farmers are more likely to be beginning farmers (less than 10 years of experience farming) and young farmers (under the age of 45).²⁵

The number of U.S. farm operations owned and operated by minorities has also increased significantly. Between 2007 and 2012, farms with owner operators who identify as Hispanic, African American and Asian increased by 21%, 12% and 21%, respectively.²⁶ Female farmers make up 30% of all farmers nationally; in regions such as the Southwest and Northeast, they represent an even larger proportion of farmers.²⁷

Farmers who are minorities, young or new to farming, may experience unique barriers to information transfer. They may rely on different resources or networks to obtain information than the traditional farmer. Young farmers may have different information needs, and minority farmers may face challenges such as language barriers to information access.

Conventional farmers interested in transitioning to organic comprise another group to consider. This group of farmers poses a significant communication challenge because they lie outside of the organic sphere, and it can thus be difficult to identify their needs and priorities. These farmers are also more likely to rely on conventional sources of information and therefore may not have access to or know about organic agriculture research and the results typically disseminated via platforms specific to organic stakeholders.

Finally, farmers who are active communicators in the industry are more likely to be advanced farmers and early adopters of innovative practices. While this group provides a valuable service, they typically are not representative of the average organic farm operator. Farmers who are less advanced may have very different needs and challenges that may go unheard. Thus, communication efforts must make efforts to reach populations who may be less vocal to ensure the range of experiences and needs are captured and that information is reaching all relevant groups.

**RECOMMENDATION:**

A comprehensive effort must be made to ensure that all organic stakeholders are engaged in the process of research needs gathering, cooperation in study design and execution, and results dissemination.

- » Researchers must ensure that outreach materials are disseminated in multiple formats, both online and offline so that they are available to a diversity of farmers via numerous platforms.
- » Research and outreach materials should be translated into different languages and made available via venues where they are likely to be accessible to the target population.
- » Research outreach plans should be specifically designed to disseminate information to organic farmers who are not active participants in farming groups or other active communication networks for farmers.

Relevant Research Design

Organic producers must understand and rely on complex biological processes that occur over long periods. The majority of agricultural research funding, including organic funding, is restricted to projects that use reductionist approaches—attempting to isolate and evaluate the effect of one single practice in a short period. While these strategies are common in conventional agriculture research, they are not ideal for sustainable and organic systems because organic farms are holistic in their approaches to finding on-farm solutions, and the benefits that come from combined organic systems strategies can be greater than the sum of the individual components.

In addition to ignoring the complexity of the organic farming system, these studies also frequently fail to take into account non-agronomic yet equally important issues. On-the-farm practices are not implemented in a vacuum, and farmers are ultimately forced to consider a combination of environmental objectives, productivity, and cost-efficiency when facing production and business decisions. Research must consider a multitude of parameters to evaluate and improve the entire farming system.

National organic standards also mandate organic agriculture cropping systems to implement specific practices that directly influence the effectiveness of many short-term research projects. For instance, many organic farmers implement extended crop rotations. A research project taking place in a four-year crop rotation scenario that is replicated over more than one full cycle would require a minimum of eight years. The maximum funding duration for the Organic Agriculture Research and Extension Initiative is four years. The challenge is there currently is no federal funding source that provides funds for long-term research initiatives.

Similarly, because organic farming relies on an understanding of biological processes that vary based on localized factors including topography, soil chemistry and climate, research results from one area or crop may not translate to others. Farmers are constantly looking for research results based on the crops that they produce and conducted in the regions in which they farm. Thus, while regionally focused research projects may be relevant to a smaller subset of growers, they also may result in higher levels of result utilization and adoption overall.

Challenges to effective research design also arise simply due to time constraints associated with planning and writing large-scale grant proposals. Most USDA grant opportunities, including the OREI, typically allow three months between the release of the request for applications (RFA), which details the priorities and requirements for the grant cycle, and the



deadline for the proposal submission. This leaves very little time to develop a new proposal that often requires extensive collaboration with numerous researchers across various universities, not to mention coordination with university and department budget offices and administration. As a result, it is not uncommon for researchers to move forward with a proposal after less than adequate counsel with farmers or other relevant stakeholders who are also balancing busy schedules. This means that while most research appears to consult growers, many projects do not adequately meet the needs of stakeholders or are designed in ways that are not relevant in the field.

Finally, even when researchers communicate with the organic community to create a project addressing a top priority, they must take extra care to ensure that the project design reflects actual on-farm practices. For instance, an OREI-funded project for almost 1.5 million dollars entitled *Evaluation of the Milk and Meat Residues of Organic Therapies for Mastitis*²⁸ sought to determine if products used to treat mastitis in organic cows could be detected by antibiotic residue detection tests. Researchers also set out to assess general effectiveness of the products and to determine the amount of time post administration that residues of the treatments were detectable in milk and meat. While this study sought to answer a question of high priority for regulators and the organic dairy sector—who must deal with udder infections in lactating dairy cows (known as mastitis) without the use of antibiotics, it ultimately did not provide very much usable producer level insight because of differing label and on-farm usage in practice.

