IPRs in Agriculture:
Implications for Seed Producers and Users

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Impacts on Research in the Public Sector

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The goals of my presentation are to review the current situation in public plant breeding and plant germplasm relative to IPRs, present some benefits and challenges presented by IPRs and offer some suggestions to confront the most serious challenges. Based on my experience I will place a greater emphasis on land grant universities (LGUs) than on USDA-ARS. These two entities represent the vast majority of public plant breeding and germplasm efforts in the US and there are important and fundamental differences between the two. The USDA has continued its long-term policy of making research results and products as widely and freely available as possible. Generally USDA only applies intellectual property rights when they are required for the invention to become applied. On the other hand, since 1980 when the Bayh-Dole Act was passed, LGUs have actively asserted IPR, with, it seems, ever increasing vigor and aggressiveness. Since assertion of IP is the reigning paradigm in the LGUs, I will spend a brief amount of time discussing the benefits of IP and focus more intently on the challenges that IPRs present to the LGUs.

It is a good starting place to recall the mission of the LGUs and USDA-ARS. On the USDA-ARS website I could not find a formal mission statement but the following statement was prominently displayed.

"Our job is finding solutions to agricultural problems that affect Americans every day, from field to table"

The mission of the LGUs is agreed to consist of three separate tasks, teaching, research, and outreach/extension. This tripartite mission was accepted by the states when they accepted the Federal land and money that was appropriated to fund these tasks. The original mission of the LGUs was teaching. In 1862, President Lincoln signed the Morrill Act, which allotted land to each state that could be used as a source of funds

"to the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies and including

military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes on the several pursuits and professions in life."

The second mission research was spelled out in the Hatch Act of 1887

"... It shall be the object and duty of the State agricultural experiment stations through the expenditure of the appropriations hereinafter authorized to conduct original and other researches, investigations, and experiments bearing directly on and contributing to the establishment and maintenance of a permanent and effective agricultural industry of the United States, including researches basic to the problems of agriculture in its broadest aspects, and such investigations as have for their purpose the development and improvement of the rural home and rural life and the maximum contribution by agriculture to the welfare of the consumer, as may be deemed advisable, having due regard to the varying conditions and needs of the respective States."

Followed later by other acts supporting research in specific areas. The third mission, extension, was another land grant in the Smith-Lever Act of 1914.

"In order to aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture, home economics, and rural energy, and to encourage the application of the same, ... Cooperative agricultural extension work shall consist of the development of practical applications of research knowledge and giving of instruction and practical demonstrations of existing or improved practices or technologies in agriculture, uses of solar energy with respect to agriculture, home economics, and rural energy, and subjects relating, thereto to persons not attending or resident in said colleges in the several communities…"

Plant breeding has been a component of the research and teaching functions of the LGUs since the signing of the Hatch Act. The benefits of public plant breeding and the return on investment have been demonstrated in a number of studies. Through the first half of the 20th century nearly all professional plant breeding was done by the LGUs or the USDA. During that time private companies began to develop substantial plant breeding programs, especially on hybrid maize. In addition to supplying germplasm and knowledge to the nascent private programs, the LGUs supplied professionals trained in plant breeding.

In the later half of the 20th century private plant breeding companies expanded and took a dominant role in many important crop species. Crops such as maize soybeans, tomatoes, sweet corn, and others came to be dominated by the private sector, while others such as oats and certain vegetables were ignored. The availability and type of IP applicable is only one factor in determining the interest of a private plant breeding company in a particular crop. Usually, other market forces play a larger role in those decisions.

Since private companies can be successful in developing cultivars it is fair to ask why the public sector should continue to be involved in cultivar development. I believe there are a number of reasons that public breeding should continue.

1. Food Security: Plant breeding decisions determine the future of the world's food supply. Placing the responsibility for the world's crop germplasm and plant improvement in the hands of a few companies is bad public policy. The primary goal of private corporations is to make profit, and even in the case of the most civic-minded corporations, this goal will be at odds with certain public needs. Even if we assume that the one or two companies controlling a crop were completely altruistic, it is extremely dangerous to have so few people making decisions that will determine the future of a crop. Even well intentioned people make mistakes. The future of our food supply requires genetic diversity but also demands a diversity of decision makers (plant breeders).

2. Sustainability: Diversity at multiple levels leads to a more sustainable agriculture. Genetic diversity, crop diversity, cropping system diversity, farming system diversity, community diversity, and intellectual diversity are needed. The merger-acquisition model of late 20th century economics continues today. Justification for such activity includes efficiency of scale, which by definition works against diversity. As acquisitions occur in the seed industry, large geographical areas and regionally important crops are abandoned. Farmers in these regions are left to use old cultivars or ones that were developed elsewhere and just happened to fit their needs. This has negative effects on the future of those farms, thereby decreasing diversity at the level of community. Numerous public breeders working in diverse ecosystems with diverse crops needed to increase diversity at all levels.

3. Independence: Ideally, public plant breeders do not have an economic interest in the results of their breeding program. Therefore decisions should be made in the public interest. Public breeders should be able to focus on solutions that do not necessarily result in high seed sales volume, such as long-lived perennials and pure line and open-pollinated cultivars.

4. Public service: Plant breeders actually developing cultivars adapted to the local environment must be familiar with the needs and challenges of the local farmers.

5. Education: Actual cultivar development programs at universities with complete plant breeding curricula offer the best opportunity for training the next generation of plant breeders.

There are numerous negative trends affecting public sector plant breeding and genetics research. Many of these trends are unaffected by IP considerations, but IP is often looked to as a potential solution to some of these.

