

Plant Breeding from a Farmer Perspective
Seeds and Breeds for 21st Century Agriculture
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With text from Woody Deryckx and Matthew Dillon

First I am going to share with you the words of a very experienced and knowledgeable farmer – Woody Deryckx who was unable to attend and give this presentation. Then I'll share with my thoughts with you.

Woody writes:

“My perspective comes from over thirty years as an organic farmer – operating a farm which runs on fundamentally different principles compared to its conventional, industrialized counterpart and, as such, it presents a distinctly different environment for plants and animals and distinctly different opportunities for breeders. I primarily work in vegetables – both fresh market and for processing. The organic fresh market sector is currently at 5% nationwide and growing rapidly. It is wonderfully gratifying to see researchers and breeders embracing the opportunities to serve the organic community and I am honored to comment on how you might better serve what is undoubtedly an under-served sector.

As I said an organic farms function in fundamentally different ways compared to their industrialized counterparts. An organic farm is more than a farm that meets the list of criteria laid out by the National Organic Program Standards for certification - its difference is more than the absence of chemicals and soluble salt fertilizers. An organic farm is a complex biological community, diverse both in obvious and invisible ways, and dependent upon the health and fitness of all it's complex parts because they interact to form a whole, functioning ecosystem. For example, a “unit” of nitrogen in an industrial farm comes from a product derived from natural gas though a costly industrial process and distributed by an even more costly and environmentally damaging transportation and handling system eventually feeding the crop possibly more than it needs while inflicting deleterious side effects upon the over-all biological integrity of the soil, undermining the physical structure of that soil and perhaps polluting waterways and contributing greenhouse gasses. In the organic farming system, on the other hand, the comparable nitrogen needs of the plant are supplied through countless microorganisms interacting with each other and a substrate of organic matter – self regulated in complex information dense and sensitive feedback systems involving biological nitrogen fixation, crop rotation, animal/plant interdependencies, ecological nutrient cycling, and nitrogen mineralization with desirable side effects such and improved soil structure and biodiversity. Similar comparisons can be made for other fundamental farm functions such as pest and disease management and weed control.

The organic viewpoint reaches out to encompass a redefining of social and community interactions as well. Just as a crop plant needs to fit into its field and soil setting well, possessing the ability to thrive alongside its neighboring ecological collaborators, so a

holistic organic farming system fits into and contributes to its community economically, aesthetically, ecologically and even spiritually. When we contemplate the growth and maturation of the organic food movement we are looking at one component of an over-all reorganization of society beyond the smokestack industrialized, and corporate directed existence of the late 20th. Decentralized, integrated economies – that is self-reliant food sheds that result in ecologically sound and socially equitable agricultural systems - contribute to the general security and wellbeing of the whole community. The logic of community food security suggests a profound concern over control and involvement in all aspects of food systems including the development of cultivars and breeds. The extended logic is that breeding should be decentralized, diverse, regional or local, and under the control of or available to as many individuals as possible. Indeed – recognition needs to be paid to the historic fact that greatest accomplishments in domestication occurred under the constant care and nurture of individual producers – gardeners, farmers, and herding people in every community on the planet before university and government and corporate breeding programs took over. We could do well to show respect to the legacy of those who got us most of the way to where we are now by reinvigorating a localized, decentralized, public matrix of trained professional breeders working for the public good.”

I wish Woody could have been here to further elaborate, a farmer of his experience undoubtedly has a wealth of perspective to share with all of us.

In the last few days, since I was asked to stand in for Woody, I've had time to consider what I see as an essential element in reinvigorating public plant breeding. Let me first share a bit about my background. I was raised in a traditional farm family in eastern Nebraska from cattle to commodities, along with a family run agricultural supply business – ear tags and salt blocks and whatnot. I left that family business after college but later returned to farming – producing vegetables and flowers for farmers market and restaurants, and small scale seed production. For the last seven years I've worked with with farmer-based NGOs, forging and managing farmer contracts, building educational and research programs that are farmer-centered. I am not a titled plant breeder, researcher or educator. My college days were spent studying, as I admitted last night to one of the patrons of OSA breeding programs, “evolution of human consciousness” - if you don't ask me to explain that I won't ask any of you to explain the true intricacies of heterosis. I will say that my studies were strong on philosophy, anthropology and religion. In any case I like the pulpit and I am seeking converts. And I even have a catechism – the role and value of the farmer – in this case, in regards to seed development.

Fundamental to the success of any agricultural system is the use of appropriate crop genetic materials that are adapted to current production methods and environmental conditions. If any aspect of the crop's genetic make-up is not suited to the environmental conditions then it is up to the farmer to add inputs as a way of controlling the crop stress. For biotic stresses such as plant diseases and insect pests there has been an increasing dependence on chemical inputs and transgenic modification to control these maladies, options not always desirable or allowable within organic agriculture.

In organics there are fewer inputs available for controlling biotic maladies, reinforcing the importance of resilient genetic materials. Many of the crops bred in conventional breeding programs are selected and adapted to perform under high input systems, and in fact do respond best under these systems. There are a number of projects in the US that are evaluating conventionally bred materials on certified organic trial land to identify varieties that perform well in organic systems. There is no way to predict which conventional varieties will excel and which will falter. Comparisons between conventional bred varieties versus organic bred varieties cannot be made as we lack long-term organic breeding programs and subsequent studies of their efficacy. There is however an old plant breeding axiom, based on the understanding of the effects of environment on genotype, “Breed in the area of intended use.” This fundamental approach to breeding increases the likelihood that a variety is well adapted to a particular set of environmental conditions.

