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Apomixis Research, Biotechnology for the Resource-Poor -- Some Ethical and Equity Considerations

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A paper delivered at the workshop on:

Ethics and Equity in CGIAR's Use of Genetic Resources for Sustainable Food Security

Foz de Iguazu, Parana Brazil

April 1997

Final version 3 July 1997

APOMIXIS RESEARCH
BIOTECHNOLOGY FOR THE RESOURCE-POOR
– SOME ETHICAL AND EQUITY CONSIDERATIONS

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Background

Apomixis refers to naturally occurring modes of asexual reproduction through seeds. Apomictic processes lead to the production of offspring which are exact genetic replica of their mother plant. Therefore, in contrast to sexual plants, it offers a unique potential to fix favorable alleles and allele combinations in all subsequent generations. This fact bears directly onto current efforts to develop high yielding varieties in developing countries using hybrid crops/ Indeed, apomixis might potentially revolutionize deployment strategies for hybrids in all major food crops, by (1) limiting the need to purchase seeds yearly; 2) allowing a drastic reduction in seed production costs, and 3) allowing for faster and more locally targeted breeding programs.

CIMMYT, Mexico and ORSTOM, France, have collaborated on a joint research program aimed at the development of apomictic maize for over 7 years. This has involved the location of one or more ORSTOM scientists at CIMMYT, with additional staff and support provided by both CIMMYT and ORSTOM. In 1996 a Mexican scientist also joined the team through special support from the Government of Mexico.

The primary objective of the ORSTOM-CIMMYT apomixis project is to transfer the gene or genes responsible for apomixis into maize from its closest apomictic wild relative, *Tripsacum*. The research approaches involve two different and complementary routes. One is to transfer the genes for apomixis into maize from *Tripsacum* through a conventional "wide-cross" breeding approach. Alternatively, molecular strategies have also been developed to identify and isolate the apomixis genes in *Tripsacum*, in order to make them available not only for maize, but potentially for a broader range of food crops. Research initiatives are also being undertaken concerning the appropriate strategies for the deployment of apomictic crops. This includes the definition of novel breeding schemes for apomicts; the evaluation of the potential economic impact of apomixis; and the assessment of the biological risk associated with the release of apomictic cultivars, in terms of biodiversity.

Progress has been regularly reviewed. Recent breakthroughs have significantly increased the chances of success, but ultimate success is still a number of years away.

Why is apomictic maize important to CIMMYT's and ORSTOM's Partners?

This research is conducted within the CIMMYT-ORSTOM project 'Equity in access to Hybrid Vigor for Resource-Poor Farmers.' Because apomictic maize would not change genetically from generation to generation (unlike normal sexual hybrids or open-pollinated varieties), a single purchase of hybrid maize seed (with apomixis) could enable the resource-poor farmer to gain from the benefits of hybrid vigor in his or her crop, and then use the seed from the harvested crop to plant year after year. A once only purchase could therefore confer significant yield benefits for 3, 4, 5 years or more. This is desirable from an equity viewpoint – unlike richer farmers, resource-poor farmers often cannot afford to buy hybrid seed each year. Harnessing new technology and focusing it on the needs of the poor also meets the high ethical standards of CIMMYT, ORSTOM and the CGIAR. In a recent paper by Dr. Miguel Altieri, Chairman of the CGIAR NGO Committee, apomixis was cited as an example of the types of biotechnology most appropriate to the needs and circumstances of the resource poor farmers.

The Issues

For this technology to be effectively used for the benefit of resource-poor farmers it should be freely available to them through the long-standing partnerships CIMMYT has with national agricultural organizations and NGOs throughout the developing world. This is the case with all technologies produced by CIMMYT.

However, both ORSTOM and CIMMYT saw potential threats to this future free availability, given the likely value of this technology to commercial seed companies and the plethora of patent applications for related, and unrelated inventions being filed, particularly by the larger companies, during recent years. This trend is currently increasing.

