

## PUBLIC PLANT BREEDING IN AN ERA OF PRIVATISATION

**Robert Tripp and Derek Byerlee**

*Both agricultural research and national seed systems are undergoing increasing privatisation. Although there are a number of possibilities for making public agricultural research more efficient and better able to interact with the private sector, the major opportunities are in plant breeding. This paper examines the possibilities and limitations associated with revenue generation through public plant breeding; the opportunities for moving the products of public plant breeding through the private sector; and the need for increased contacts with, and contributions from, private research.*

### Policy conclusions

- Increasing the emphasis on opportunities for private agricultural research must be balanced by sharpening the focus and defining the comparative advantage of public research programmes.
- Public breeding programmes should explore opportunities to recover some costs, but not at the expense of generating broad social benefits, their basic mandate.
- Public plant breeding can be made more efficient through a flexible strategy that tests varieties from a range of sources while shifting from national towards regional testing and release approaches.
- Public plant breeding must improve its links with the commercial seed sector, becoming more proactive in promoting its products and moving them through appropriate private channels to the ultimate user.
- Countries need to establish adequate plant variety protection regimes in order to stimulate private seed activity and to facilitate use of public varieties by the private seed sector. An appropriate plant variety protection system will allow continued open exchange of public germplasm and preserve farmers' ability to save seed of protected varieties.
- Public plant breeding programmes need to increase their negotiating and legal skills in intellectual property management in order to access privately held tools and technologies that can help the public sector address its mandate, especially to serve small-scale farmers.

### The privatisation of agricultural research

Privatisation is an increasingly prominent feature of the policy advice directed at agricultural research in developing countries. Structural adjustment to reduce the role of the state, and the trend toward liberalisation of markets and trade, make privatisation a logical component of public research reform. It is important to understand how increased private activity in agricultural research will affect the public sector.

The term 'privatisation' is subject to interpretation. Public research has opportunities to relinquish some of its activities to the private sector. The public sector can also improve cost recovery and efficiency in its remaining research activities. Innovative public-private partnerships – another aspect of privatisation that is particularly important and often overlooked – are contingent on intellectual property protection and increased access to biotechnology tools and processes.

The paper begins with a brief review of the rationale for shifting some public research responsibilities to the private sector. The next section looks at how public research itself can be made more efficient. The third section introduces the importance of strengthening the relations between public research and the private seed sector, followed by discussions on intellectual property protection and access to biotechnology. The paper concludes with a brief summary of the arguments.

### Opportunities for the private sector

The opportunities for private agricultural research depend greatly on the characteristics of the technology. Private research will only be attracted to technology that allows research and development (R&D) firms to appropriate some of the benefits. Private research investment is also more likely where particular products or techniques can be utilised over a range of environments and where future demand for the

technology will ensure increasing market size. Although private investment in the manufacture of agricultural chemicals, machinery and equipment can be expected to grow, investment in the research required to adapt those products to specific farming environments is likely to be less evident. Similarly, private investment in research to generate crop or resource management information (which can not be protected) is likely to be low, even when this information may be utilised in highly commercialised farming. On the other hand, there is increasing scope for private plant breeding, especially for crops and varieties that are widely grown. The availability of hybrid technology has already been responsible for significant private investments in plant breeding, and the strengthening of legal mechanisms for intellectual property protection should allow further scope for private research investment. Indeed, plant breeding would seem to be the most likely candidate for increased private agricultural research in developing countries.

There are several possibilities for encouraging more private investment in agricultural research. One way is through national policies that promote private agribusiness, such as regulations on seed imports and variety release, intellectual property regimes, and tax incentives for R&D. In some cases, parts of the public research service might be sold to the private sector, particularly when the research programme involves few public goods and the private sector will be more efficient at providing the services. For example, the UK Government decided to sell the Plant Breeding Institute to Unilever (later acquired by Monsanto).

An indirect way to encourage private funding of research is through levies or contracts with commodity associations. If a particular crop industry is sufficiently well organised to charge a levy to its producers, this can be used to fund research. Commodity boards or associations can undertake

their own research or contract research on behalf of their members. Using commodity associations to fund research is relatively equitable (because larger producers make greater contributions), but it works only for commodity sub-sectors that are commercialised. Several countries have successful examples of this type of commodity research, but it usually takes legislation to make the levy obligatory for all producers. Research through commodity associations works best where farmers control the level of funding and research agenda, and the government gives matching grants to promote consumer and environmental interests.

There are other ways to stimulate private participation in agricultural research. One increasingly common strategy is the use of competitive agricultural research funds, for which various organisations may apply. These include national institutes, universities, non-governmental organisations, and private firms. These funds are independently managed, although most funding comes from public sources, including donors. A recent review showed that such funds can indeed be useful, but their considerable administrative and financial requirements impose limits on their applicability (Gill and Carney, 1999).