The research design was constrained to assess usage strictly taken from label requirements of the mastitis treatments. However, in reality, organic farmers are typically using these treatments at rates significantly higher than the label rate (i.e., off-label). This gap between 'recommended' use and actual use has naturally grown as innovative farmers and veterinarians pioneer new approaches to animal treatment

to fill the gaps left under organic by the prohibition of antibiotics. Even though the results of the study provided accurate information regarding the label rates, those results were not relevant to most organic dairy farmers. In this case, the researcher's advisory committee identified this challenge early on yet research regulations required that the study adhere to the label rates. Improved communication between farmers and researchers and treatment makers earlier in the conception and design of the study could have resulted in a study that would have provided results more useful to organic dairy farmers. In other cases, researchers need to connect with farmers to make sure they truly understand the farming system in question and that the research ties in to the realities of the field.



RECOMMENDATION:

Research must address the needs of end-users and be conducted in field relevant settings so that results are useful.

- » Funding must increase for long-term research and research that takes a whole systems approach to address the complexity of organic systems, including assessment of economic benefits and trade-offs.
- » Research questions must focus on increasing efficiency, enhancing output, reducing costs and enhancing the quality of the product.
- » Research must be designed with significant input from farmers to ensure that the outcomes are field relevant, and farmers must accurately and explicitly express their needs to researchers.
- » More research with a regional emphasis is needed.
- » Federal granting agencies should allow a minimum of three months from release of the request for proposals to the submission deadline to allow effective inclusion of farmer input in the design of research projects.

Making Research Results Accessible

Effective dissemination of research results at the completion of a project is key for the adoption of new methods and technologies. It is imperative that the dissemination of research is carefully targeted to reach its intended audience and translated into actionable recommendations. If pertinent research is completed but the results are not presented in a manner that is accessible to non-scientists, relevant information may remain underutilized by farmers and policymakers.

Many scientists face the challenge of fulfilling the roles of researcher and administrator throughout their careers. Unfortunately, while the majority of researchers are highly trained in the details of their field and the scientific method, it is not uncommon for scientists to have little or even no training in the field of outreach or education. Current USDA funding opportunities do emphasize the importance of extension and education where researchers are required to include plans for outreach and evaluation and are encouraged to collaborate with extension and non-profit partners to increase the reach and accessibility of the results. However, this does not always happen effectively. Perspectives on what constitutes adequately translated science may vary widely between a farmer and a researcher or a policymaker. Furthermore, most project budgets are tight; when forced to choose, scientists are likely to omit education and outreach activities in favor of funding research.

Another major challenge to effective results dissemination is understanding the best outlets by which to reach organic farmers. As new funding initiatives for organic agriculture research, such as the OREI, emerge, it is expected that researchers who have traditionally focused on conventional farming systems will enter the realm of organic agriculture research. While this shift is generally positive, research suggests that conventional and organic growers are likely to utilize different resources to obtain information. Surveys have found that organic farmers are much less likely to rely on traditional extension than conventional producers, and instead prefer other organic farmers as a primary source of information.²⁹⁻³⁴

This preference, in part, may be driven by a number of factors. For one, current or past unproductive or sometimes even antagonistic relationships with extension professionals may deter organic farmers from utilizing traditional education resources. For instance, many educators, cooperative extension agents and USDA personnel who did not work with organic producers regularly lacked a basic understanding of organic agricultural practices, the needs of organic and sustainable farmers, existing research aimed at addressing those needs, and often harbored bias against organic farming practices in general.³⁵⁻⁴¹ While the extent to which these challenges are still exist in agricultural education systems is

unclear, many organic farmers do not rely on these traditional education outlets as a primary source of information and continue to prefer peer-to-peer learning.

Another explanation for why so few organic farmers utilize traditional sources of information may simply be that agronomic staff with expertise in organic and sustainable farming techniques are scarce across many parts of the country. For instance, the National Resource Conservation Service (NRCS) funds only one organic specialist for the entire U.S. A variety of constraints (such as budgetary or political) may also hinder education professionals from focusing seriously on organic farming methods, limiting the amount of knowledge they have available to share with others. It is therefore key that researchers in the field of organic agriculture work to ensure that their outreach and extension plans place emphasis on activities and resources most likely to be used by organic farmers.

One final consideration in the area of effective results dissemination is the choice of whether to disseminate research results at all. This may occur in the case of non-significant results due to publication bias, where scientific journals preferentially publish studies with significant results, or if a researcher chooses not to publish their research because results are non-significant. For example, if a study tests the efficacy of a variety of products in combating disease but finds that none of them is effective, researchers may choose not to or have trouble publishing or disseminating the results because they are considered uninteresting. Negative results, however, do provide very real and useful information to organic farmers. Because organic farmers are prohibited from using antibiotics, synthetic pesticides, mineral fertilizers and genetically engineered crop varieties, they are limited in the

tools they can use to address agronomic challenges. While many products created and marketed to organic growers lack data supporting their efficacy, this does not stop them from being marketed to growers as effective solutions. Particularly in cases where typical preventive measures fail to control a pest or pathogen outbreak, organic farmers may invest in treatments and practices not backed by scientific data. As such, the results from studies that do not indicate a clear 'solution' to a challenge may be just as important to organic farmers as one that finds a solution.