As Woody pointed out - Breeding for organics goes beyond breeding for appropriate disease and insect resistance – and in its fullest form it is breeding within an ecological context, increasing the positive interactions within a complex system. As such, looking for the simple genetic fix to any one problem is not in harmony with an integrated organic approach. An integrated approach must build a crop plant with resiliency under an array challenges. An understanding of these challenges, and a strategy to address them, must have at it's foundation a high degree of farmer involvement.

I want to talk about the role of farmers in breeding systems....

Farmers play a key role in developing a decentralized model of plant breeding, one that serves regional needs, recognizes niche ecology and niche markets, and adds to a sense of what Woody referred to as community security. We saw an interesting and excellent example of farmer participation in breeding projects, at Don Adams and Nan Bonfils farm yesterday evening. And I believe it was a highly appropriate way to begin this week's work.

It is also a rare example.

While “Participatory Plant Breeding” has long been perceived as something “good enough” for the southern hemisphere, it now appears to have increasing appeal in sustainable and organic agriculture. PP is quickly becoming kind of sexy. On a certain level it has this great sound and appearance – it's participatory – something we might have learned on Sesame Street. It puts a face on breeding, one more accessible to the public than that of researchers (not that there's anything wrong with any of your faces – but the public loves a farmer).

But how will the farmer participate? How will we conduct PPB on North American farms? Do the southern models fit us? Is it enough for formal breeders to involve farmers in field trials and call it participatory plant breeding? Will farmer participation be no more than a token nod? A pseudo-collaboration to satisfy funder requirements for farmer outreach or achieve an appearance of being inclusive in some politically correct sensibility? Initially, yes, this may be the case – as most farmers simply do not have the skills, time or even desire to become involved in formal research. It is a rare subset of

farmers that actually want to add one more thing to their calendar. Most farmers will always prefer to have their varieties handed to them, no questions asked. This is the status quo and this will not change overnight, if it changes at all. In the last century farmers have been largely excluded from plant breeding, told that plant breeding is for the specialist – and while we must recognize the value of the specialist - be she geneticist, pathologist, or economist – we must also work to return the farmer to their place at the table as a specialist. We as researchers and educators in the public sector – NGOs and Universities – may reach out to producers for participation, may have a sincere desire to work with farmers, recognizing their valuable place in plant breeding, but will they have us?

In order to create a fully inclusive and farmer-valued form of Participatory Plant Breeding, we must promote, educate and extend a hand of true collaboration to the farm community. And as we do so a generation of farmer-breeders will emerge. Our collaborations with these farmer-breeders will have a much higher rate of success. We have seen this in OSA breeding projects: when a farmer initiates a project, as opposed to our solicitation of their involvement, the work progresses more effectively and results in better seed. Initiation versus solicitation makes for better PPB.

PPB refers to a continuum of breeding approaches involving farmers and formal researchers. The seminal distinction between “formal” PPB and “farmer” PPB is in the level of control in design, implementation and ownership of the program. In farmer PPB farmers are invested from the beginning in design, objectives, and ownership of benefits of breeding programs.

I want to touch a moment on benefits of a plant breeding program – too often reduced to dollars and cents that are quickly gobbled up by the stockholders of seed companies, or in some cases by university royalty agreements. This is not to say that breeders – be they public or private - do not need and deserve compensation, or that innovations should not be rewarded. Certainly the benefits of a breeding program are more than seed sales, and even when translated to currency it is best to remember that crop genetic innovation existed before the advent of molecular biology and that as such, we have a responsibility to create equitable forms of benefit sharing, one with high returns to the public, and specifically to the farmers.

Later in the week we will hear Charlie Brummer present a paper from Keith Aoki on Intellectual Property Rights - I believe it will be a discussion of current trends and developing alternatives. As we create new models of breeding for a new form of agricultural (and it is a new form - organics is not the same as pre-industrial agriculture) we must also create new models of ownership. Perhaps we will learn from the open source software movement, or create long term futures bonds for public investment and return on genetic resources. Perhaps we will develop a new form of “commons” that is readily accessible without falling prey to exploitation by those with the longest arms to reach into the depths of diversity. An open commons need not be an unprotected commons, nor a stagnate one but rather can be stirred and be refreshed by the participation of stakeholders.

We will in all likelihood not create a new model of ownership here at the Gateway center. Much as in plant genetics, the complexity of the challenge does not give way to a quick fix.

We might make a few useful policy recommendations for the next round of appropriations and drafting of future farm bills. This is good, but there are core questions of investment, ownership and participation that will remain unanswered.

But even when a map is not yet drawn, the cardinal points exist. I don't know the names of these directions – perhaps collectively we all do. I do believe that the terrain is a complex landscape not easily reduced to a diagram. If we are to make headway, then we must have cardinal points, guiding principles. There are perhaps many – more than four – but I would suggest a minimum of one magnetic north – and that is a high level of farmer involvement, and a commitment to nurture and increase that involvement with meaningful collaboration. I congratulate all of us for beginning the process. As we continue to re-magnetize the direction of plant breeding we ought not lose sight of the farmer, lest we get lost.