Another way to encourage private sector participation is to reform variety testing and release systems. These systems were designed to serve national public plant breeding programmes, providing a standardised protocol for approving the release of the programme's own varieties. The rules often make it difficult for outside (private or foreign public) varieties to compete. Such testing systems should be opened to all varieties and should adopt more flexible standards for approval. Experience from a number of countries has shown that adopting more liberal seed regulations can stimulate private seed activity and increase the range of varieties available to farmers (e.g., Pray et al., 1991).

As public budgets are squeezed, research institutes are also being asked to earn more through the sale of their products and services. Whether this results in the identification of previously unrecognised sources of revenue for agricultural research – or simply diverts part of the research personnel to the management of income earning activities (such as commercial production on experiment stations) – remains to be seen. Some propose that farmers should pay directly for the services that they receive (e.g. the full cost of services such as soil testing). It is not obvious that this type of directive is any more than a cosmetic gesture towards the advocates of privatisation, rather than a contribution towards increasing efficiency in a time of restricted funding.

### **Increasing the efficiency of public research**

Despite the increasing opportunities for private agricultural research, public research systems still have a vital role to play. Steps should be taken to define the mandate of public research, explore means of cost recovery, and improve efficiency.

The first step is to clarify the mandate of public agricultural research and to re-establish and articulate its goals and principles. Policies that promote private sector investment must also identify specific responsibilities for the public research service, not simply treat it with benign neglect. Public agricultural research will continue to take the lead in areas such as pre-breeding, germplasm conservation, crop and resource management research (where the principal products are information and advice), and plant breeding research for crops and environments that do not attract commercial attention (CIMMYT, 2000).

Another step is to focus on cost recovery. As public budgets are squeezed, research institutes are being asked to earn revenues through the sale of their products and services.

One of the most widely utilised options for revenue generation by public agricultural research programmes is through the commercialisation of their plant breeding products, by collecting royalties for public varieties and through the sale of seed. In Brazil, the national maize breeding programme sells basic seed (and charges royalties) for the production of public hybrids to members of a consortium of small private seed companies. In South Africa, the South African National Seed Organisation brokers the licensing of all public crop varieties to members of the seed industry.

However, selling public varieties to the private seed industry can divert attention from the needs of farmers with few resources. The examples from both Brazil and South Africa entail seed use by commercially oriented farmers. There is evidence from other breeding programmes (such as in China) that producing commercially attractive germplasm has diverted attention in the research service from the problems of farmers in marginal areas and has upset the balance in research programmes by emphasising plant breeding over agronomy (where it is difficult to capture royalties).

Although the private sector might often be willing to pay for research by public institutes, any cost recovery proposal for public research should be scrutinised in terms of efficiency, incentives, and mandate (Box 1).

A third step is to make research more efficient. In an era of privatisation, it is imperative that public plant breeding programmes devote more attention to increasing their own efficiency. Too much emphasis is often placed on selecting and releasing national varieties rather than using varieties or lines from regional breeding programmes or international networks. Recent work has shown that full breeding programmes to develop locally adapted varieties are not cost-effective compared to more modest investments in testing and selection, especially for small countries (and even some large countries) with relatively small markets (Maredia and Byerlee, 1999).

This conclusion does not necessarily challenge the importance of current efforts at promoting local-level and participatory plant breeding techniques. But even in these cases, the products should have application beyond the few localities in which they are developed; indeed if this is not the case, then it will be very difficult to justify the investment in such efforts.

#### **Box 1 Five key questions to ask regarding cost recovery for public research institutes**

- 1 If the sale of research products is feasible and profitable, why should the public sector be involved in the first place?
- 2 If the public sector is motivated by financial rewards, will its research be diverted to serve better-off regions and farmers at the expense of small-scale farmers and more marginal areas that might be the primary target of national policy for public research organisations?
- 3 If a public institution sells nonresearch products, will research outputs decline?
- 4 If technologies are protected by intellectual property rights, do the funds generated from research justify the cost of collecting revenues from contracts and royalties?
- 5 If research generates funds from new technologies, how should the funds be divided between the programs responsible for developing the product and the rest of the research organisation?

*Source:* Byerlee and Alex, (1998).

## **Public-private interaction in seed provision**

In addition to identifying appropriate public and private mandates and improving the efficiency of public research, research programmes should develop productive public-private collaboration. One clear and desirable outcome of liberalisation is the declining importance of government seed production; the production and delivery of seed for public varieties depends increasingly on private companies, cooperatives, or local seed projects. National breeding programmes must therefore be prepared to interact with a range of potential seed providers.