The traditional, and still preferred approach, to avoiding third parties patenting and 'tying up' technology is public disclosure. This has often been used by public and not-for profit organizations such as CIMMYT and ORSTOM throughout the world. It is increasingly evident however, that public disclosure is becoming less effective as broad patent applications are being used to protect wide domains of intellectual property around publicly disclosed inventions.

Public disclosure of key facets of the CIMMYT-ORSTOM work was imminent in February 1997 with the 'defense' of a Ph.D. thesis based on this research. Given the overriding objective of ensuring that this technology, if successfully obtained, should be freely available for its intended beneficiaries – the resource-poor of the world –, and in light of aggressive IP protection by others, ORSTOM filed a patent application in Paris on 17 February 1997. Any patent arising from this application would be co-owned by ORSTOM and CIMMYT.

The Guiding Principles for the CGIAR Centers on Intellectual Property and Genetic Resources

The CGIAR has a set of working principles relating to intellectual property and genetic resources. Whilst these have not been fully endorsed by CGIAR members, they have been formally noted as the framework within which the Centers carry out their work as custodian trustees of global genetic resource collections (see attachment 1).

Under the CGIAR guideiines, there are specific references to patenting (points 10 and 11) that are both pertinent to the apomixis filing. Immediately CIMMYT knew of the defensive patent application, contact was made with the CEO of INIFAP, the national agricultural research organization in Mexico, for two ethical reasons. Firstly, Mexico was in the process of becoming a participating partner in the apomixis research and secondly, Mexico is a long-standing and most gracious host of CIMMYT's headquarters. A meeting was held between CIMMYT, ORSTOM and INIFAP in March 1997 and there was unanimous agreement that the objective of all parties was to ensure that, if achieved, apomictic maize would be freely available for the resource-poor farmers of the developing world. A 'hands-on' approach to proactively protect for the poor, was seen as more ethical and equitable than a 'hands-off' approach of doing nothing and hoping for the best (but expecting the worst).

This action has been communicated to colleagues in NARSs, NGOs, and advanced research institutions and has been praised as an appropriate, responsible, ethical and equitable approach.

Where to from here? - some dilemmas

At the least, CIMMYT and ORSTOM have bought some thinking time for decision-making, but given the current IP environment, not a lot! The patent application could be allowed to lapse at any time – the simplest, but not necessarily the most responsible approach. However, to effectively implement the patent will be an expensive business and requires large amounts of funds that neither CIMMYT nor ORSTOM have, nor would want to divert from other research activities. An option being investigated at present therefore is to contract with a third party interested in this technology seeking a 'win-win' outcome.

Early and preliminary discussions with the private sector have identified some interesting possibilities for such an outcome. For example, one scenario is as follows:

- CIMMYT/ORSTOM retain the IPR of apomictic maize
- Company A takes financial responsibility for execution and defence of the patent.
- The Company provides 'in-kind' additional resources (principally access to proprietary technology) to accelerate research and increase the likelihood of success of the apomixis program.

- In return, CIMMYT/ORSTOM would license the technology for Company A to use solely in the developed world, the 'North.' (Their use of apomixis would more likely be to increase the efficiency of plant breeding and seed production). CIMMYT/ORSTOM would be able to (and indeed would!) make the technology freely available to partners in the South.

Such a scenario would be a 'win' for resource-poor farmers; a 'win' for Company A, a 'win' for CIMMYT/ORSTOM, and an excellent example of a strategic partnership between public/private, and north/south, to harness technology in the fight for poverty alleviation, food security and protection of our natural resources.

Conclusions

The environment in which CIMMYT and its partners work is rapidly changing. In order to remain effective and relevant and to meet our mandate it is necessary to respond to that change in many ways, including the establishment of effective partnerships with the private sector. CIMMYT is re-positioning in such a way that high standards of ethics and equity remain paramount in our endeavors for the resource-poor of the world. We will make all future decisions accordingly.