1. Declining tax support of higher education and public sector research.
2. Declining federal formula funds.
3. Shift of funding to competitive grant model.
4. Increased importance of molecular biology and transgenics.
5. Continuing shift of decision making on germplasm release to tech transfer and IP professionals.

Confronted by these trends plant breeders, other researchers and university administrators have responded in a number of ways, some of which negatively affect the future of public plant breeding. Most prominently there has been a continued shift away from plant breeding programs especially those with a field emphasis. Instead, when money is available to fill new positions, these positions are usually in a more basic area of biology. In many cases the primary consideration in determining a new position is whether this is a position that will be able to complete successfully for Federal competitive grants. Within existing programs some breeders have developed new areas of emphasis such as turf grass breeding, leaving another less lucrative crop. Of course that original crop may still have an important role in agriculture but with little opportunity for funding. Frequently these crops will be important to poorer farmers, minor uses and small consumer groups. Perhaps even more serious is when breeders redirect their programs into areas and methodologies and germplasm that are well covered by commercial breeders leaving behind more noncommercial objectives such as working with exotic germplasm or long term high risk projects unsuited to private programs. This results in overlap between public and private programs and gaps in important areas. Ultimately this is a self-defeating process, because it negates the rationale for the existence of the public program.

In the search for new sources and methods of funding plant breeding programs many universities have turned to the development and enforcement of highly restrictive IPR. Such attempts have been widespread and have led to conflicts among public breeders, public breeders and tech transfer people, university breeders and USDA-ARS personal and international program staff. Many of these restrictive IP protection programs clearly act in the opposite direction of the land grant mission and raise valid questions regarding the purpose of LGU breeding programs.

It is clear from a number of publications as well as much empirical evidence that IP protection is often beneficial and sometimes necessary. Successful utilization of the invention or cultivars often requires IP protection. When the only mechanism for cultivar release is commercial companies most companies are reluctant to invest in marketing and production unless they have exclusive control of the cultivar. Clear IP rules will often encourage and clarify research relationships between public and private researchers. IP protection can protect the integrity of a cultivar in the certified seed system and also insure “public ownership” of cultivars or germplasm. Finally IP can result in the return of revenue to the breeding program but this should not be a primary consideration.

There is no evidence that statutory IP mechanisms (rather than hybrids) have contributed to increased crop production through traditional breeding. PVP and the utility patent may have resulted in a greater shift of soybean breeding to the private sector. On the other hand public wheat breeding efforts seem to have increased relative to the private sector. Since both species are usually sold as pure line cultivars and other aspects of their breeding are similar, it is likely these shifts are due to factors other than IP issues. One study suggested that IPRs greatest impact was as a marketing tool.

While IPRs are clearly beneficial in some instances, there are many examples of problems caused by IP and mismanagement of IP. IPRs have resulted in decreased interactions among plant breeders in all sectors. IP protection has inhibited flow of germplasm and information and in one survey 23% of the respondents said that graduate student research had been negatively affected. Negative results of IP have resulted in tension with clientele groups including farmers and NGOs. Poorly conceived and managed IP tools have resulted in general confusion and delays and this can be very damaging to time sensitive research.

Other threats to public sector research by mismanaged IP are much more serious. The perception by clientele of bias and loss of objectivity can be a death blow to a research and public service career. Breeders whose programs depend on income from cultivars produced are liable to be influenced by this when they carryout cultivar trials and make reservation. Whether such bias is real or simply perceived is immaterial, the same damage will be done to the individual and the institution. As mentioned above, researchers who depend on this sort of funding are likely to redirect their research away from public goods type work to more profitable research area. Minor crops are likely to be dropped for the same reason the private sector ignores them.

IP cannot and should not replace tax supported research. Inevitably, attempts to do so will direct research objectives and essentially subsidize a narrowly oriented "private" breeding program with public dollars. In 1999 UC $74 Million gross income from royalties and license fees of which approximately $24 million was technology transfer expenses $30 million went to inventors, and the remaining $20 million funded research. Estimated license income for US universities in 1999 was $149 million, while total R&D expenses were $30 billion (Barton et al 2002).

There have been many conferences such as this over the last 20 years (Caldwell and Schillinger 1989; Baenzinger et al. 1993; Eberhart et al. 1998; Graff et al. 2001; Barton et al. 2002; Fretz and McKenzie 2002) and these conferences and authors have made many excellent observations and recommendations with little evident impact. Many of their predictions have to come pass and little has been done to avoid them

Recommendations

- Support PIPRA (Public-Sector Intellectual Property Resource for Agriculture)
  - Consortium of major LGUs and NGOs
  - Review public sector IP practices
  - Collective IP asset database

- Shared technology packages

- Work with international and national programs to encourage free exchange of germplasm
- IP should be used to enhance mission of public service not as a way to support the program.
- Increase base funding for public plant breeding –new models for federal grants?
- Patents only when clearly beneficial to mission of public service.
- Encourage breeder exemption for utility patents - develop molecular, morphological or performance standards for essentially derived.
- Standardize public sector release agreements - (Educate IP people on traditions and needs of breeding community)
- Breeders/inventors should be involved with initial decision to protect – should avoid involvement in commercialization
- Public sector breeders (all inventors) receive no personal remuneration beyond salary.
- Require breeder exemption for all germplasm registered in Crop Science
- Amend Crop Science ethic statement to encourage all germplasm developed and released by members of CSSA to have breeder exemption.

Concluding thoughts

"The real danger is that the public sector will withdraw from public plant breeding."
Evenson, 1999

"The costs of getting the IP system wrong in a developing country are likely to be far higher than in developed countries."
Barton et al., 2002

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