An essential requirement is a well-managed source seed supply. In most instances, only the breeder seed of public varieties should be the responsibility of national research institutes. Foundation seed (i.e. the generation used to produce commercial seed) should be in private hands. But in some cases, where private capacity or interest is not yet sufficient, the national programme may take responsibility for foundation seed as well. National programmes often complain that their new varieties are not being disseminated but admit that they are unable to maintain enough breeder seed for rapid multiplication. If public breeding programmes expect continued funding, they will have to ensure access by all interested parties to a transparent system of source seed supply and to adequate information about the range of varieties available (Tripp, 2000).

In addition, public plant breeding must direct more of its resources to providing information about its varieties. Given current funding scenarios, extension services are often unreliable partners, and in any case a rational incentive system should place the major responsibility for variety promotion with the plant breeding organisation. Although in some cases the rights to a particular public variety may be assigned to a single company, most public varieties will be available to any seed producer. In these instances we cannot expect a private seed producer to devote its own resources to promoting varieties that are also available from competitors; hence the research institute will need to actively promote its products.

## **Intellectual property management**

For sound public-private partnerships, public breeding programmes must formulate clear policies for managing intellectual property. Strategies to generate funds through the sale of public varieties will require some form of plant variety protection (PVP), especially for self-pollinated crops. (The inbred lines used to produce hybrids are the equivalent of trade secrets, providing their owners with in-built intellectual property protection. Private companies have already invested heavily in the development of hybrids for crops such as maize, including for use by small farmers.)

Most countries are moving to establish a system of PVP, motivated in large part by the requirements of the World Trade Organisation and the agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs). It is difficult to predict the impact of formal PVPs. In theory, protection is a powerful incentive for private investment in research that can lead to superior varieties; however, strong empirical evidence for such positive results is surprisingly difficult to find. For example, several studies on the effects of PVP in the United States have shown mixed results, and a recent study in Latin America also found relatively little impact (positive or negative) (van Wijk and Jaffé, 1996). Further studies are needed on the effects of PVP in both industrialised and developing countries (Lesser, 1997).

Efforts to establish efficient and effective PVP in developing countries face several obstacles. First, PVP is predicated on a registration system for characterising varieties, which can be

costly to operate. For small countries, a regional registration authority might make sense, to share cost, speed varietal release, and stimulate access to a wider range of varieties. Second, public programmes require an effective administrative system for collecting royalties for public varieties. This can be done through a seed certification scheme, but many developing countries have trouble maintaining an effective certification authority, so alternative methods might be necessary. Finally, enforcing PVP can be difficult for both public and private sectors. For example, in seed markets that serve small-scale farmers, the seed of self-pollinated varieties can easily be saved or shared among farmers; legal action against such practices is not cost-effective for private firms and, in any event, might not be socially desirable. In such situations, emphasis should be on protecting companies from having their products stolen by competitors.

Countries must enact PVP legislation that provides an optimal balance among competing needs, including the need to establish adequate incentives for private plant breeding, to ensure breeders' exemptions and the open exchange of germplasm among public programmes, and to protect farmers' rights to save seed (of protected varieties). The focus should be on establishing a protection scheme (and associated administrative structure) that will protect private companies from each other and allow them to serve the needs of commercial farmers. The system should operate on a full cost-recovery basis.

Efforts to establish plant varietal rights for public varieties and generate income from royalties face an additional dilemma with respect to the open exchange of germplasm with other countries. Much of this exchange is mediated by the international agricultural research centres (IARCs) and the rest is a product of regional or bilateral networks and agreements. As the possibilities for taking advantage of PVP increase, there is a growing temptation for national programmes to close their doors, to charge collaborators for what used to be freely exchanged, or to deny national or regional partners access to material for fear that they will gain a commercial advantage. The dilemma extends to the use of international germplasm, and there have already been cases where national breeding programmes have protected and charged for IARC varieties. As the IARCs broaden their scope and devote more attention to private seed companies, the problems of defining access intensify. However, the overwhelming preponderance of evidence to date suggests that the benefits to society of freely exchanging germplasm outweigh any revenue gains generated by restricting access to the products of public breeding programmes.

## **Access to biotechnology**

A second area in which public plant breeding systems must increase their interactions with the private sector is in sharing biotechnology techniques and materials, most of which have been privately developed and patented. Biotechnology can be used to address the problems of small-scale farmers who are the principal clients of public research. However, gaining access to privately held genes and techniques will require not only hard bargaining, but also appeals to a corporate sense of duty to support public efforts to address food security and poverty alleviation.

