# Gene patents and the Genetic Resource Recognition Fund:

## Sharing benefits from use of plant genetic resources by agro-biotechnological inventions and traditional agricultural practices

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The subject of this case study is the role of intellectual property rights in the benefit-sharing arrangements surrounding the gene Xa21 of *Oryza longistaminata*, a wild rice from Mali, which was isolated, cloned and patented at the University of California at Davis. A specimen of *Oryza longistaminata* was originally accessed in Mali and transferred to a rice research program in India, where its resistance to bacterial rice blight, one of the most serious rice diseases, was identified. The blight resistant specimen was transferred to the International Rice Research Institute (IRRI) in the Philippines, which determined that the resistance was coded by a single locus called Xa21 and bred the resistance into cultivated rice varieties by conventional breeding methods. One such variety was then acquired by the University of California at Davis, where gene Xa21 was mapped, sequenced and cloned. After a patent application was filed and granted for the cloned gene, a Genetic Resource Recognition Fund (GRRF) was established at UC Davis to share with the stakeholders in Mali and other developing countries the benefits arising from the commercial utilization of the patented gene. This intellectual property-based benefit-sharing mechanism provides that the licensee of the patent over Xa21 shall annually pay a certain percentage of sales of products and derivatives of Xa21 into the GRRF for a specified number of years following the first year of commercialization. The Fund shall be used to provide fellowships to agriculture students and researchers from Mali, the Philippines and other countries where the wild rice is found, so as to build capacity in the donor country. At the time of conclusion of this study, however, no funds had yet been received by the GRRF. There are presently no plans at UC Davis to mainstream this model for accessing biodiversity and sharing benefits with gene donor countries. Within the overall policy of UC Davis and its own claims on such benefits, it remains at the discretion of individual researchers to decide how he or she wants to share the benefits and with whom. Patent US5859339, which forms the subject of this case study, is attached as Annex 3.2.1 of this case study.

This is a part of WIPO sponsored study on the role of intellectual property rights in the sharing of benefits arising from the use of biological resources and associated traditional knowledge.

# Case Study One

# Mali

# Case Study One: Mali

### Gene patents and the Genetic Resource Recognition Fund:

### Sharing benefits from use of plant genetic resources by agro-biotechnological inventions and traditional agricultural practices


**Overview**

The subject of this case study is the role of intellectual property rights in the benefit-sharing arrangements surrounding the gene Xa21 of *Oryza longistaminata*, a wild rice from Mali, which was isolated, cloned and patented at the University of California at Davis. A specimen of *Oryza longistaminata* was originally accessed in Mali and transferred to a rice research program in India, where its resistance to bacterial rice blight, one of the most serious rice diseases, was identified. The blight resistant specimen was transferred to the International Rice Research Institute (IRRI) in the Philippines, which determined that the resistance was coded by a single locus called Xa21 and bred the resistance into cultivated rice varieties by conventional breeding methods. One such variety was then acquired by the University of California at Davis, where gene Xa21 was mapped, sequenced and cloned. After a patent application was filed and granted for the cloned gene, a Genetic Resource Recognition Fund (GRRF) was established at UC Davis to share with the stakeholders in Mali and other developing countries the benefits arising from the commercial utilization of the patented gene. This intellectual property-based benefit-sharing mechanism provides that the licensee of the patent over Xa21 shall annually pay a certain percentage of sales of products and derivatives of Xa21 into the GRRF for a specified number of years following the first year of commercialization. The Fund shall be used to provide fellowships to agriculture students and researchers from Mali, the Philippines and other countries where the wild rice is found, so as to build capacity in the donor country. At the time of conclusion of this study, however, no funds had yet been received by the GRRF. There are presently no plans at UC Davis to mainstream this model for accessing biodiversity and sharing benefits with gene donor countries. Within the overall policy of UC Davis and its own claims on such benefits, it remains at the discretion of individual researchers to decide how he or she wants to share the benefits and with whom. Patent US5859339, which forms the subject of this case study, is attached as Annex 3.2.1 of this case study.

**Figure 1 *Oryza longistaminata* growing in a swampy area on a river bank in Mali.**

The story of *Oryza longistaminata*, a wild rice from Mali, is a story of struggle between different strands of consciousness. Some farmers and policy makers in Mali consider it only as a weed, whereas there are other parts of the population depend on it for their subsistance. The field study indicates that the most impoverished parts of the population, the rural landless poor, are the ones who collect, conserve and utilize *Oryza longistaminata* for their subsistence. But these conservers of *Oryza longistaminata* or "*Kamlo*" (in local language, implying "rice from the river") are not aware that they have helped in conserving a wild rice which is the donor of a unique gene, Xa21, which now confers resistance against bacterial diseases throughout the world. The effects of the biotechnological invention which is based on gene Xa21 from *Oryza longistaminata* could be the increase of food security due to increased bacterial blight resistance in major crops. Intellectual property rights which were granted over this invention provide an important mechanism for the sharing of monetary and non-monetary benefits arising from this use of the plant genetic resource.

Some of the issues addressed in this case study are:

- to what extent can patenting and licensing of the cloned version of Xa21 help in generating resources for benefit-sharing with the communities in Mali and other countries involved in conservation of the wild rice
- to what extent will these conservers benefit from their contribution towards conservation
- does our appreciation of TK and its socio-cultural context help in better appraising

  (a) the institutional arrangements for benefit-sharing and

  (b) the role that intellectual property rights can play in such benefit-sharing arrangements.

Intellectual property rights play a central role in a benefit-sharing mechanism that was established at the University of California at Davis, USA, namely a Genetic Resource

Recognition Fund. Even though no payments have yet been deposited in the Fund by genetic resources users, the case offers numerous lessons to be learnt about the role of intellectual property rights in benefit-sharing and about ways in which this role could be further strengthened to improve equity and ethics. Patent US5859339, which forms the subject of this case study, is attached as Annex 3.1 of this case study.

### *Institutional Context*

Biotechnological advancements make it possible to incorporate specific genes from one crop or specie into another, conferring on them specific advantages either for dealing with various environmental stresses, including resistance to pest and diseases, or for improving productivity through better nutrient utilization. Advantages arise from genetic engineering not only in the agricultural sector but also in medicine. The commercialization of new products generates questions about who should benefit, in what proportion, and when. The University of California at Davis has set up a Genetic Resource Recognition Fund to ensure that "part of the royalties derived from licensing of academic discoveries using developing countries' materials can be used to fund fellowships for developing nation scientists" (Ronald,

1998)[1].

**Figure 2 The International Rice Research Institute (IRRI), Manila, Philippines.**

The institutions of the *Consultative Group on International Agricultural Research* (CGIAR), such as the International Rice Research Institute (IRRI) in Manila, have maintained *ex-situ* germplasm collections from various parts of the world to improve crop productivity. These institutions distribute not only the germplasm but also the improved lines among various developing countries to aid respective crop yield improvement programmes. However, the access to the germplasm of these institutions is not restricted to developing countries only. Public and private sector research and commercial institutions from developed countries can also access these germplasm collections. After the CGIAR collections have come under the governance of World Bank, every recipient of the germplasm from CGIAR Centers is in principle obliged to sign a Material Transfer Agreement (MTA). In the post-Rio phase of agricultural germplasm collection and exchange,[2] there has been a general decline in the rate

[1] Pamela C. Ronald, 1998, The Genetic Resources Recognition Fund, AgBiotech News and Information Vo.10, No.1; http://www.agbiotechnet.com/review/jan 98/html/ronald.htm

[2] Collection and exchange of germplasm following the adoption of the Convention on Biological Diversity (CBD) in 1992.

of deposition of germplasm by various developing countries in the gene banks and a consequent decline of exchange (Hawtin, 1999, pers.comm.). This decline might indicate a decreasing confidence of the potential gene providers, i.e., germplasm contributors, in the international pool. The fact still remains that these international gene banks play a very important role in ensuring continued food security and the productivity of national crop improvement programmes. There are instances when international germplasm collections have helped in rehabilitating national germplasm diversity which was damaged due to natural disasters and wars, as was the case in Cambodia.

**Text Box 1:**
**The CGIAR Centers: An overview**

The Consultative Group on International Agricultural Research (CGIAR), established in 1971, is an informal association of fifty-eight public and private sector members that supports a network of sixteen international agricultural research centers. CGIAR's mission is to contribute to food security and poverty eradication in developing countries through research, partnership, capacity building, and policy support. The World Bank, the Food and Agricultural Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), and the United Nations Environment Programme (UNEP) are cosponsolrs of the CGIAR.

CGIAR centers conduct research programs in collaboration with a full range of partners in an emerging global agricultural research system. Food productivity in developing countries has increased through the application of research-based technologies. Other results include reduced prices of food, better nutrition, more rational policies, and stronger institutions.

The CGIAR focuses on several major research thrusts, including:

*Increasing Productivity*. The CGIAR strives to make developing country agriculture more productive through genetic improvements in plants, livestock, fish, and trees, and through better management practices. One important feature of the CGIAR's productivity research is its focus on building into plants greater resistance to insects and diseases that adversely affect productivity and the stability of production in the tropics.