RECOMMENDATION:

Researcher results must be accessible, understandable, and actionable.

- » Researchers must have a clear understanding of their different audiences and recognize the needs of those different audiences.
- » Funding should be increased to cover the creation of materials that convey research results to the intended audience in a compelling and understandable manner.
- » Agriculture research grants should encourage farmer participatory research as a means to teach farmers new skills and disseminate research results. At a minimum, research grant programs should require meaningful farmer participation to ensure that research is useful to the organic farming community, and research results must be shared with farmer participants as well as the organic community at large.
- » Universities with large agricultural research programs should enlist a designated farm research coordinator to act as a liaison between the participating farmers and the researchers to ensure smooth transfer of information including the intention of the project, clear expectations and timeline, and delivery of the results.
- » When necessary, researchers should collaborate with individuals and organizations who are experienced in results dissemination.
- » Non-significant results should be communicated with farmers through direct communication, or included in summary reports that draw together many smaller projects around a common topic.



2017 Conference attendees participated in group discussions exploring challenges to research development and communication

Adequate Research Funding and Resources

Applied organic agriculture research is drastically under-funded in the United States. Organic growers face many of the same large-scale challenges as conventional growers, but the lack of investment in research has left them with a limited number of agronomic tools. This lack of funding has had a very real impact on organic producers. For instance, organic growers often have no choice but to plant crop varieties developed specifically for conventional cultivation.

Policymakers have begun to note the importance of organic agriculture research. As a result, funding has begun to increase over the past decade. However, the proportion of research funding going toward solving challenges in organic agriculture is still disproportionately small. For instance, of the \$956.4 billion allocated over a 10-year period in the most recent farm bill, only \$167.5 million over a five-year period directly funds organic agriculture research. This means that only 0.02% of the Farm Bill funds organic agriculture research. Even when programs that are unrelated to agricultural production such as SNAP and WIC are removed from the total budget, organic agriculture still receives less than 1% of the total funding.

In spite of low levels of investment, the organic sector has already begun to experience the benefits of investment directed toward overcoming challenges to organic production. With increased funding, more tools will continue to be developed that will allow organic farmers to overcome agronomic challenges and that can be incorporated into conventional management schemes.

Finally, while public funding is necessary for the advancement of basic scientific understanding, public-private partnerships also have an important role to play in advancing the organic industry. The success of the organic industry is dependent on organic farmers, and research and extension investments are imperative if organic is going to be successful.



RECOMMENDATION:

Increase both public and public-private research initiatives to advance the success of the organic sector.

- » The organic industry should strive to increase the number of private-public partnerships.
- » The organic community must work to secure federal research funding for the organic sector that is proportional to organic's market share.
- » Funding for USDA NIFA's Organic Agriculture Research and Extension Initiative (OREI) must be renewed in the next farm bill, with permanent direct funding set at a minimum of \$50 million annually.
- » Large-scale partnerships should be established among multiple companies, non-profits, and researchers to tackle large-scale challenges to the organic industry.
- » An organic research and promotion order should be established to help set federal grant priorities and act as matching funds for federal grant programs.

CONCLUSION

Research funding devoted to organic agriculture remains low compared to the investment in conventional sector agriculture. Accordingly, it is imperative that the dissemination of research findings is carefully targeted to reach its intended audience, that research is conducted on topics prioritized by farmers and other stakeholders and that information is disseminated in a form that is understandable and useful.

Addressing the challenges discussed in this report will improve the usefulness of research being conducted and the adoption of new science-supported techniques on the farm. For instance, by lengthening the amount of time between the release of a grant request for application and the proposal submission date will allow researchers more time to effectively communicate and collaborate with farmers to come up with important research questions and design a study that will answer them in a useful and relevant way.

Industry involvement in research is imperative for a number of reasons. As intermediaries in the supply chain, they can provide a unique perspective on the needs and challenges faced throughout the supply chain. Increased public-private partnerships that invest in organic agriculture research and extension are key for the survival of the entire industry including any brand or company that relies on organic agricultural products.

Access to information is also of key importance. Policymakers must be aware of both challenges faced by the organic sector as well as solutions that are being developed. It is only through collaboration and communication with public agencies and offices that the organic sector will ensure that its voice is considered in the development of programs, policies, regulations, and funding opportunities.

Finally, translation of research into understandable and applicable recommendations is key to the success of organic farmers and necessary to ease the perceived risk of transition for conventional farmers considering transition. Effective research translation and dissemination are among the most important challenges to ensuring the success and continued growth of organic agriculture in the U.S. Perhaps most importantly, with additional targeted outreach toward conventional farmers and underrepresented groups already in organic farming, we can retain current organic farmers and encourage transition.

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