To meet the challenge, public programmes – especially the larger ones – will have to rapidly increase their capacity for developing public-private R&D partnerships. Considerable dialogue among national public programmes, IARCs, and the private sector (both local and multinational) will be required to reach broad agreements to allow the sharing of germplasm and other biotechnology tools in a manner that fosters a competitive private sector while permitting the public sector

to utilise the new tools to serve farmers not reached by the private sector. At the same time, innovative institutional mechanisms will be needed to encourage regional collaboration among public programmes to enhance their efficiency and strengthen their bargaining position with the private sector (Fischer, 2000).

Sound intellectual property management is also required to give public breeding programmes access to privately owned biotechnology tools and products. Research managers will have to develop skills in negotiation and management of intellectual property. Large research institutes might establish an office for intellectual property management, although its costs must be balanced against benefits generated. In most countries, a central office for all research institutes should suffice to provide highly specialised skills, such as legal assistance. For example, Indonesia has recently established a central technology transfer office, and the Consultative Group on International Agricultural Research (CGIAR) is in the process of establishing a unit for servicing its intellectual property management. Public programmes must also exploit opportunities to use their own products, especially germplasm, as bargaining chips in negotiating for access to tools and products from the private sector. In some cases, this might require defensive patenting of public technologies (Fischer, 2000).

## Conclusion

Public agricultural research must adjust to meet the challenges of privatisation. Despite existing opportunities for cost recovery and competitive funding strategies, much of the current pressure from donors and ministries of finance, motivated by a vague concept of privatisation, will not make public research more efficient or effective. Instead, attention must shift to specific opportunities for interaction with the private sector.

Particular responsibility falls on public plant breeding programmes, where complementarities are most obvious. Public plant breeding must become more open, and seed regulations must encourage private plant breeding. A key to effective interactions with the private sector is the establishment of appropriate PVP and intellectual property management. This will give the public sector increased access to private technology and will encourage the growth of the private seed sector. Public plant breeding must take the lead in redividing responsibilities between the public and private sectors in agricultural research.

## References

- Byerlee, D. and Alex, G. (1998) *Strengthening national agricultural research systems: Policy issues and good practice*. Washington, D.C.: World Bank.
- CIMMYT (2000) 'Tlaxcala statement on public/private sector alliances in agricultural research.' Mexico, D.F.: CIMMYT.
- Fischer, K. (2000) 'Access to modern science: Issues and opportunities for the public sector agricultural research systems,' draft paper. Washington, D.C.: Rural Development Department, World Bank.
- Lesser, W. (1997) 'Assessing the implications of intellectual property rights on plant and animal agriculture.' *American Journal of Agricultural Economics*, 79: 1584-91.
- Gill, G. J. and Carney, D. (1999) 'Competitive agricultural technology funds in developing countries.' *Natural Resource Perspectives*, 41. London: Overseas Development Institute.
- Maredia, K. and Byerlee, D. (1998) 'The global wheat improvement system: Prospects for enhancing efficiency in the presence of spillovers'. CIMMYT Research Report No. 5. Mexico, D.F.: CIMMYT.

- Pray, C., Ribeiro, S., Mueller, R. and Rao, P. (1991) 'Private research and public benefit: The private seed industry for sorghum and pearl millet in India.' *Research Policy* 20: 315-24.
- Tripp, R. (2000) 'Strategies for seed system development in sub-Saharan Africa.' ICRISAT Working Paper. Patancheru, India: ICRISAT.
- van Wijk, J. and Jaffé, W. (eds) (1996) 'Intellectual property rights and agriculture in developing countries'. Paper from the proceedings of the seminar on the Impact of Plant Breeders' Rights in Developing Countries, 7-8 March 1995, Santa Fé de Bogotá, Colombia. Amsterdam: University of Amsterdam.

**Robert Tripp** is a Research Fellow for the Rural Policy and Environment Group and can be contacted at the Overseas Development Institute, Portland House, Stag Place, London SW1E 5DP, UK. *Email:* r.tripp@odi.org.uk *Tel:* +44 (0)20 7393 1636 *Fax:* +44 (0)20 7393 1699.

**Derek Byerlee** is Principal Economist in the Rural Development Department, The World Bank, 1818 H Street, N.W., Washington, D.C. 20433, USA. *Email:* dbyerlee@worldbank.org *Tel:* +1 202 458 7287.

The authors are grateful to Don Duvick, Michael Morris, and Cees van der Meer for helpful suggestions. The paper's conclusions are the authors' responsibility and do not necessarily represent the opinions of ODI, the World Bank, or DFID.

ISSN: 1356-9228

© Overseas Development Institute 2000

See [www.odi.org.uk/nrp/](http://www.odi.org.uk/nrp/) for papers in this series.

Natural Resource Perspectives present accessible information on current development issues. Readers are encouraged to quote from them or duplicate them, but as copyright holder, ODI requests due acknowledgement. The Editor welcomes manuscripts for this series.

Series Editor: John Farrington      Administrative Editor: Melanie Woodland