*Saving Biodiversity*. The CGIAR holds one of the world's largest *ex situ* collections of plant genetic resources in trust for the world community. It contains over 500,000 accessions of more than 3,000 crop, forage, and agroforestry species. The collection includes farmers' varieties and improved varieties and, in substantial measure, the wild species from which those varieties were created.

The CGIAR has placed its collections under the auspices of FAO within the International Network of *Ex Situ* Collections. The terms of the agreements signed between the FAO and CGIAR Centres, stipulate that the germplasm within the in-trust collections will be made available without restriction to researchers around the world, on the understanding that no intellectual property protection is to be applied to the material. Samples of the in-trust germplasm are thus made available by the individual Centres under a standard Material Transfer Agreement (MTA).

Notwithstanding the controversies about the rights of communities and countries in the germplasm contributed to the international gene banks, the norms of equity and ethics require a reciprocity to be established among donors and recipients of the germplasm and specific genes. The Commission on Genetic Resources for Food and Agriculture (CGRFA) at the

Food and Agriculture Organization (FAO) in Rome has been engaged in discussions on the revision of the International Undertaking on Plant Genetic Resources. *Oryza longistaminata* is a plant genetic resource for food and agriculture (PGRFA) in the meaning of the International Undertaking (IU).

### *The International Undertaking on Plant Genetic Resources for Food & Agriculture*

The International Undertaking is the first comprehensive international agreement dealing with plant genetic resources for food and agriculture. It was adopted by the FAO Conference in 1983, (Resolution 8/83), as an instrument to promote international harmony in matters regarding access to plant genetic resources for food and agriculture. One hundred and thirteen countries have adhered to the Undertaking, which seeks to "ensure that plant genetic resources of economic and/or social interest, particularly for agriculture, will be explored, preserved, evaluated and made available for plant breeding and scientific purposes". The text of the IU is provided in Annex 3.2.3 to this case study. Since November 1994 the Commission on Genetic Resources for Food and Agriculture of the FAO (CGRFA) has been working on a Revision of the International Undertaking to bring it into conformity with the provisions of the CBD (see Text Box 2).

**Text Box 2:**
**The Revision of the International Undertaking on Plant Genetic Resources**

After the entry into force of the CBD, negotiations for the revision of the Undertaking in harmony with CBD started in November 1994. Although the scope of the Undertaking is limited to plant genetic resources for food and agricuture, this mandate, adopted after careful negotiation, is not limited to the ex situ collections not addressed by the CBD. In 1996, FAO convened the Leipzig International Technical Conference on Plant Genetic Resources, where 150 countries formally adopted the Leipzig Declaration and the Global Plan of Action. The GPA and its implementation is a subject of discussion in the Undertaking. The other key elements currently under discussion in the negotiations include the scope, and access to plant genetic resources; the fair and equitable sharing of benefits arising from the use of plant genetic resources for food and agriculture; and the realization of Farmers' Rights. Countries have agreed that the Undertaking should maintain a multilateral system of access and benefit-sharing, that meets the specific needs of agriculture.

The Undertaking is at the cross-roads where agriculture, environment and trade meet and intellectual property rights may play an important role in its implementation. The revised Undertaking will be an international instrument reflecting the significance of access and benefit-sharing as the basis for continued and sustainable utilization of plant genetic resources for food and agriculture.

The role of intellectual property rights in the context of plant genetic resource utilization has been contentious, in particular regarding the patenting of genes derived from naturally occurring germplasm. Some believe that patenting of genes leads to private control over life forms which have not been generated by human efforts. There are others who believe that the efforts required to isolate, modify and express a specific gene for a specific purpose constitute inventions and innovations with enormous advantages in improving the productive potential of crops. These scientists also believe that without compromising on environmental and other social effects, the tools of biotechnology should be used just like any other scientific tool to improve food security in the developing world. The debates surrounding the patentability of genes are not in themselves the subject of this Study and shall therefore not be discussed in detail here.[3] However, it shall be emphasized that the patenting of genes *per se* poses a less severe dilemma than the dilemmas posed by the persistence of poverty, hunger, malnutrition and inequity.

Technology can indeed influence the institutional arrangements for sharing benefits, if the asymmetry in the comparative advantages of gene donors and gene recipients is very high. However, the same technology can lend itself to different institutional arrangements for ensuring widely divergent social outcomes. Therefore, technology cannot be considered to be the sole determinant of its potential social and economic impacts. Given the current state of asymmetry in the above-said comparative advantages, the case for greater accountability on the part of gene receiving institutions and countries has been repeatedly made. All stakeholders, including the biotechnology industry, the scientific community, and the gene donor countries and communities are seeking to achieve legal certainty, accountability and equity in benefit-sharing. This case study illustrates one such attempt.

## Intellectual Property Rights

### *The Xa21 gene*

**Figure 3 *Oryza longistaminata* growing near a Bela Community village.**

Rice is the crop which fulfills the basic food needs of the largest number of people in the world. It is estimated that almost 50 per cent of the potential rice yield in the world is lost to diseases caused by bacteria, fungi and viruses (Ronald, 1998). One of the most serious bacterial diseases of rice in Africa and Asia is reported to be bacterial blight, caused by the bacteria *Xanthomonas oryzae pv. oryzae* (Xoo). The famous Bengal Famine in 1940s was caused by rice blast and since then Indian scientists have been acutely aware of the dangers which diseases and pests pose to food security. Consequently, the search for genetic sources of resistance to major diseases and pests has been a major research priority with rice

[3] For an account of these debates, see e.g., Grunwald, R. and Vogel, F. *Patenting of Human Genes and Living Organisms*. Heidelberg: Springer, 1994.

scientists. One such effort of an Indian scientist, Dr. Devadath, to find disease resistant rice led him to an individual of the wild rice specie of *Oryza longistaminata* (originally misidentified as *Oryza bharatii*, Kate and Collins, 1998:2, Richards, 1996). This resistant sample of *Oryza longistaminata* was brought to the International Rice Research Institute (IRRI), Manila for breeding purposes in 1978 (Khush, et al., 1991). Scientists at IRRI, namely Dr. G. Khush, Dr. R. Ikeda, and other co-workers, introduced the resistance found in the above sample into cultivated varieties using traditional plant breeding methods. They discovered that the resistance was contributed by a single locus called Xa21 (Ronald, 1998). In 1990 Prof. Pamela Ronald in the United States of America mapped this locus at Cornell University in the laboratory of Dr. S. Tanksley (Ronald, et al., 1992).

**Figure 4 IRRI maintains extensive breeding programs. *Oryza longistaminata* was bred there.**

Prof. Ronald describes the history of this technology thus,

> *Tanksley's group had recently completed construction of a rice genetic map with support from the Rockefeller Foundation which had facilitated mapping efforts worldwide (McCouch et al., 1988). From 1992 to 1995 high resolution mapping, DNA library construction, cloning and sequencing was carried out at the University of California (UC) Davis leading to the isolation of a few candidate clones carrying Xa21. This work was supported by the US Department of Agriculture, the National Institute of Health and the Rockefeller Foundation.*
>
> *A collaboration with Lili Chen at the International Laboratory for Tropical Agricultural Biology (ILTAB) in La Jolla, CA, USA co-directed by C. Fauquet and R. Beachy, was formed to transform a susceptible rice variety, Taipei 309, with the candidate Xa21- carrying clones. The resulting plants were assayed at UC Davis for bacterial blight resistance. One of the candidate clones conferred high levels of resistance to bacterial blight in transgenic plants. The coding region was located on the transformed piece of DNA and named Xa21 (Song et al., 1995). A patent application covering the Xa21 sequence was filed in 1995. Once cloned, there was tremendous international and commercial interest in using this gene to develop modern crop varieties. Species of Xanthomonas infect virtually all crop plants (Ronald, 1998).*

It was expected by Prof. Ronald and her colleagues that this cloned gene Xa21 may help improve productivity not just in rice but also in other important crops such as wheat, maize and barley through conferring the capacity for disease control. She also observed,

> *It is likely that without a patent application on file there would be less commercial interest and therefore less overall investment in developing the gene for use in these other crops. Ultimately, deployment of such engineered varieties could reduce the application of pesticides to the environment.*

During discussions with Prof. Kevin M. Smith, Vice Chancellor (Research) at UC Davis it was learnt that the total revenue from patents was about USD 6 million of which about fifty per cent were from research related to strawberry, a major crop of California. In the case of *Oryza longistaminata* a patent application was filed after the the invention of Xa21 was made and the patent became a pivotal tool for the benefit-sharing arrangements that were instituted for gene Xa21 and the plant genetic resource of *Oryza longistaminata*.

### *The Patent US5859339*

On June 7, 1995, the Regents of the University of California filed a patent application (no. 475,891) for “Nucleic acids, from oryza sativa, which encode leucine-rich repeat polypeptides and enhance xanthomonas resistance in plants.” The patent application contains 24 Claims, 6 Drawing Sheets, and a Sequence Listing for 15 Sequences of nucleic acid base pairs and amino acids for which they code. The inventors named in the application are Prof. Pamela C. Ronald, Davis, CA; Guo-Liang Wang, Davis, CA; and Wen-Yuang Song, Davis, CA. The Abstract of the application states that,

> *The present invention provides nucleic acids encoding polypeptides which confer resistance to Xanthomanas spp. The nucleic acids can be used to produce transgenic plants resistant to the pathogen.*

The patent was granted by the United States Patent and Trademark Office (USPTO) on January 12, 1999. The patent is classified according to the International Patent Classification (IPC) under Maingroup 5.00 (“Flowering plants, i.e. angiosperms”) of the IPC Subclass “New Plants or Processes for Obtaining Them; Plant Reproduction by Tissue Culture Techniques” (Subclass A 01 H). More detailed information on the International Patent Classification is provided in Box 4.

The application cites 10 references, including 9 publications of non-patent literature and 1 foreign patent document, namely the “international” patent application WO9307279A1 which was filed under the Patent Cooperation Treaty (PCT) on “Inductible Plant Defense Gene Regulatory Regions from Potato and Rice, Uses thereof, and Assays”. The Patent Cooperation Treaty is administered by the World Intellectual Property Organization (WIPO) and makes it possible to seek patent protection for an invention simultaneously in each of a large number of countries by filing an “international” patent application. For more detailed information on the Patent Cooperation Treaty see Box 3.

**Text Box 3:**
**The Patent Cooperation Treaty (PCT)**

The PCT was concluded in 1970, amended in 1979 and modified in 1984. It is open to States party to the Paris Convention for the Protection of Industrial Property (1883). The Treaty makes it possible to seek patent protection for an invention simultaneously in each of a large number of countries by filing an “international” patent application. Such an application may be filed by anyone who is a national or resident of a contracting State. It may generally be filed with the national patent office of the contracting State of which the applicant is a national or resident or, at the applicant’s option, with the International Bureau of WIPO in Geneva.

For more detailed information on the PCT see Text Box 7 in Case Study Three on Nigeria.

Subsequent developments, however, do not meet the level of commercial exploitation foreseen by Prof. Ronald’s initial optimism. For whatever reasons, the companies which had licensed the gene for commercial exploitation either did not utilize it or generate any commercial returns from its application. They have not deposited any money in the Genetic Resource Recognition Fund for the past three years.

So far as the environmental impact of transgenic rice containing the Xa21 gene is concerned, more evidence would be needed to see whether (a) pesticide use for cultivation of the transformed rice is less, and (b) whether any gene drift from transgenic rice to its other wild or cultivated relatives could take place.[4] It may be useful to mention that blight is not a problem with rice in the US although it is a serious problem in most developing countries.

**Text Box 4:**
**International Patent Classification (IPC)**

The International Patent Classification, which is commonly referred to as the IPC, is based on an international multi-lateral treaty administered by WIPO. This treaty is called the Strasbourg Agreement Concerning the International Patent Classification, which was concluded in 1971 and entered into force in 1975. The Agreement is open to States party to the Paris Convention for the Protection of Industrial Property. On January 1, 2000, 45 States were party to the Strasbourg Agreement. However, the industrial property offices of more than 90 States, four regional offices and the International Bureau of WIPO under the Patent Cooperation Treaty (PCT) actually use the IPC.

The Strasbourg Agreement establishes the International Patent Classification which, in its seventh edition, divides technology into eight sections with approximately 69,000 subdivisions. Each subdivision has a symbol consisting of Arabic numerals and letters of the Latin alphabet.

[4] The generation of resistance through expression of a gene is a complex process which requires considerable technological expertise. However, the possibility of viruses transferring such genes from crops to weeds is not unthinkable. It is a fear of this kind which has made some environmentalists quite suspicious about transgenic technologies. On the other hand, the damages due to pesticides are well known and unfortunately do not generate similar passions despite considerable adverse consequences for farm workers, particularly women and their children, and the environment.

The appropriate IPC symbols are indicated on each patent document (published patent applications and granted patents), of which about 1,000,000 were issued each year in the last 10 years. The IPC symbols are allotted by the national or regional industrial property office that publishes the patent document.

The Classification is indispensable for the retrieval of patent documents in the search for "prior art." Such retrieval is needed by patent-issuing authorities, potential inventors, research and development units, and others concerned with the application or development of technology. In order to keep the IPC up to date, it is continuously revised and a new edition is published every five years.

## Benefit-Sharing

### *Creation of the Genetic Resources Recognition Fund (GRRF)*

Prof. Ronald (1998) provides a succinct summary of how the Genetic Resource Recognition Fund was conceived:

> *Because there was no university precedent for germplasm compensation to source countries and because there was no prior agreement governing intellectual property rights (the material was collected in Africa before the entry into force of the United Nations Convention on Biological Diversity), UC Davis wished to define an appropriate method of recognition to the germplasm source countries. The absence of some form of recognition was deemed inappropriate and would be likely to make it more difficult in the future for the university to obtain research access to developing countries' national genetic materials. Our goals were five- fold:*
> *(1) To establish a mechanism to recognise and compensate for germplasm contributions from developing nations.*
>
> *(2) To provide a means for scientists to patent their inventions while maintaining productive collaborations and good relations with scientists from developing countries.*
>
> *(3) To encourage university/ developing nation/ industry links for commercialization of genetically engineered products.*
>
> *(4) To create a constructive solution that would be easy to implement and be widely accepted.*
>
> *(5) To create economic incentive for continued sharing of germplasm and conservation efforts.*

**Figure 5** ***Oryza longistaminata*** **grows in the marshes and river banks of Mali.**

Prof. John Barton of Stanford University, a widely respected international authority in the field of law relating to international germplasm conservation and utilization, advised Prof. Ronald on implementing these goals in an effective benefit-sharing mechanism. Prof. Barton suggested that GRRF should be created and dedicated for providing scholarships to students from the donor countries. It was also realised that it would be difficult to find out as to "who exactly should receive compensation as the owner of a specific genetic resource".

In June 1996 UC Davis established the GRRF to recognize the contributions of various developing countries to the success of Xa21 cloning. The intention was that the royalties generated from commercialization of the cloned gene would be pooled in the GRRF. The GRRF will be used for providing fellowships to students from developing countries who would return to their countries to help in nation building. The fellowship would be given first to the students from countries which have donated germplasm, such as Mali, but not only to the students from these countries.

It was expected that the GRRF would have USD 150,000 as future royalties from industry, UC Davis, and the inventors' contributions (Ronald, 1998). Other forms of compensation, like health care or conservation costs were expected to be incorporated into future agreements. Dr. Ronald pointed out (Ronald, 1998) that her goal was:

> *to create a practical compensation method to genetic resource contributors while allowing for the development, dissemination and commercialization of their contributions. The GRRF is a special fund set up for income derived from Xa21. However, it is hoped that the GRRF concept will be widely adopted by all the University of California campuses and in other major agricultural and medical research institutions. The setting up of similar funds at other major research institutions would provide a large and ongoing source of funds for fellowships or other types of contributions. The presence of compensation programmes would encourage source countries to conserve valuable land and genetic resources and can provide an economic incentive to do so.*

Non-commercial researchers such as public sector funded programmes were to enjoy free access to the gene, so long as they did not develop commercial products based on that genetic material. UC Davis and IRRI have agreed that IRRI would have full rights to develop new rice varieties incorporating cloned Xa21 and distribute this material as well as clone the gene freely to developing countries. This is a major conceptual and operational breakthrough in terms of North-South transactions on biodiversity. The Material Transfer Agreement draft letter available at the UC Davis website is enclosed in Annex 3.2.2.

Dr. Ronald (1998) proposed a sample text which could be used by various institutions to set up similar GRRFs:

> *(I)n addition to other royalty obligations, company x shall annually pay n% of sales of products and derivatives of gene x as defined in Article X, into a genetic resources recognition fund for n years following the end of the first year of commercialization, until it has transferred a total of X$ into that fund under this agreement. The genetic resources recognition fund shall be maintained by the university as a separate restricted fund, to be used entirely for fellowships and fellowship assistance to students and postdoctoral researchers from developing nations studying agriculture with a preference to be given to students and researchers from (name of source countries). The GRRF shall be managed by the Dean of the College of Agriculture and Environmental Science of the University of California at Davis.*

### *Institutional responses to GRRF:*

The response to GRRF can be seen at three levels:

a. The response of UC Davis and other stakeholders such as the licensee companies, the Rockefeller Foundation and other fellow scientists using biological resources from developing countries for developing patentable technologies.
b. The response of formal research institutions in Mali and their awareness as well as preparedness to participate in GRRF.
c. The perception and response of local communities involved in the conservation and utilization of, or interaction with, *O. longistaminata.*

### a. Response at UC Davis

Kate and Collis (1998) in their comprehensive study on GRRF point out that the access and benefit-sharing conditions of the CBD do not apply to *ex-situ* collections acquired by various research institutions prior to the CBD entering into force.

One view is that anybody who receives the designated germplasm from a CGIAR Center would not be able to seek plant variety protection on the unchanged material but would be entitled to seek patent or plant variety protection on inventions or new plant varieties derived from such materials. On the other hand, there was also a view that the recipients of designated germplasm from CGIAR Centers cannot claim any monopoly on the use of germplasm.

IRRI uses a "Standard Order Form" in which, Kate and Collis add, the recipient would undertake "not to claim ownership over the material received, nor to seek intellectual property rights over that germplasm or related information" and to ensure that any subsequent person or institution to whom the material was sent would be "bound by the same provision". The material is then sent to the recipient, accompanied by a "Shipment Notice" containing the same terms, which the recipient is obliged to sign. (Kate and Collins, 1998:8).

In February 1998, the CGIAR system had called for a moratorium on the grant of intellectual property rights on designated germplasm held in the Centers. While the restriction applies to all the germplasm that was transferred after 1994, the CGIAR hopes that recipients would exercise self-restraint even for the material obtained before 1994 for which Material Transfer Agreements (MTAs) were not signed. The Moratorium was called for after it was alleged that numerous grants for protection had been made in respect of designated germplasm. These allegation were never substantiated. It was acknowledged that Australian government agencies had filed applications for plant variety protection rights on two chickpea varieties obtained from International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) under a research co-operation whose origins pre-dated the institution of MTAs. However, even filing was not accepted since the applicants were unable the satisfy the Australian plant variety protection authorities that they were entitled to file an application.

During the negotiations with the companies, Kate and Collis (1988) described the proposal of UC Davis,

> *(T)he financial benefits contributed by companies should take the form of a royalty of a certain percentage of sales of the products marketed by the companies based on Xa21. However, from the companies' perspective, Xa21 would only make a small contribution to the genome and desirable traits of any new crop variety developed, so they were not comfortable with an open-ended royalty commitment. Instead, the university and the companies settled on financial benefits consisting of payment of a single lump sum by each company: US$ 52,000 in the case of the first company, and US$ 30,000 in the case of the second company. Given that only a minute proportion of research actually leads to a successful commercial product, the companies and the inventors settled on "commercialization" of a successful product, defined as the availability of the product for sale on the market, as the most appropriate trigger for payment of these sums. The benefit-sharing arrangement involves a single payment by each company into the Fund of the agreed sum one year after the commencement of sales by that company of the first new product that makes use of the Xa21 gene.*

Dr. Ronald stressed in personal discussions as well as through subsequent correspondance that corporations pledged a sum of about USD 80,000, once the Xa21 gene was commercialized. UC Davis pledged to match the corporate contribution. It was also understood in the licensing agreement with the two companies that if the companies concerned did not commercialize or use the gene for three years, the rights would revert to UC Davis for subsequent licensing to any other party. Three years have passed and the GRRF has received no money to date. Thus, no monetary benefits could yet be shared with the germplasm donor countries. As mentioned earlier, IRRI has the right to use this gene in any variety and make it available freely to developing countries.

**The draft Material Transfer Agreement (MTA)**

Communication from UC Davis (February 16, 2000) states that the material concerning Xa21 which belongs to UC Davis can be used only in cooperative scientific research. The recipient would not have any right to pass “these materials, their progeny or derivatives on to any other party or use them for commercial purposes without the express written consent of The Regents of the University of California” (See Annex 3.2.2 for a copy of the MTA). Any risks in using this material will be borne by the recipient. Since exclusive patent rights have been granted, “no commercial licenses or rights are available for this material”.

Personal discussions and subsequent communications with the right holders have indicated that this gene can be used freely by developing countries for incorporation in their plant varieties for conferring resistance to bacterial blight. Since the private sector may be involved in multiplying the seeds for distribution among farmers, it is not clear whether they will have rights to do so. At the moment, if material is received through IRRI, there is no constraint to its use in any way, except that intellectual property rightss cannot be obtained on this material.

Regarding the role of the Rockefeller Foundation, Dr. Ronald feels that “it would be inappropriate for them to contribute” to GRRF. However, the effectiveness of benefit-sharing frameworks and the role of intellectual property rights within such frameworks could be improved if the Rockefeller Foundation had a clear cut policy about:

(a) how royalties from resulting intellectual property rights will be shared if the genetic resources utilized in research funded by the Foundation originates in developing countries (irrespective of whether it was collected before or after entry into force of CBD),

(b) how benefits will be shared if the funded research generates commercializable technology, as appears to have been the case here, and

(c) what would be the rights of communities and countries from which the germplasm has been obtained.

In this case the effort to share potential benefits with germplasm donor countries came from the moral sense of equity of a scientist, Prof. Pamela Ronald. However, beyond the voluntary choice of the researcher, the CBD provides that Contracting Parties “shall take legislative, administrative or policy measures […] with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources. Such sharing shall be upon mutually agreed terms.” (Article 15.7). As mentioned earlier, no amount has yet been credited to the Fund even after three years (duration of the agreement). In the absence of any contribution from the university, the benefit-sharing mechanism seems to be dying a slow death).

**<u>USA</u>: gene Xa21 cloned; patent application filed; patent granted; Genetic Resource**

**<u>USA</u>: gene Xa21 mapped at Cornell**

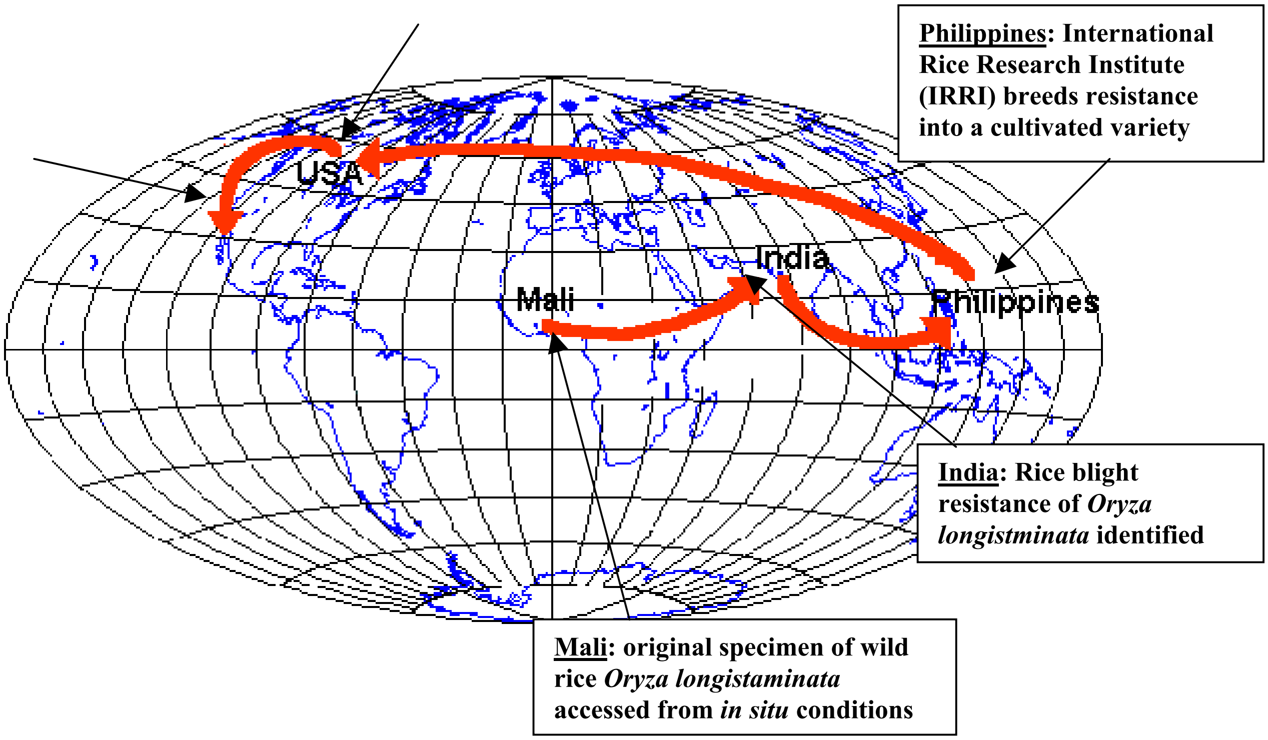


**Figure 6  The path of *Oryza longistaminata* from Mali through India, Philippines and the USA and the sequence of Research and Development that led to the isolation, cloning and patenting of gene Xa21.**

Prof. Ronald explained that she had devised in consultation with Prof. Stephen Brush a simple system in which every UC faculty member could mark a box on the "*UC Invention Disclosure Form*" suggesting that a share of the royalties from patents obtained on these inventions be credited to the Genetic Resource Recognition Fund .[5]  If the two companies concerned do not license this gene by December 1999 the rights for commercialization would revert back to the university.

Prof. Coulsett, an eminent wheat breeder, noted that the concept of the GRRF was not very popular on campus, nor had it been mainstreamed.  Some of the scientists felt that sharing benefits arising from the use of genetic resources in their inventions cannot be mandatory. Prof. Ronald agrees with the submission of some scientists that benefit-sharing cannot be obligatory.  She considers that it should be a standardized voluntary policy. Others felt that benefits could be shared in the form of technologies, i.e., improved varieties being made available to developing countries.  While there was a consensus among senior scientists at UC Davis for *ex-situ* conservation, many senior scientists did not seem convinced about the importance of *in-situ* conservation of landraces.  Dr. Charles Ricks, a scientist knowledgeable in the conservation of germplasm, recognized the need for *in-situ* conservation although he admitted that no institutional arrangement existed for the purpose so far.  He also noted that when the seeds were selected for acquisition by gene banks, the banks assumed that the samples were random and did not take into account the genetic structure of the population. He also felt that breeders did not spend much time on conserving biological diversity within the country.  There was no downside in his view to the concept of *in-situ* conservation.  For example, the University of California at Davis has more than 3000 accessions of tomato varieties, of which 1000 had been identified for donating genes, 1000 were cultivated varieties, and another 1000 could be wild races.   The *ex-situ* banks have also been used to

5  Prof. Pamela Ronald, personal communication.

safeguard genes endangered in war. It is easier to know the pedigree of varieties but more difficult to know which gene came from which parent. Prof. Brush argued that benefit-sharing was necessary at least for *in-situ* conservation.

Dr. Kevin M. Smith, Vice Chancellor for Research at UC Davis, mentioned that he was quite supportive of the concept surrounding Prof. Ronald's initiative[6]. In a subsequent communication, Dr. Smith observed,

> *UC systemwide has a policy regarding distribution of royalties, some going to patent/ licensing expenses, some to inventors, some to the State of California, and some to Chancellors of campuses. If inventors wish to reassign their royalties they may do so, but we cannot unilaterally mandate any actions with regard to the other funds which are outside of the control of the inventors - currently policy does not allow that. Neither does our policy allow the campus to mandate the use of the inventors' income*[7].

Some stakeholders in developing countries may feel that the voluntary assignment of rights does not encourage full reciprocity among germplasm-contributing and -utilizing institutions and countries. Such a policy is bound to affect the pattern of liberal germplasm exchange among various countries that existed in the past. Further, such a policy also does not encourage local communities to conserve local genetic resources and their diversity. Accordingly, the optimism that had been shown by UC Davis through its press releases in 1997, has been succeeded by limited institutional and financial success.

### b. Institutional response of scientists in Mali

Dr. Bino Teme, Scientific Director, Institute of Economic Research (IER), who is in charge of agricultural research in Mali, did not know about the UC Davis initiative of establishing a Genetic Resource Recognition Fund. This illustrates the importance of extensive information exchange for any benefit-sharing arrangements in which all stakeholders are to participate effectively.

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[6] Kevin M Smith, personal communication, December 22, 1999
[7] Kevin M Smith, personal communication, January 7, 2000

Box 5: Stakeholders in *O. longistaminata*

| **Mali** | **India** | **Philip-pines** | **USA** |
|---|---|---|---|
| •Government of Mali<br>•Scientific Research Institutions (ERI, etc)<br>•Local land-owning farmers<br>•Landless Bela community<br>•Malian agriculture students | •Rice research program | •Int'l Rice Research Institute (IRRI) | •Government of USA<br>•UC Davis<br>•Prof. Pamela Ronald, et. al<br>•Two private companies in agrobiotech sector |

On the cloning and patenting of gene Xa21, the view was that as long as the scientists in Mali could get access to the cloned gene to improve quality and productivity of their own agriculture, then they did not object to the patenting and cloning. They would of course appreciate if there was collaboration between UC Davis and their organization and if the improved material was exchanged.

When informed about the framework of the Genetic Resource Recognition Fund and the cloning of the gene from Malian *Oryza longistaminata*, Dr. Teme was highly appreciative of the efforts made by UC Davis. He did not have any objection to a patent being granted on gene Xa21 and felt that scientists who do research to add value to local biological resources should be granted exclusive rights for the same. He mentioned that the proposed scholarship scheme would be highly appreciated in Mali. There was no policy for *in-situ* conservation as yet and also no Plant Variety Act in force.

### Local scientific knowledge about *Oryza longistaminata*

According to the Malian agricultural scientists, there are three kinds of wild rice which sometimes grow together, namely *O. barthii* (red color), *O. glabberma* (panical wide open), and *Oryza longistaminata* (panical slightly tight and propagation vegetatively). Generally, the fields where *Oryza longistaminata* is found are supposed to be very fertile. This rice is a host to the Rice Yellow Mottel Virus though it is not affected by the virus. While *O. glabberma* is used for breeding, *Oryza longistaminata* was not being used in any of the major crosses. In 1976 all native germplasm was surveyed and about 1000 local varieties were collected.

Dr. Teme and other scientists were intimately aware of the fact that this wild rice spreads in the paddy fields, so much so that in some cases the fields have to be abandoned because of the extensive spread of *Oryza longistaminata*. Poor people collect the grains, which fall down since the grains of this landrace shatter very fast.

Mr. Dond Kone, Farming Systems Research Team leader at the Niono Research Center of IER, considered *O. longistaminata* to be a weed. He pointed out that people have developed strategies to fight it. Ten years ago there was a serious problem to control it and even the herbicide 'Round Up' failed to control its spread. Farmers tried double ploughing and many other ways to control it, including second ploughing at the beginning of the season. Farmers have also tried to uproot the rhizomes which remained buried in the water.

**Figure 8 (l-r) Mr. H. Magassa, Prof. A. Gupta (the author), Mrs. Aisse Toure, Mr. M. Diawasa and Mr. M. Roes. The author with local scientists who are undertaking socio-cultural and economic research in Mali, including research into rice–based indigenous knowledge systems.**

Dr. M. K. Nidia Ye, Soil Scientist, and Mr. Ydounbia, Agronomist, provided additional information about *Oryza longistaminata*. They mentioned that the older varieties were photo period sensitive, but more tasty. Only the *phulani* and *bela* people were dependent on *Oryza longistaminata* for their subsistence. *O. bhartii* is an annual wild rice, whereas *Oryza longistaminata* is perennial. The local name for *Oryza longistaminata* is '*maluf*' (black rice) whereas *O. bhartii* and *O. glabberma* are called '*Komolo*'. Some of the cultural uses of *Oryza longistaminata* and *O. bhartii* are:

- The *Bela* people used to make masks out of *O. bhartii* to cover one's body while performing rituals. Muslims, who are not supposed to use masks and perform the rituals, have not used *O. bhartii*.

- While performing ceremonies, the stem of *Oryza longistaminata* is used to fence the place where ceremonies are performed. Sheep, goats, cows and donkies are fed on the straw and *tifa*, another weed found along side, is used for making roofs. Generally the *mopti* people collect *O. bhartii* and sell it in the market.

There are several other wild rice varieties growing in the region besides *Oryza longistaminata*. Some of the old varieties of rice have either become extinct or are not favoured at present. The relation of *O. longistaminata* to the *in situ* utilization and conservation of related wild rice varieties include the following:

- '*bintubala* ' is not found any more. It had a good taste, a long grain, and white caryopses. Its yield was about 2 tons per hectare and it matured after six months in November. This variety has died out.

- '*docu*' was a late maturing, slow growing dwarf variety (40 centimeter variety), light red in color, with a short grain size, and a yield of three tons per hectare.

- *O. bhartii* is called '*malibli*' when found in the cultivated rice fields and it is called *komolo* when found in swamps outside the fields. Farmers try to weed this rice out and landless women, particularly those belonging to *bela* community, collect it.

Mr. S. Sala, a weed scientist, acknowledged that people used this wild rice as a food in the past though it is considered a weed at present. In the North of Mali from the Mopti to the Gai regions, people collect the grains of this rice, particularly the landless people. People also eat the grains of the weed, called *Echinochola colona*, which is very difficult to distinguish from the paddy plant at the early stages of growth. This weed is much more prevalent in poorly flooded soils and in low lying rice areas it is a very competitive plant and is often very dominant.

**Figure 9  Millet and corn being dried for local food consumption in Mali.**

Farmers have selected some types of *Echniochola pyramidallis*. They transplant it and use it as a feed for animals in the Mopti areas, since it does not cause a problem in frequently cultivated areas. In contrast, *Oryza longistaminata* earlier caused a lot of problems. In Matsana, a small town, sixty kilometers from Segou, farmers abandoned about 900 hectares of irrigated area because of *Oryza longistaminata*.

All the center delta regions are populated by *Oryza longistaminata*, which plays multiple roles in the local ecosystems. For example, *Oryza longistaminata* provides the host for the stem borer and the Rice Yellow Mottel Virus. However, *Oryza longistaminata* seems also to be a host of *Oncocephalus*, the predator of the stem borers. So far, no formal scientific study has been done to determine whether the resistance of *Oryza longistaminata* to the two stem borers, i.e. *Chile zaccepious* and *Maliarpha separatala*, is correlated with its ability to provide a host to *Oncocephalus*. The most serious problem of land-owning rice farmers is the virus for which *Oryza longistaminata* provides the host. But *Oryza longistaminata* itself is never affected by the Yellow Mottle Virus. Nobody has even seen a dead plant of *Oryza longistaminata* displaying the symptoms of the virus. An awareness about the likely resistance of *Oryza longistaminata* to viral and bacterial diseases thus existed among the local scientists, even though they never considered it worthwhile to be a subject of scientific research, because they considered this wild rice to be a weed only.

**Figure 10 Women of the Bela community use stalks of *Oryza longistaminata* for basketry production and other local needs.**

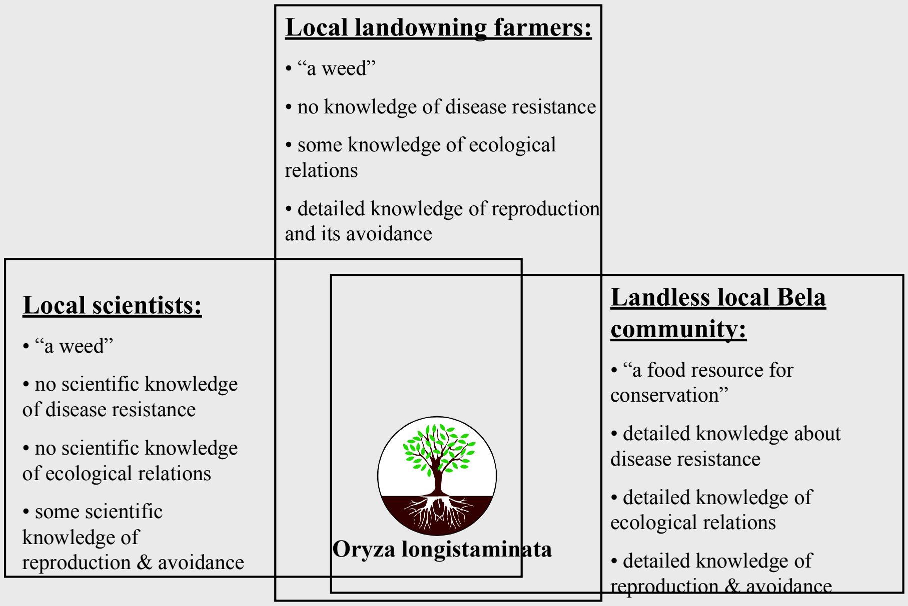
In the past, during magic shows the local people used to beat drums, organize a dance and a person covered by *Oryza longistaminata* stalks would appear like an animal and dance. Nobody acknowledged consuming the wild rice, except the *Bela* people who consume *Oryza longistaminata* as well as *Echinochloa colona*. *Oryza longistaminata* is supposed to have diffused through the rivers and waterchannels in the region. *Oryza longistaminata* was found in the region before the irrigation system was established. In the olden times villagers would uproot *Oryza longistaminata* and dry its roots.

While *Oryza longistaminata* is considered a weed, there are several other varieties of rice which have been developed and are being cultivated by the land-owning farmers of the local communities. Some of these related local varieties of rice are the following:

- Banjul — Big grains, reddish, mature in six months, used as par boiled rice, there is a town named Banjal near Gambia (the capital of Gambia). This rice may have come from Gambia.
- Gambiaka — Close to Bomoko there is a village, Kokum, and researchers made selections from the local rice to develop this variety.
- Bindu bala — White grain, thin and slightly brownish red stock, matures in six months.
- Doc — Late maturing, about seven months.

Before colonization of this area, *Oryza glabberma* rice was found here, called *Melabli* in the local language. Shattering was one of the reasons why the government did not allow cultivation of *Oryza glabberma*. Its advantage was that it matured early, and had good taste, lot of energy and did not fall prey to any diseases. It was believed that people who consumed it also did not get many diseases.

Box 6: *O. longistaminata* in different Local Knowledge Systems in Mali.




## c. Community's perspective

The local communities have developed detailed taxonomies, practices and knowledge systems around the *in situ* utilization of *O. longistaminata* and related wild rice varieties. According to the botanical taxonomy of the traditional knowledge system, both *O. longistaminata* and *O. Bharthii* are considered *komolo. Komolo* is a generic term for rice growing in the river. However, *O. longistaminata* shatters more than *O. Bharthii*. *O. bhartii* matures late and is non-synchronous in nature. Its panicles are tight when it matures and after maturity the spikelets spread out. *O. longistaminata* has slightly different kind of spikelets. *O. longistaminata* is also called '*diga*.' It has to be controlled very fast when it is in the field since it may make land unfit for cultivation. The grain yield is very low, namely about ten grains per plant and extremely poor people collect it.

**Figure 11 Geneva Dia Ilo from Sasrakalla, Mali, demonstrating local use of *Oryza longistaminata.***

Several aspects of the prevalent socio-cultural system are relevant to the case: people use black rice (*O. Glabberma*) during fairs, collected from the wild, and mill it. Because it is an early maturing rice in swampy areas, those who do not have anything to eat, harvest it and it is generally considered a famine food. The number of cattle, which grazes the stalks of *O. longistaminata* after the October/November period, is generally considered the sign of an individual farmer's wealth. Vegetables like Okra, which are grown around the rice fields, as well as income from the poultry belong to male farmer. Women are given small plots to do horticulture and income from these plots belongs to them. The income from farming belongs to their entire joint family.

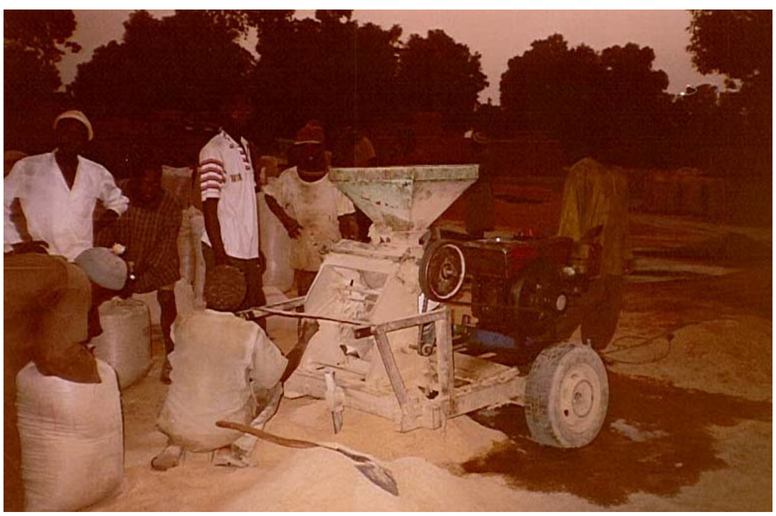


**Figure 12 Local grain being milled for local food supply.**

In the past, families in the Nanco village used to grow sorghum, cotton, millet, some of which are still cultivated. The community came from Sariwala about one hundred years ago and now cultivates six hectares of land. The community of the Nanco village had come from Kuchala about a hundred years ago, when the French forced them to migrate. Consequently, the community is apprehensive that if they build permanent houses, they might be moved away. They grow several grains such as *kadmi*. This white long grain susceptible to shattering yield was good and very tall, but bird attack was much more frequent. The *bindubala* variety of rice was valued much more. Mr. Okesamaki, one of the farmers had four hectare of very poor land. Earlier he and his family members used to grow cotton but when water came, the plantation of cotton was discontinued.

There were a lot of diseases and pests and ultimately the community had to abandon the land. Even aerial sprays of pesticide did not help and the pest damage in other crops were very serious. They also used to grow '*cokono malu*', i.e., rice grown in small rivers. It was black or red and was not known as a high quality variety. They used to broadcast the seed in the river and different families used small patches of swamps. The patches closer to the sorghum and millet fields were being used with particular frequency and the community had more fields than it could cultivate at that time. The farmers were fighting against *O. longistaminata*.

### The Bela people and the Village Sirewual:

### The real stakeholder in conservation of *O. longistaminata*

The Bela people originally came from Gudan, a place near Timbuktu. They moved from the northern dry regions to Sirewual several decades ago, in hope of a better life. The Bela settlement is situated on the outskirts of the township, though very close to the research center. All the fallow land in the area where the Bela settled was taken over by the government which in turn allotted it to private owners. Some of the private owners, who did not cultivate the land themselves, allowed the impoverished Bela people to grow sorghum for the time being. They now live on the land granted to other residents of Niono, who have let them stay here and till the adjoining plots. As and when these owners/grantees of land will need it, the Bela will have to move away, maybe a few kilometers or more. The Bela have made numerous petitions to government for land, but have not been granted any.

**Figure 13 Community members of the economically marginalized Bela people in Senawal, Mali.**

The community members pursue brick making, manual labor on others farms, and the plantation of sorghum for the market. They also grow a pearl millet variety called *sanyon joma*, a kind of white pearl millet, and a sorghum variety was called *kinki.* When asked if they could get improved seed, they declined. Their socio-economic context is comparable to the fate of the rural landless poor in other developing countries of Africa or Asia. The Bela are, in effect, a highly impoverished and economically marginalized people.

The black rice growing in the swamps and river was uncontrolled and the Bela could harvest the rice or collect the fallen rice. They collected about six hundred kg to one ton of rice from the wild. They harvested *O. longistaminata* and *O. bhartii* together and cooked it with meat. They found this rice to provide a lot of energy and strength. During discussions, they pointed out that hungry people do not have the privilege of discrimination when asked as to which rice they preferred. Consequently, they collect and conserve whatever is available.

**Figure 14 A community member of the Bela people, preparing *Oryza longistaminata* for food consumption.**

While nobody in Mali was fully aware about the disease resistance of *O. longistaminata*, the Bela were the only community which held detailed ecological and ethnobotanical knowledge about the functions and characteristics of this rice, including its resistance to rice blight. The Bela people pointed out that *O. longistaminata* never contracts any diseases under normal conditions. Only when water is scarce have they noticed dead plants, perhaps from diseases, but in general they knew about the resistance of *O. longistaminata* to many diseases.

While everybody else referred to birds as a nuisance from which they had to protect the crop, the Belas viewed the birds very differently. Without birds, they stressed, the grains would not be distributed. Birds distribute the grain/seed and thus the community can collect rice from larger areas. A concentration of birds in the adjoining trees indicates that the rice is mature nearby and that the community can begin collection. The bird that particularly eats *O. longistaminata* and indicates places of particular rice concentration by singing around such locales, is called '*Chironi*'. For farmers, this bird increases the burden of weeding, but one person's weed is another person's food.

Based on the traditional practice of collecting wild rice and other local biological resources, the traditional knowledge system of the Bela community about the wild rice varieties, recognizes that *O. longistaminata* is a variety with a particular resistance to diseases, which exceeds the disease resistance of other varieties, including for rice blight.

**Figure 15 Bela woman demonstrating local practices and knowledge related to *Oryza longistaminata.***

This illustrates that ethnobotanical knowledge of plant genetic resources is neither tied to scientific, nor land-owning farmers, nor to criteria of 'indigenousness', but rather to the local and practical *in situ* use of the genetic resource. This has several conclusions for benefit-sharing arrangements surrounding genetic resources and associated traditional knowledge:

- The stakeholders are not limited to formal scientific research institutions of the country of origin of the genetic resource;

- The ethnobotanical knowledge of local PGRFA is not necessarily and only held by local landowning farmers, but can also be held by local communities that are landless and subsist on mixed modes of income. This may have implications for the concept of farmers' rights.

- The ethnobotanical knowlegde is not limited to indigenous communities, but often is held by local communities to a larger extent than by indigenous communities. This may have implications for the implementation of Articles 8(j), 10(c) of the CBD, which refer to the TK embodying the lifestyles of "indigenous and local communities relevant to the conservation and sustainable use of biological diversity."

**Figure 16  As in the previous figure, a demonstration of local utilization and knowledge of *Oryza longistaminata.***

There was general consensus among the community that there were no fights on who collected from where, and all counterparts referred to the principle of "first come, first serve." Anybody who reached earlier could collect the grains from a given place.  The Bela harvest some grains and the rest they collect from the river after it has shattered and fallen from the stems.  In some aspects, the Bela may be viewed as the continuing link between the ancient culture of food gathering from the wild and the culture of contemporary cultivation. However, the Bela people are not an unstructured and homogenious community; they themselves have distinct internal social structures and classes. The community members who move about and sing for remuneration are considered of lower social standing than the other community members.  There is no inter-marriage between these subgroups.  The Belas also did not let their women talk too much.  When asked, the stock reply was they might not know.

When asked about their vision for the conservation of *O. longistaminata*, they replied that they didn't own the land and therefore had no agency to make suggestions on the conservation and utilization of the biological and other resources on which they subsist. However, the Bela have developed specific conservation practices for *O. longistaminata,* since they are economically dependent on this plant for their subsistence and survival.  Ms. Gineba Diallo, the grand daughter of Aminata, mentioned that if they did not remove the husk from *O. longistaminata*, one could conserve it for over a year.

Contemporary innovations:

At the Musawere village, some families of the Belas came from different parts of Mali. They came from a region growing cotton, sorghum, pearl millet and cow pea, and they learnt about rice only after arriving in the Niono region.  For them the use of rice, and the knowledge on the properties and collection of *O. longistaminata*, was a contemporary innovation to their traditional practices and one on which they depend for their survival.

Feedback:

At a seminar held at the Center for Indigenous Knowledge with participation from government departments, the local university, NGOs, and international research centers like ICRISAT, discussions focused on the accountability of researchers towards those who provide knowledge and information about genetic resources in Mali. There was concensus that the disjunction between formal knowledge and the informal knowledge systems was very strong here. The awareness about intellectual property as a tool for the promotion of innovation and the sharing of benefits arising from the use of Malian genetic resources was considered very low.

**Figure 17 Malian stakeholders discussing the case of *Oryza longistaminata* and the role of intellectual property rights in the sharing of benefits arising from the use of the rice at the Center for Indigenous Knowledge, Bamako.**

However, the community members did raise concerns about the ethics of knowledge sharing and the inequity of knowledge retrieval by Western scientists. The interactions of an outsider with any community pose several methodological dilemmas, including in this case study. For instance, when I asked a lady, Aminata Coulabaly (Figure 2), in the Sarakala region about this rice, her remark was, ‘white people ask too many questions?’, ‘we can’t ask them similar questions?’ After this dialogue I encouraged every respondent in individual and group meetings to ask questions about anything they wished and this led to rich insights about knowledge exchange.

## Lessons Learned

The case study offers a few lessons:

Concerns raised about so-called 'bio-piracy' have led numerous scientists and companies to seek innovative ways of sharing the benefits arising from their use of plant genetic resources and traditional knowledge, and intellectual property rights play an important role in them. However, no benefits have yet been shared from efforts, which rely on only voluntary benefit-sharing. There was no evidence at UC Davis that the initiative of Prof. Pamela Ronald had received sufficient support. Some policy fora and processes, such as the revision of the International Undertaking on Plant Genetic Resources at the FAO, have therefore considered establishing a multilateral system for facilitated access to and mandatory benefit-sharing in PGRFA.

- The administration of large universities like UC Davis is sympathetic to the idea but apparently unable to trigger a major university-wide debate on the subject of intellectual property and equitable benefit-sharing. While the Genetic Resource Recognition Fund is highly instructive about the possible roles of intellectual property rights in bilateral benefit-sharing, the fate of the GRRF does not warrant optimism about the success of voluntary biateral benefit-sharing initiatives in PGRFA. By implication, the GRRF may also offer some lessons as to the role of intellectual property rights in a multilateral system.

- The fact that the land-owning farmers in the region where wild *O. Longistaminata* grows have no interest in its conservation and no knowledge about its rice blight resistance raises several important issues for benefit-sharing in traditional knowledge and for the concept of farmers' rights as contained in the revision of the International Undertaking.

- Should the local farming communities of the region where plant genetic resources for food and agriculture are accessed be considered as the default stakeholder? In this case, the Bela community, which is from Timbuktu in the far north of Mali, but which is dependent upon *O. Longistaminata* for its survival and knows about its characteristics and utilization, is the real stakeholder in the conservation of *O. Longistaminata*. Under conventional ABS frameworks, both bilateral and multilateral, this landless community is likely to be excluded. Policy makers concerned with benefit-sharing policies may wish to take into account such landless communities as stakeholder in the *in situ* conservation of local biological resources.

- The case study exemplifies a limitation in the applicability of the criterium of "indigenous" knowledge, when speaking of biodiversity conservation. In this case, the ethnobotanical knowlede of *O. Longistaminata*, and in particular its resistance to rice blight, was held by impoverished local immigrant communities, rather than the 'indigenous' local farming communities. The case study indicates that the definitive criterium of traditional ecological knowledge is its connection with the local ecosystem, i.e. its *local* character.

- The policy processes at the FAO, the CGIAR and the CBD require further discussions in order to clarify whether international regulations to ensure facilitated access and equitable benefit-sharing in using biological resources are necessary. Attention will have to be given to the role of contractual arrangements as a practical tool for benefit-sharing. Given the asymmetry in technological competence among different countries, the question is whether international regulations will help in overcoming the asymmetry or further exacerbate it. The role of the Global Environment Facility in conservation or value addition in agro-biodiversity has been limited so far. It is obvious that we have to go a long way if experiments like GRFF have to be institutionalized within developed country institutions.

- The role of intellectual property rights is crucial in generating benefits from commercializable technologies which utilize the genetic resources, in this case by Mali. In the present case, UC Davis had the legal right to use the germplasm without any permission from anybody. The fact that the gene was first identified at a public funded research institution in the Philippines, namely IRRI, may raise questions about inventorship in relation to the patented gene Xa21. While the willingness of UC Davis to provide this gene freely to developing countries is highly commendable, the Material Transfer Agreement might make this goal more clear and explicit.

- A close involvement of the gene donor country, i.e. Mali, in the biotechnolocial research which utilizes the Xa21 gene was not sought in this case. This benefit might have been the easiest to be shared and such sharing might have been possible within the research funds available from the Rockefeller Foundation as well as from the two companies to whom the gene was licensed for three years. The Rockefeller Foundation did not have a policy of mandatory benefit-sharing with genetic donor countries in the research which they fund. However, the Director of Food Security of the Foundation expressed the following views regarding the role of intellectual property rights in benefit-sharing from Rockefeller-funded research:

  > *The position of the Rockefeller Foundation is that the results of the research it funds should be made available without royalty charges for use in developing countries. However, IPR can be taken in developed countries to generate income for further research.*
  >
  > *In the case of the Xa21 gene, UC-Davis licensed the cloned gene to IRRI and others without charge for use in developing countries. They also licensed it to companies and generated income which will, in part, support further research. The Foundation has had no involvement with the GRRF gene fund but I personally think it's a good idea.*
  >
  > *The naturally occurring Xa21 gene can, of course, be used in conventional breeding without any restrictions since it was discovered by IRRI and there is no IPR on it.*[8]

  This raises several technical questions on how such a policy on intellectual property and benefit-sharing should be implemented in the exercise of intellectual property rights which were acquired to protect the results of research funded by the Foundation. These questions include, *inter alia*:

  - when the Foundation enourages the acquisition of IPRs on funded research, has any consideration been given to the possible incorporation of claims of gene donor

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[8] Gary Toenniessen, Director, Food Security, Rockefeller Foundation. Personal communication, February 29, 2000.

communities in licensing arrangements after IPRs on the research results have been acquired. In such an arrangement it would be possible to share with the gene donor community, benefits accruing form royalties or licensing or both of Rockefeller-funded research.

- which measures could be taken to take into account that the capacity for using proprietary technology may not exist in the gene donor country. The present case is indicative since the scientific leaders in Mali did not know about the gene patent on Xa21. This raises the question whether information sharing and scientific capacity building in gene donor country should not be part of the Rockefeller Foundation's funding policy.

The Foundation addressed these questions through the following statement, which is based on its extensive past experiences and work in agricultural research funding:

*The vast majority of RF funding is committed to capacity building in developing countries. This includes hundreds of fellowships for Ph.D. training in labs such as Pam Ronald's and then support for the fellows' research after they return home. Over the past ten years over 400 fellows received training in biotechnology including some from Mali. However most fellows from Africa receive training in conventional breeding, agronomy, IPM, microeconomics and other areas that are more relevant to the needs of their home institution and country. If the RF helped to fund the GRRF we would be taking funds from these other fellowships and from research in developing countries and giving even more to UC Davis who I doubt could do as good a job as we can in selecting fellows who will return home.*

*We do not encourage IPRs on RF funded research, we allow it. We do not have contracts, we give grants. We cannot force our grantees to do anything. If they do not share we simply do not renew their grant because they are not meeting the objectives of our program. We do not have a policy on sharing royalties with gene donor communities because this issue is of no relevance to the vast majority of our grants.*[9]

➢ Recent debates have raised questions regarding the provision of scholarships as a means of benefit-sharing. Some commentators have raised issues with regard to alternative ways of conceptualizing benefit-sharing.[10]

(1) Who will really benefit from the scholarship fund? The idea of providing scholarship … aims at building long term capacity in the gene donor countries as well as in the country where the germplasm was conserved. The problem arises when we try to understand as to who may actually benefit from such scholarships. Studies have shown that school dropout rates are generally highest in biodiversity-rich regions and also where agriculture is rain-fed and risk prone. It is these regions in which land races are likely to be conserved. Yet, young boys and girls (in fact, the dropout rate of girls is almost twice as high as that of boys) from these regions are unlikely to get the advantage of scholarships unless a specific stipulation is made in the rules requiring this fund.

[9] Gary Toenniessen, Director, Food Security, Rockefeller Foundation. Personal communication, March 3, 2000.

[10] Anil K Gupta, 1997, 'Biopiracy' vis-à-vis Gene Fund : A novel experiment in benefit sharing, Honey Bee 8 (2), 16-17.

Further, it should be made mandatory for recipients of such scholarships to go back to their own countries. It will be ironical if the recipients stay behind in the USA and the fund works like a suction pump to draw out able young scholars.

(2) The contribution to the conservation of land races may also require the setting up of trust funds under the leadership of local growers of land races in the gene donor countries. It must be insisted that the funds must be managed by those who grow land races. Otherwise owners of irrigated land holdings, growers of high yielding varieties, and those having more influence and power will dominate these funds.

(3) Sharing royalties with students from the Philippines is fine so far as the need for that country to get such help is concerned. But this must be distinguished from giving property rights to the Philippines on every germplasm on which research is done at the International Rice Research Institute (IRRI). Otherwise it could imply, for instance, that India will become claimant for royalties from germplasm stored at ICRISAT, Columbia for CIAT's collection, the United States of America for the repository of genetic resources at Fort Collins, etc. Having the gene donor country's share in royalties depleted by such stakeholders would not conform with the CBD objective for fair and equitable benefit-sharing. A weighting criteria and priority list in this regard may need to be developed. Otherwise, better off countries and communities in Western Africa or any other region will take away the benefits of this new instrument of reciprocity between gene donors and gene beneficiaries.

(4) The contributions to these funds should come not only from University royalty funds but also from corporate stakeholders who are utilizing this gene for a period of no less than 20 years (the standard minimum term of protection for patents, as set out in Article 34 of the TRIPS Agreement). To ensure that such funds become large and attractive for local communities to really conserve land races it will be necessary to generate revenues from seed companies and/or the growers of disease resistant varieties of rice having this gene. In any case all the high yielding varieties have incorporated genes from land races without exception.

(5) Sharing of benefits should be seen as a mark of responsibility rather than charity. It is, however, important to mention that such a responsibility should be shown by public and private sector agencies (seed companies, grain procurement agencies, exporters, growers and consumers of high yielding varieties, etc.) in each country. By focussing exclusively on a few stakeholders the issue of generating larger civil society responsibility in all countries towards conservation is easily lost sight of.

- The Mali case brings out the import of the issue of voluntary benefit-sharing. But it also highlights a need for increased institutional commitments to such initiatives. UC Davis or, for that matter the UC across all campuses, have not had a dialogue so far on institutionalizing a system of mandatory benefit-sharing from the patented products or processes based on genetic resources or linked traditional knowledge.

  Short of having an international agreement establishing international norms for the protection of TK and improvements therein, ways and means of using existing intellectual property rights for benefit-sharing must be explored.

Surely, in cases where prior knowledge is documented and available, it can be cited to invalidate the patents as was done in the case of US Patent 5,401,504[11] over the use of turmeric in wound healing. In the present case, no knowledge was used but only a sample of wild rice was accessed prior to the CBD entering into force.

- A minimum benefit to be shared by UC Davis is to provide the gene and associated know-how to the Institute of Economic Research in Mali. At present, Chinese scientists are working with Prof. Pamela Ronald and transferring this gene into Chinese varieties. Why not do the same with Malian varieties with the help of Malian scientists? This gene is available free for non-commercial purposes to third world institutions and accordingly it is available to the scientists in Mali also. However, creating capacity among the Mali scientists to absorb this technology should have been one of the first follow up steps of this research.

- *The role of donor and funding agencies in benefit-sharing:* The Rockefeller Foundation did not respond to queries about their policy in this case. However, donor and funding agencies should have a policy on benefit-sharing arrangements in cases where intellectual property rights are acquired for research results attained through their investment. The management of UC Davis would hardly have ignored the benefit-sharing issues had there been some conditions or benchmarks from the Rockefeller Foundation.

- *Considering all stakeholders:* The conservation of wild rice from which the gene in question has been obtained can not be pursued effectively if benefits were to be channeled only to the communities from the region where this wild rice grows. The land-owning farmer community in Mali had no interest in the conservation of wild rice and the same applies to the government. For them *oryza longastaminata* is merely a weed and it must be banished. It is for the *Bela* people that this rice matters. They hold detailed ethnobotanical knowledge about this plant genetic resource, on which *in situ* conservation of genetic resources depends. The literature and initiatives on benefit-sharing have ignored so far issues and concerns of this type of stakeholders.

- The merit of providing scholarships as a means of sharing benefits has been criticized in some recent publications on intellectual property rights and benefit-sharing.[12] The point was that in the areas in which this wild rice may be found and among those who are involved in its conservation (i.e., the *bela* community), there may not be anybody qualified to avail of PhD fellowships at UC Davis. If the fellowship were given just like that, then sons and daughters of elite scientists or bureaucrats may actually benefit - contrary to the intention of Dr. Pamela Ronald. Therefore, the choice of instruments for sharing benefit needs to be decided after much greater discussion with the communities who conserve both the knowledge system and the genetic resources.

- Sharing of research findings with the communities needs to be done in the local language.

[11] See, *Use of Turmeric in Wound Healing*, U.S. Patent No. 5,401,504, issued March 28, 1995

[12] *Honeybee Newsletter* 8(2) 1997: p. 16-17.

# Case 1: Mali
# Annex 3.2.2

Material Transfer Form

February 16th, 2000

IN DUPLICATE

This is to acknowledge receipt of your email in which you requested certain research materials developed in this laboratory be sent to you for scientific research purposes. The materials concerned, which belong to The Regents of the University of California are the *XA21* gene from rice.

While I cannot transfer ownership of these materials to you, I will be pleased to permit your use of these materials within your research laboratory for our cooperative scientific research. However, before forwarding them to you, I require your agreement that the materials will be received by you only for use in our cooperative work, that you will bear all risk to you or any others resulting from your use, and that you will not pass these materials, their progeny, or derivatives on to any other party or use them for commercial purposes without the express written consent of The Regents of the University of California. You understand that no other right or license to these materials, their progeny or derivatives, is granted or implied as a result of our transmission of these materials to you.

These materials are to be used with caution and prudence in any experimental work, since all of their characteristics are not known.

As you recognize, there is a processing cost to us involved in providing these materials to you. We will bill you for our processing costs, which will amount to no charge.

If you agree to accept these materials under the above conditions, please sign the enclosed duplicate copy of this letter, then have it signed by an authorized representative of your institution, and return it to me. Upon receipt of that confirmation I will forward the material(s) to you.

The patent application and corresponding patents covering these materials have been exclusively licensed to a company in the United States, and accordingly, no commercial licenses or rights are available for these materials.

Sincerely yours,
Pamela C. Ronald

ACCEPTED:

RESEARCH INVESTIGATOR

Name:

Signature here:

Date:

[Research Institution] Representative:

Date: