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Sovereignty or Hegemony?
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Issue: Whether governments will adopt a multilateral or a bilateral mechanism for access and benefit-sharing with respect to germplasm relevant to food security will be the focus of debate during the Seventh session of the FAO Commission on Genetic Resources for Food and Agriculture (CGRFA), May 15-23, 1997. At the heart of the debate is whether or not governments will opt for a multilateral system of germplasm exchange or determine to pursue bilateral agreements between countries and companies. While bilateral contracts are being heralded as the best way to support seed sovereignty, bilateralism will likely strengthen the North's hegemony over the South's germplasm. This Communique examines Africa's bargaining position.

At Stake: Food security.

Impact: Every food crop has its centre of origin, but the world's major food crops have been widely dispersed for hundreds (or even thousands) of years. *Ex situ* germplasm collections are equally dissipated. If the South opts for a bilateral negotiating system for these food crops - and their related species in forests and savannahs - the trade advantage will default to the North. Industrialized countries have stockpiled sufficient quantities of the South's germplasm to weather as much as the next half-century of normal breeding requirements. In addition, the wide distribution of gene bank collections - especially through CGIAR - makes it difficult for individual countries to negotiate effectively with multinational seed companies or powerful trading protagonists.

Stakeholders: No country or region in the world is remotely self-sufficient in food germplasm over time. The real stakeholders in this issue, however, are the over 800 million people defined by the World Food Summit as "food insecure." The most vulnerable of these people are in sub-Saharan Africa. Bilateral exchange mechanisms would run strongly counter to Africa's short and medium-term food security interests. In the longer-term, however, Africa could again become a major contributor to its own - and the world's - food security. Africa has an enormous untapped wealth of food genetic diversity nurtured and well-used by those who need it most (see Appendix II).

Any intergovernmental arrangements that encourage bilateral negotiations over germplasm access and benefit-sharing will further allow the North to play its best cards - playing poor countries off against one another and using its trading weight to make cheap deals.

The most delicate position of all is held by countries unable to decide whether or not their interests are best served by multilateral or bilateral mechanisms covering the most important food germplasm. There is almost universal agreement that specialist germplasm must be negotiated under different arrangements. Some Latin American and some Asian states seem to be making dubious distinctions between their fields and their forests. In essence, they believe they are bargaining food security (via multilateral agreements) against a theoretical "windfall" from the industrial or medicinal use of other plant genetic resources. This could be a Faustian (and famine) bargain. They must decide, soon, which side of the stake they are on. In the meantime, their position is certainly unenviable!

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Sovereignty and Food Security

The Fundamental Issue

Ask any government participating in the revision of the International Undertaking on Plant Genetic Resources and its delegates will tell you that the primary concern of any intergovernmental agreement must be food security. First and foremost, countries have an obligation to ensure that their citizens have access to whatever crop germplasm (be it local or exotic) they need to maintain and increase agricultural productivity. Secondarily, diplomats will acknowledge an understandable desire not to be *ripped off* - to be able to benefit from any economic gain created by crop genetic diversity in the marketplace.

These are dual - but hardly clonally-propagated - objectives. The effort to strengthen national food security encourages a world view that crop germplasm is the common heritage of all humanity - and must be shared fully and freely. The desire to reap economic benefit where financial surpluses are created, on the other hand, encourages trade restrictions. Since the Garden of Eden has been (at least temporarily) misplaced, governments are left to calculate whether or not the system of germplasm exchange should be biased toward their food security concerns or toward their need to find economic returns. As they try to find equilibrium between this *yin* and *yang*, governments must also determine whether their interests are best secured through a multilateral "trade union" arrangement or through bilateral (often country-to-company) negotiations.

The perceived wisdom is that the North has too much grain and not enough genes - that it is germplasm poor. Conversely, the South - with its Vavilov Centres of Genetic Origin (or Diversity) - is gene-rich though grain-poor. On the surface, this should be the basis for reciprocally-beneficial agreements.

Within the South, however, Africa is particularly vulnerable. Africans draw heavily upon exotic crops originating in Latin America (maize, cassava, potato, sweet potato, etc.) and Asia (banana, plantain, Asian rices) While Africa is a centre of diversity for sorghum and most millets, it shares its significant genetic diversity in cereals with the Near East. Thanks to Africa, even sorghums and millets now have substantial diversity in South Asia. At first glance, Africa's genetic dependency is palpable - if your menu is "European".

As Noel Vietmeyer and the US National Research Council are discovering in their six volume analysis of Africa's "lost" crops, however, there are more than 2000 traditional food plants in Africa that are presently being nurtured or cultivated as part of somebody's diet. Vietmeyer concedes that these food sources are far from "lost" - except to the North's investigators and to International Agricultural Research Centres. Many of these food plants could have potential for production outside of Africa. The most famous example of a so-called "lost" crop is Ethiopia's *teff* - one of the country's most important staple, famous around the world, and totally discounted in international statistics. Beyond these 2000 plant species lies the wider *hidden harvest* of non-cultivated and non-plant food sources that can make up between a quarter and a third of the seasonal diet for rural peoples.

Typical North-based calculations also make rather glib assumptions about Africa's need for exotic germplasm to maintain imported crops such as cassava and maize. Both of these crops arrived with the Portuguese five hundred years ago and both spread throughout Africa on the wings of farmers' wisdom and genius in plant breeding. Though not "native" to Africa, their diversity and durability within the region is considerable.

In sum, considering the *in situ* diversity of food sources and germplasm in the field as well as Africa's growing capacity for *ex situ* germplasm storage on a national or regional basis, Africa does not seem as vulnerable as many suggest. Further, Africa's "under-utilized" food plants position it to benefit from trading relationships with other regions.

Sovereignty and Development

Preparing for the Future

To say that Africa's food security is not notably vulnerable in terms of the continent's access to germplasm is not to deny that Africa remains the most food insecure region in the world. To utilize existing genetic resources to maintain current levels of productivity is to ensure increasing hunger as Africa's population grows in the decades ahead.

Does the burgeoning population mean that Africa must be dependent upon the rest of the world? Hardly. Africa has both the germplasm and the genius it needs to meet its future needs. In a fair and just world, it would be able to fashion its natural and human advantages into an engine of economic development that could far surpass its own food requirements.

But "fair and just" went out with the Garden of Eden and Africa is left to make do in Paradise Lost.

Several factors mitigate against Africa's potential to benefit from its own diversity...

- 85% of all collected crop germplasm is held in the North or by the CGIAR (75% of all biomaterials are in the North) and these are outside the Biodiversity Convention. There is more African plant genetic material in Europe and North America than there is in gene banks in Africa.
- Until the issue of *ex situ* germplasm is resolved , Africa has - by omission - ceded to the North's "national sovereignty" over Africa's exported germplasm. *De facto,* the CBD and the WTO call upon Africa to pay royalties to access its own germplasm under patent protection in the North.
- While the genes and the genius may remain *in situ* in Africa, most of the scientific research facilities are in Europe and North America. The "discovery" of commercially-useful African genes and species may well take place in the North more frequently than in Africa.

The fateful concessions made in Nairobi in May, 1992 (the Nairobi Final Act) that sidelined the resolution of the ownership of germplasm collections gathered prior to the coming into force of the Biodiversity Convention - and that postponed the resolution of Farmers' Rights - strengthened and offered credibility to the North's claim to Africa's diversity. The CBD's inaction in addressing the Nairobi resolutions now threatens to legitimize the North's sovereignty (or hegemony) over everything it had gathered in the colonial and neo-colonial eras and leaves the South with a kind of *mirage sovereignty* - the superficial right to everything we do not know to exist and do not know to have value - *in situ* germplasm.

The Botanical Chess Game

Bilateral Bargaining - By Crop and Country

RAFI has selected Africa for this study for a number of reasons. First, because it is the most food insecure region in the world. Second, because its level of genetic dependency strikes a reasonable mid-point between the comparative independence of East Asia and the Near East on one hand and the greater dependence of Latin America on the other hand. While it is true that no country in the world is genetically self-sufficient, only Guatemala and Mexico (in Latin America) approximate the level of independence common in Africa. Most Asian countries - led by Burma and Cambodia - can account for half their genetic stocks domestically.

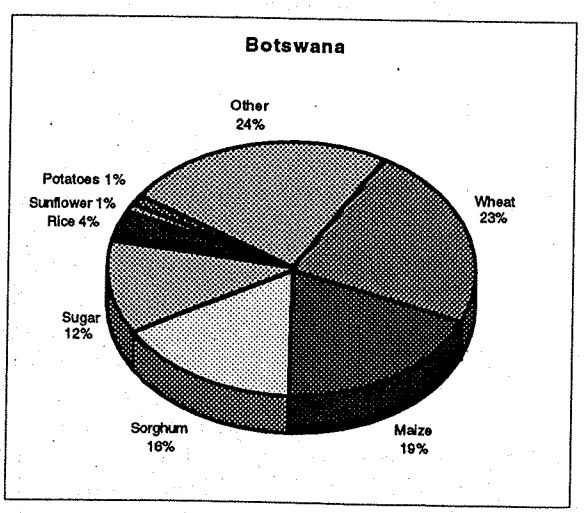
Within Africa, Ethiopia has the greatest genetic diversity. Ethiopia also has one of the world's best gene banks and has done more than almost any other country to safeguard its seed sovereignty. In order to understand the bargaining position available for Africa, RAFI has looked at the situation for Ethiopia (a "best case" scenario) and that of five other countries within which RAFI cooperates on *in situ* conservation programmes.

RAFI is a partner in the Community Biodiversity Development and Conservation Programme (CBDC) - an initiative begun in 1994 to undertake research on practical ways in which farming communities can be supported in their work to conserve and improve agricultural biodiversity. The CBDC is a global experiment coordinated in Chile with regional coordination in that country and in Ethiopia and the Philippines. In Africa, the CBDC has six national partners. In attempting to understand the impact of a bilateral approach to crop germplasm exchange, RAFI looked to these six countries.

In analyzing genetic resources - whether by crop or by country - it must be understood that even the best databases are weak. That a European country has a larger maize collection in its gene bank than some Latin American countries does not mean that the European collection is more diverse or valuable. Many countries, for example, have large wheat collections that share many accessions in common. An African country could have a much smaller wheat collection that has not been replicated by other banks.

Botswana:

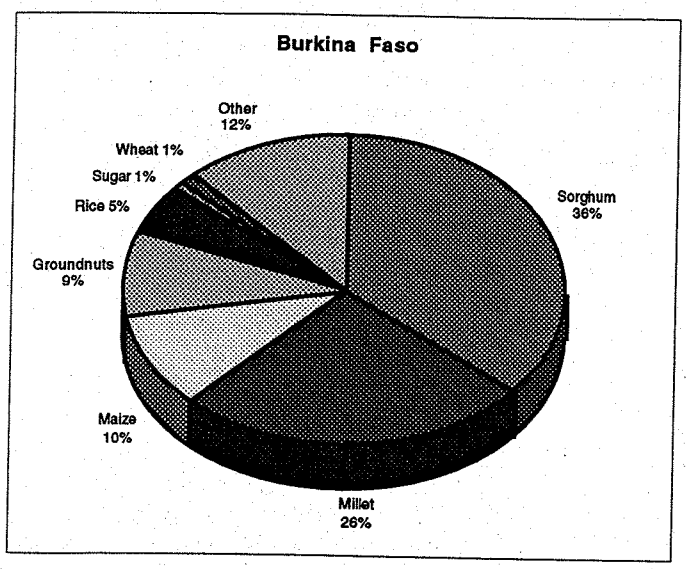
Almost two-thirds of Botswana's food consumption comes from three crops: wheat, sorghum, and maize. However, internationally-collected data probably underestimate the importance of pulses and vegetables in the local diet. The country looks to commercial imports to meet its cereal requirements and to relief programmes to support an estimated 570,000 vulnerable people.

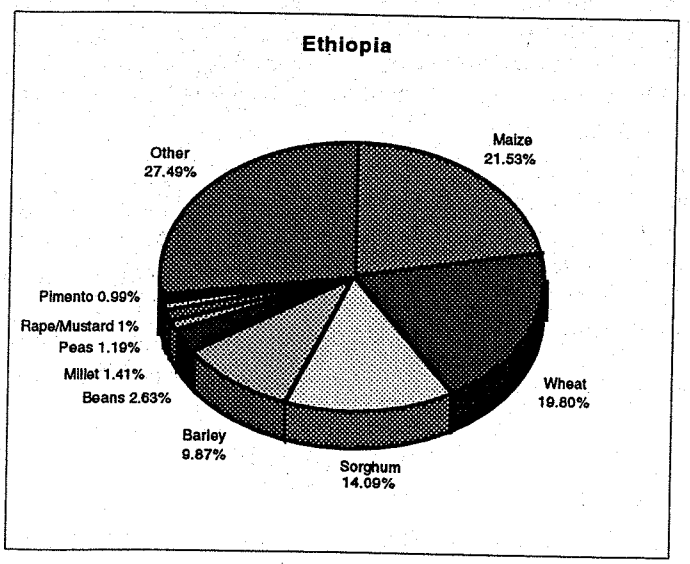


Burkina Faso:

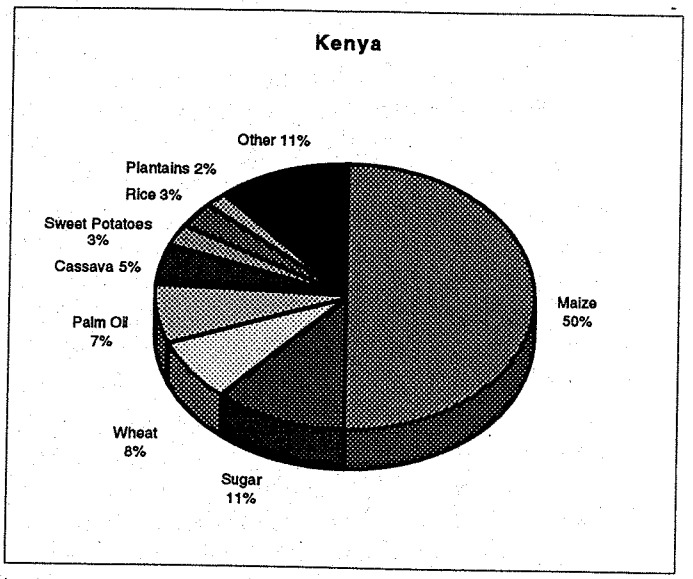
Millet and sorghum account for almost two-thirds of the country's reported calorie consumption. Maize

and groundnuts offer another 20%. At the time of the Food Summit, FAO estimated that 700,000 people were in need of supplementary feeding and large amounts of cereals were shipped to the country during 1996 at the government's request.



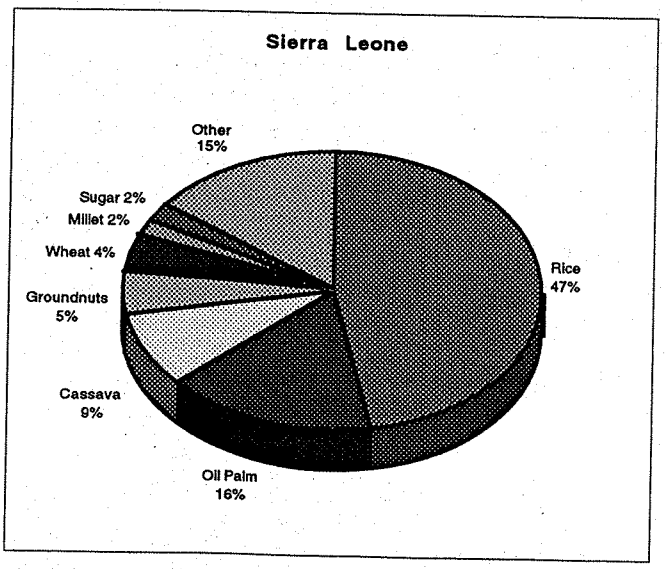


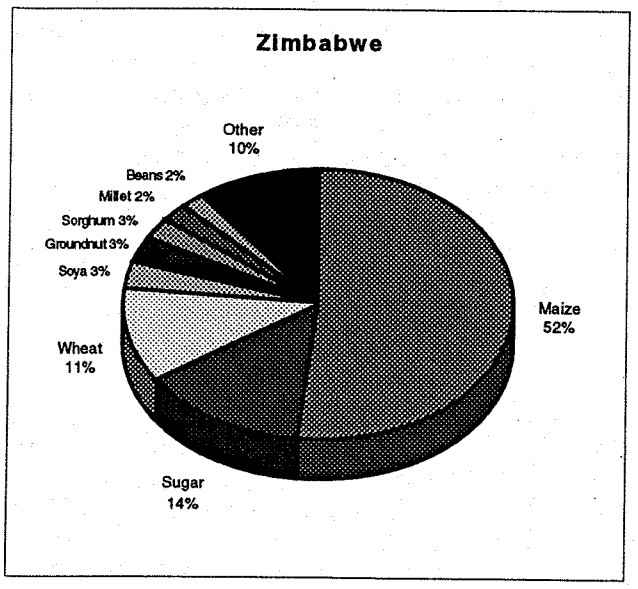
Ethiopia:
According to FAO statistics, Ethiopians look to maize, sorghum, and wheat for more than half of their calorie consumption, It is inevitable, however, that national crops such as teff and enset (false banana) are greatly underestimated as are barley and a number of pulses. Although it does not figure in international calculations, teff is commonly second only to sorghum in national production. Ethiopia's food security has improved considerably in recent years although, at the time of the Food Summit, there were about 3 million people in need of some food aid. This, however, was more a problem of food distribution than of food shortages.

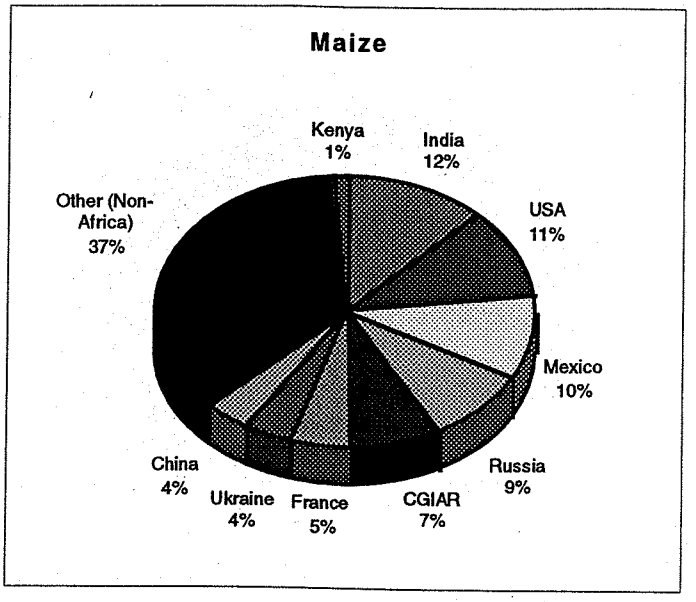


Kenya:
Fully half of Kenya's annual caloric consumption is anchored to a crop of foreign origin - maize. Beyond this, the country relies on wheat, pulses, and roots and tubers. During 1996, Kenya was obliged to import maize to meet local requirements.

Sierra Leone:
As much as Kenya depends upon maize, Sierra Leone obtains almost half of its calories from rice. Lagging far behind rice are root and tuber crops such as cassava - a crop that originated in Latin America. Although traditional African rice is extremely important, increasing quantities are based upon Asian rice germplasm. At the time of the Food Summit in November, 1996 about 520,000 people needed food aid.







Zimbabwe:
Maize accounts for more than half of the country's annual caloric consumption. Wheat represents another 11%, followed by millet and sorghum. More than two-thirds of the maize harvest is provided by small-holders who currently receive free seed and fertilizer. As a consequence, genetic uniformity in the country's key crop is increasing by leaps and bounds.

Nine Critical Crops

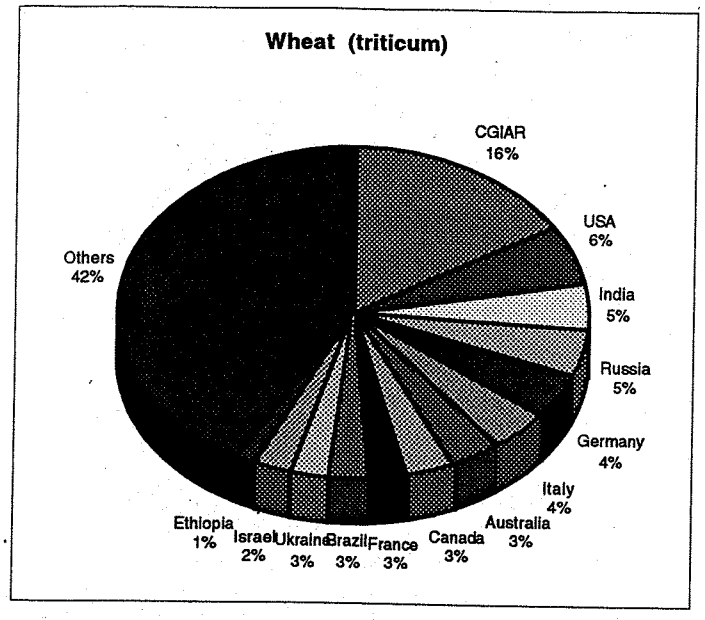
The following nine crops play a central role in food security in all (or several) parts of Africa. Three are exotic foreigners to Africa (maize, cassava, groundnut); three split their centre of diversity between Africa and other parts of the world (wheat, barley, rice); and three are clearly "African" (sorghum, cowpea, pearl millet). How would Africa fare if each country had to make bilateral arrangements to exchange germplasm for these vital crops?

Maize: Among the so-called "exotic" food crops that have become African staples, maize (whose centre of diversity lies in Latin America) is almost invisible within African gene banks. Only Kenya has a statistically significant maize collection with 1% of world accessions. Yet, Kenya obtains half its calories from maize and is often obliged to import quantities from other countries. Zimbabwe is in a similar situation, and Ethiopia and Botswana, who each base a fifth of their calories on the crop, are hardly less vulnerable. If Africa has to go shopping for maize germplasm, the USA, Mexico and Russia can together claim almost a third of the world stock followed by France, Ukraine and China. Although its collection is important, CGIAR has only 7% of global accessions.

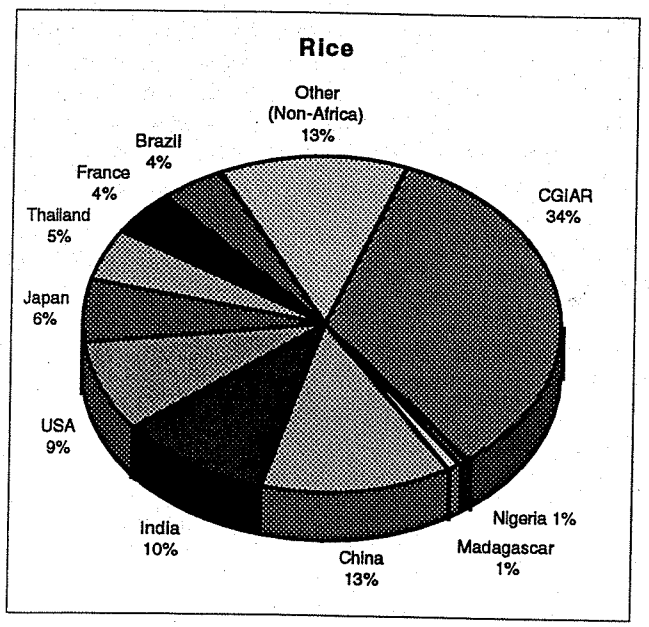
Cassava: Another crop of Latin American origin, cassava plays a very important role in African nutrition. Unfortunately, it is usually lumped into "roots and tubers" as a category and it is difficult to extract accurate figures. Despite its importance, only Uganda's seed collection warrants international attention and it still falls behind India and Brazil. The CGIAR can claim almost a third of the global germplasm supply but numerous small national collections make up more than half of all known accessions.

Groundnut: An important export crop for several West African countries, groundnuts, nevertheless, originated in Latin America. When it comes to looking for new germplasm to improve market opportunities or overcome diseases, Africa has virtually nothing to sell and will have to go shopping in the United States and India (who have half the world's accessions) or to CGIAR (which has another quarter).

Wheat: Although wheat has a long and distinguished history in North Africa and in the Horn of Africa, its career has been much shorter on the rest of the continent. The crop accounts for almost a fifth of Ethiopia's recorded calories and a



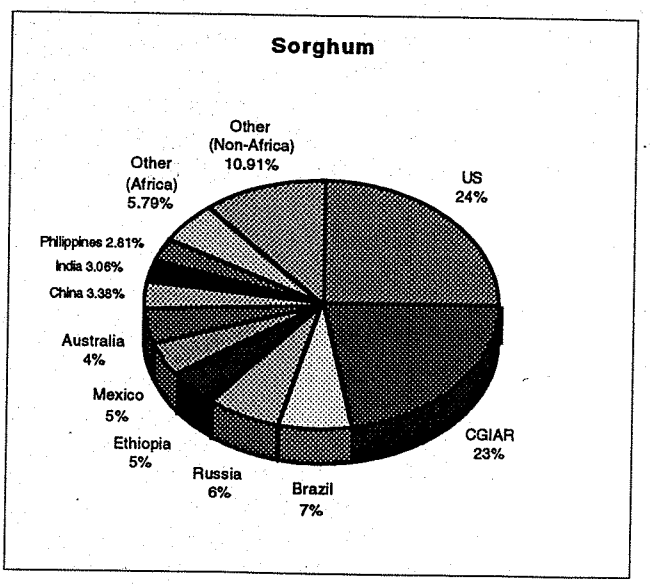
quarter of Botswana's consumption. Zimbabwe and Kenya both draw about a tenth of their calories from wheat. Only Ethiopia, with 1% of global accessions, is statistically significant in wheat germplasm exchange. In this, it trails behind the CGIAR (16%) and the USA, Russia, Germany, Italy, and India - each with 4-6% of the global stockpile. Aside from India, the only other country in the South with a notable seed supply is Brazil. When it comes to gene trading, Africa will largely have to face off against the North.



Rice: Although traditional African rice is both important in the African diet and in global germplasm exchange, the substantial majority of rice consumed in Africa is now of Asian origin. International breeding programmes have tended to ignore Africa's hardy domestic species in favour of those with which they are the most familiar. The result is tremendous and devastating genetic erosion for one of Africa's most vital crops. Only Nigeria and Madagascar have noteworthy collections - and they, together, equal only half the number of accessions that can be found in Brazil, for example. Together, China and India have close to a quarter of global stocks followed by the USA, Japan, Thailand, and France. CGIAR holds a third of the world's accessions.

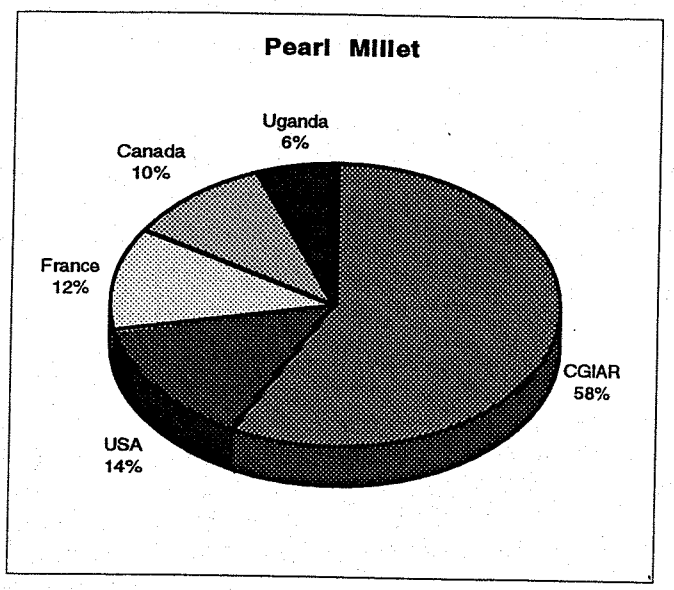
Barley: Although it has a long history in Ethiopia where it still accounts for 10% of caloric consumption, Ethiopia has barely 4% of global seed stocks - or a fifth the number that can be found in Canada, for example. The USA and Canada together corner a third of collected barley accessions. The other big barley traders are the UK, Germany, Russia, and Brazil. Aside from Ethiopia, no African country appears to have significant material.

Sorghum: As a home-made crop, it would be hard to overestimate sorghum's importance to African food security. The crop meets more than a third of the calorie needs of Burkina Faso and about 15% of Ethiopia's consumption. Yet, collectively, Africa has barely 10% of the world accession stockpile which is considerably less than half the number of samples held by the USA or the CGIAR. Brazil, Mexico, and Russia all have as much or more sorghum germplasm than Ethiopia. When it comes to gene trading, buyers will first look to the CGIAR and the USA.



Cowpea: Another underestimated crop, cowpea is not only important in the diet of many African countries, it has also contributed important genes for use in agricultural biotechnology. Botswana,

however, is the only country whose collection has any reference on the world stage. When it comes to gene trading, the big sellers are the Philippines, USA, and Brazil with India and Indonesia not too far behind, but still well ahead of Botswana.



Pearl Millet: The good news is that Uganda has 6% of the world's accessions. The bad news is that the USA, Canada, and France share 36% and CGIAR has everything else. In a country like Burkina Faso, millets (all kinds) make up more than a quarter of all calories - but poor people in many African countries would not survive without the various species of millet found in Africa.

Neither a Borrower nor a Lender Be
... But a Trade Unionist?

Africa generally has less than 10% of the collected world germplasm of the crops most important to the continent. In every instance, there is more germplasm - often more thoroughly documented - already available in the North and close to the companies undertaking high-tech breeding work. In general, gene traders would only approach African countries after Northern gene bank materials were exhausted.

If Africa has little to sell, it may have more to buy than is immediately evident. Because of their greater resources, the North's companies and gene banks will likely document the collections under their sovereignty more quickly than will governments in the South. This material will be patented. If local conditions change due to climate change, new diseases, etc., Africa may find itself knocking on the doors of Northern banks and companies to buy access to germplasm. In order to meet new market opportunities and new population demands, Africa might also find itself acting more often as a buyer than a seller.

It is vital to stress that we are talking solely about crops important to food security. Beverage crops such as coffee, pharmaceutical species like endod, and many other specialty crops are neither essential to the food supply nor widely-distributed in terms of essential germplasm. Bilateral or commodity group negotiations are probably the best way to secure national benefit from this kind of germplasm. Major food crops - because they are important to so many countries and because their germplasm is already so thoroughly dispersed - are quite a different matter.

The problem is that neither corporations nor governments have much interest in the long-term. It is for this reason, that a collaborative or "trade union" approach could be more beneficial to the South. Collectively, the South is in a better position to bargain. Collectively, the North is in a better position to pay for the conservation and utilization of germplasm. Mutually-beneficial exchange relationships that are as open and as little restricted as possible may not only yield the most economic return but may also meet every government's primary policy objective -- food security.

Appendix I

Examples of Intellectual Property Claims on African Plants and Genes

The following utility patents or plant breeders' rights certificates have been granted in the USA in the 1990s. All concern Africa. Some, such as the teff and cowpea certificates have been uncovered only in the past few weeks. Note that in most instances, even where the origin of the gene or species has been identified, it is often common to some or most countries in the sub-Saharan region. Thus, a company could use the indigenous knowledge of people in one country to seek specimens of the same species (or a related species) in another country .... or seek samples from a botanical garden in an industrialized country. These examples illustrate the

weakness of bilateral negotiations for strategic crop genes and plant varieties. While bilateral agreements are often promoted as a vehicle for benefit-sharing, there's no denying that the overwhelming advantage goes to the party in a position of power.

TEFF -- On November 29, 1996 the US Plant Variety Protection Office (the US plant breeders' rights office) issued Certificate No. 8900033 on a variety of Teff (*Eragrostis tef*) named *"Dessie."* The PVP certificate is the first ever issued on teff in the US. It allows patent-like control over the variety until 2016 (20 years) under the powerful US Plant Variety Protection Act, which closely resembles UPOV '91.

The certificate is owned by Wayne Carlson, a US farmer who grows teff to sell to US bakeries that produce an Ethiopian flat bread called *injera.* Carlson reportedly donates samples of his teff varieties to Ethiopia. During the Ethiopian famine in 1988, Carlson gave 25,000 pounds of teff to a US aid agency which sent the grain to Ethiopia. Carlson - a biologist by training - worked in Ethiopia in the early 1970s where he learned about teff. Carlson says he is unsure about the origin of Dessie. He reports that he received breeding material from a US university; but that the documentation that detailed the germplasm's origin was lost.

COWPEA -- In June, 1996 Jeffrey D. Ehlers received US Plant Variety Protection Certificate No. 9500268 (plant breeders' rights) on "Kunde Zulu" a cowpea variety that he first began breeding while employed by the International Institute of Tropical Agriculture (IITA) in Kenya using African cowpea germplasm. There's no doubt about where Ehlers got his breeding materials. He explains: "In mid-1988, I completed my contract with IITA and returned to the United States bringing several hundred breeding lines with me, including material that through further selection would become "Kunde Zulu."[1] Ehlers justifies his claim of ownership on Kunde Zulu based on the fact that the breeding lines he appropriated from Africa were freely available to others, and because "substantial investment of my time and resources were involved...to develop this material from an early generation breeding line to a finished variety." Intellectual property regimes do not recognize the "time and resources" devoted by African farmers--the true innovators of Ehlers' cowpea.

WEST AFRICAN RICE GENE -- The first disease resistant rice gene identified by scientists comes from a "wild," West African rice species that was collected by the International Rice Research Institute. The source of the disease resistant rice gene is a "wild" African rice species, *Oryza longistaminata.* According to the National Research Council (USA), *O. longistaminata* may not be so "wild." It is a close relative of African rice which is "regularly gathered for food, often in sufficient abundance to appear in the markets."[2]

In 1995, a professor at the University of California successfully isolated the "Xa21" gene, the first cloned gene known to convey resistance to bacterial blight of rice. The University of California proceeded to patent the gene and offer licenses. The patent is still pending, although several corporations have already purchased an option to license the gene. In March, 1997 the University of California established the "Gene Recognition Fund" -- a novel mechanism to recognize and compensate nations of the South for the use of their valuable genes. Here's how the fund works: any company interested in licensing rights to the patented gene will be encouraged to contribute to the fund if and when the company begins to profit from commercialization of the gene. UC Davis has already committed (US) $50,000 dollars of its future licensing royalties from the Xa21 gene to the Fund. Once funds accumulate, the university will identify the developing country or countries that should benefit from the fund, and then the university will select students from those countries to receive fellowships for graduate studies at UC Davis. In addition, the companies who license the gene will only have licensing rights in industrialized countries. The technology is being made freely available to countries in the South.

Ultimately, however, the "Genetic Resources Recognition Fund" is not a solution. First of all, the fund is based on a patent. A patent is not a benefit sharing agreement. It is a state-sanctioned, exclusive monopoly that gives the patent holder the right to exclude others from making, using or selling the patented technology. Secondly, the fund links compensation for the use of the South's genetic resources to the goodwill of corporations and financially-strapped Northern public universities. The fund offers neither the accountability nor financial stability that is necessary to insure long-term conservation, utilization and further development of plant genetic resources in the South. Recognition for Farmers' Rights shouldn't depend on charity, it is a matter of justice. The Gene Recognition Fund is a sincere, well-meaning gesture, but it's still a Northern institution controlling money and decisions about how to reward someone else's innovation.

ENDOD – Endod, also known as the African soapberry, is a perennial plant that has been selected and cultivated for centuries by African women. In many parts of Africa, its berries are used as a laundry soap and shampoo. It has also been used as a poison to stun fish. Ethiopian biologist Aklilu Lemma discovered that sun-dried and crushed endod berries are lethal to all major species of snails–and may be effective controlling schistosomiasis. After Lemma demonstrated endod's potency to University of Toledo scientists, they took out patents, hoping to sell endod as a biological control for the Zebra mussel, a costly pest in the Great Lakes of the US and Canada. The University of Toledo's endod patents include: US Patent Nos. 5,334,386 and 5,252,330. Toledo has told Ethiopia's Endod Foundation that they can have the patent outright for (US) $125,000, or license access for (US) $50,000.

BRAZZEIN -- Researchers at the University of Wisconsin have received three US patents for a super-sweet protein isolated from the berry of *Pentadiplandra brazzeana*. It is no coincidence that researchers happened onto *P. brazzeana* in Gabon, where its qualities are well known. The potential market for sweeteners is (US) $100 billion per annum worldwide and some brazzein patents have already been licensed to industry. Despite the sweetener's origin and inspiration, the University of Wisconsin has no plans to recognize or compensate Gabon.

CAMEROONIAN SOIL MICROBE --In 1994, Hoechst and Schering merged their agrochemical businesses to form a new company, AgrEvo. With net sales of (US) $2,300 million in 1995, AgrEvo is the world's fifth largest agrochemical corporation. One of its patented and highly profitable genes for herbicide resistance (US Patent No. 5,276,268) comes from a strain of *Streptomyces viridochromogenes*, isolated from a soil sample from Cameroon–the so-called PAT gene.[3] The company's glufosinate chemical compound used in its best-selling herbicide (trade name *Basta*) was also developed from a soil bacterium of Cameroonian origin. Hoechst says that Cameroon will not be compensated.[4]

C. ARABICA – It is well known that Ethiopia is the centre of origin and diversity for *coffea* germplasm. Nevertheless, food and biotech corporations have made sweeping patent claims on coffee that give them the legal right to determine the future of high-tech research for coffee. The following are just two examples:

- Escagenetics Corporation holds US Patent No. 5,334,529, a species-wide patent on all genetically modified plants and seeds of *c. arabica*, the most important commercial coffee species.
- R.J. Reynolds Corporation holds US Patent No. 5,436,395 covering new methods for variety development, breeding and scale-up of superior genotypes of coffee plants for commercial production.

HUMAN RETROVIRUS – An HIV retrovirus found in a human cell line established from the tissue of an unknown Gabonese individual was patented by the Pasteur Institute (France). US Patent No. 5,019,510 was later dropped during international controversy over the patented cell line of a Guaymi indigenous person from Panama.

Appendix II

Africa: Basket Case or Food Basket?
Crop Diversity in Farmers' Fields Offers Untapped Source of Food Security

Food insecurity looms large in Africa. In recent decades, per capita production of cereals in Africa has decreased nearly 20%. Cereals, which supply 60-80% of calories to people in sub-Saharan Africa, are chronically in deficit.[5] Cereal imports in the region have shot up from 1.2 million tonnes in 1961 to 18.2 million in 1990. One in every five Africans is now dependent on food aid.

While some international observers crudely dismiss Africa as a "basket case," the long-neglected native grains of sub-Saharan Africa have the potential to offer a bountiful "food basket" of diverse crops that are now largely conserved and used by subsistence farmers. *The Lost Crops of Africa* is the first in a series of six books to be published by the National Research Council (USA) that focus on the promise of native African food plants.[6] The following material is gleaned from the National Research Council's *Lost Crops of Africa.*

Africa's native grains are not "lost" to the millions of people whose survival depends on them. Despite their importance to Africa and the world, however, many of Africa's native grains have been "driven into external

exile." Over centuries, native grains have been under-appreciated and scorned, or dismissed as poor people's crops by missionaries, colonial powers, and mainstream scientists. With virtually no support from international agricultural researchers, many of Africa's native grains have been paid little attention, while imported crops such as maize, wheat and Asian rice have become staples throughout the continent. As a result, native crops have been replaced or out-performed by exotic, often subsidized grains. Maize, first introduced from the Americas by Portuguese colonists some 500 years ago, is now Africa's primary food crop.

Africa's agricultural heritage is ancient and rich. Humans have inhabited the African savannas longer than anywhere else and it is here that the first farmers gathered wild cereal grains and began domesticating plants. Africa has more native cereals than any other continent. At least 10 of Africa's wild grasses were domesticated by farmers and became major staples. Seeds of about 60 species of wild grasses are still gathered for food in Africa. Africa has its own species of rice, as well as finger millet, fonio, pearl millet, sorghum, teff, guinea millet, and several dozen "wild" cereals whose grains are commonly eaten. Sorghum and pearl millet are the fifth and sixth most important cereals in the world, and finger millet ranks eighth.

The untapped potential of Africa's native cereals is vast. Many of Africa's "lost" crops are hardy, productive, and self-reliant and especially well-suited to produce food in tough farming environments. The following examples illustrate the promise of Africa's native grains.

SORGHUM -- Sorghum probably has more undeveloped and underutilized genetic potential than any other major food crop in the world," states the *Lost Crops of Africa*.[6] Thousands of distinct sorghum (*Sorghum bicolor*) varieties are nurtured and developed by African farmers. In Sukumaland, Tanzania, a single researcher counted 109 named varieties in common use. In Samaru, Nigeria, over 100 local varieties were identified. In the Lake Turkana region of Kenya farmers grow many distinctly colored sorghum varieties, and just by looking at the color of a grain, some local farmers are able to identify who grew it.[7]

PEARL MILLET -- African farmers domesticated pearl millet from a wild West African grass over 4,000 years ago. Today, pearl millet is the world's sixth most important cereal. It is grown on approximately 14 million hectares in Africa, and 14 million hectares in Asia. At least 500 million people depend on pearl millet as their primary food source.[8] Of all the major cereals, pearl millet is the most heat and drought tolerant. It is extremely valuable to poor farmers because it will yield reliably in areas where it is too hot and arid to support other grains.

AFRICAN RICE -- African rice (*Oryza glaberrima*) has been grown in parts of West Africa for some 1,500 years. In many areas it has been subsumed by the introduction of higher-yielding Asian rice, but African rice is still grown by many farmers. A survey of rice farmers in Sierra Leone found that, in comparison with Asian rice, the crop manages better on impoverished soils; competes better with weeds; and matures more quickly.[9] *Oryza longistaminata*, a close relative of African rice, is a common "wild" rice species found throughout tropical Africa. It is the source of the first disease-resistant rice gene that was recently isolated, cloned and patented by a University of California researcher. Although *O. longistaminata* is usually referred to as a "wild" rice, it is regularly gathered for food and often sold at markets.[10]

TEFF -- Though it is little known outside of Africa, teff (*Eragrostis tef*) is grown on approximately 1.4 million hectares in Ethiopia, and accounts for a quarter of the country's total cereals. Teff has more food value than grains such as wheat, barley and maize. Unlike some African grains, teff is not in decline. The cultivation of teff in Ethiopia rose from 40 percent of Ethiopia's total cereal area in 1960, to more than 50 percent in 1980.[11] Teff's nutritional value and adaptability (it grows from near sea level to 3,000 metres) have long been an asset for Ethiopian farmers.

FINGER MILLET -- *Eleusine coracana* originated thousands of years ago in the highlands of Ethiopia and Uganda. Today, cultivation of finger millet is declining rapidly in southern Africa, Burundi, Rwanda and Zaire. Despite its reputation as a good tasting, nutritious grain that thrives in diverse conditions, finger millet is extremely labor intensive, and has been abandoned in favor of maize, sorghum and cassava. The NRC concludes that finger millet is a casualty of "gross neglect" in scientific and international circles, but that its impediments could be overcome if given higher priority. From the NRC's perspective, finger millet's "genetic development as a crop... is about where wheat was in the 1890s." Finger millet production is expanding in India and Nepal.[12]

FONIO -- Fonio (*Digitaria exilis* and *Digitaria iburua*) is one of the world's best-tasting, and most nutritious of all cereals. Fonio is believed to be the oldest African cereal. West African farmers cultivate approximately

300,000 hectares of fonio. Many varieties of fonio produce grain just 6 to 8 weeks after they are planted, providing a critical food source early in the growing season. Fonio tolerates poor soil and will grow where little else succeeds. Despite the fact that fonio feeds millions of West Africans, only 19 scientific articles have been published on fonio over the past 20 years.[13]

Lost Crops of Africa
National Research Council. 1996. Lost Crops of Africa. Volume 1: Grains. National Academy Press, Washington, DC
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UPDATE:

Dolly Goes to Market

World Patents on Sheep Clones Include Humans

Just last year scientists referred to the cloning of animals and humans as "science fiction." In February, 1997 the Scottish-based Roslin Institute turned fiction into hard-hitting reality by announcing it had successfully cloned a sheep from the cells of an adult ewe. The social and ethical implications of the cloning achievement are immense. So too is the commercial potential. Before announcing this startling technological feat, few noticed that Dolly's inventors had quietly applied for patents covering the cloning technology.

Patents Out - People In: On 8 May 1997 RAFI revealed that the worldwide patents on the Dolly cloning technique had been published by the World Intellectual Property Organization (WIPO). The patents are not limited to the cloning of sheep. They cover *all* animals--*and do not exclude humans.* "This isn't just a mutton monopoly," said RAFI's press release, "The patents cover everything that crawls, flies, swims, walks or talks."

The twin patents were granted under a convention of the World Intellectual Property Organization (WIPO) - a United Nations agency headquartered in Geneva. Patents No. WO 97/07668 and WO 97/07669 were published on March 6, just a few days after the world learned of the cloning breakthrough. RAFI has since been working to determine the legal scope of the patent claims and the degree to which the world's major patenting jurisdictions have agreed to the patents. According to the WIPO patents, the Roslin Institute plans to apply for the patents in virtually every country that has a patent office. The danger is that many countries will blindly accept the patent without understanding the larger implications--the patent implicitly accepts human cloning because it covers the cloning of all animals and does not exclude humans.

To confirm that the patents include human beings, RAFI contacted both the Scotland-based Roslin Institute, and PPL Therapeutics, the company established by Roslin to commercialize its research. Although Dolly's "inventors" are adamant that they have no commercial interest in - and no moral tolerance of - human cloning, Roslin Institute confirms that the patents cover all animals, including humans. While some other biotech companies, confronted with similar ethical concerns, have worded their patents to specifically exclude humans, the Roslin patents deliberately make no such exclusion. Asked why, the Institute told RAFI that the inclusion of humans would ensure that nobody else could lay claim to human cloning and thus Roslin would try to ensure that humans would not be cloned.

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Pulling the Wool over ...? RAFI does not question the sincerity of the Institute's intentions. However, the ethics and fate of human cloning is not a matter to be entrusted to the Roslin Institute. Decisions about the cloning of human beings should not be made in the marketplace, or behind closed doors in patent offices. This is an issue of profound global importance and must be resolved at the highest levels.

The Roslin Institute has agreed to give an exclusive license to PPL Therapeutics for the production of therapeutic proteins in the milk of genetically modified animals. PPL is a small biotech company with offices in the UK and the USA. PPL Managing Director, Ron James told RAFI, "We're still talking to them [Roslin] about other licensing uses and I expect that others are talking to them as well."[14] Depending on the conditions of licensing agreements, PPL or other companies could be well within their rights to

develop human cloning and/or to sub-license other companies to pursue this research opportunity. PPL has research agreements with three major pharmaceutical enterprises with interests in human therapeutics. These include Boehringer Ingelheim of Germany, Novo Nordisk of Denmark, and American Home Products of the US--all major players in the life industry. In particular, Boehringer Ingelheim is actively collaborating with human genomic companies.

World Health Assembly Rejects Cloning

RAFI's Edward Hammond arrived in Geneva in early May to inform government delegates at the World Health Organization about the Dolly patents, just prior to the World Health Assembly's (WHA) vote on a UK-sponsored resolution stating that cloning human beings--for the purposes of human reproduction-was "morally unacceptable." In reaction to the Dolly patents, many South delegates proposed stronger wording to the UK resolution. Zimbabwe, backed by Namibia, Malawi, Zambia (on behalf of SADCC), and Fiji pointed out the implications of the patents and proposed they be declared contrary to *ordre public* (the TRIPS clause allowing countries to declare patents invalid).

But it was Northern delegations, particularly the US, who prevailed in preventing human dignity from getting in the way of intellectual property. Ultimately, the text that emerged was weaker than the African proposal; but much stronger than the original UK resolution. Zimbabwe withdrew from the consensus because it felt the resolution was "not sufficiently expeditious in dealing with the patent claims;" but its efforts were not in vain. In the end, the WHA affirmed that human cloning was contrary to human integrity and morality." The resolution will make it possible for countries to refer to the highest health body in the world for support should their country decide to reject the cloning patents.

RAFI continues to investigate means by which the patents could be disallowed under a rarely-used *"order public"* ("public morality") clause in the World Trade Agreement.

Dolly Goes to Court

RAFI will take the Dolly patents issue - along with a number of other specific patent concerns - to a Special Session of the UN General Assembly from June 23-27 in New York. The Dolly patents are only the most recent of a number of instances where patent monopolies threaten public morality. RAFI and partner NGOs will encourage the General Assembly to ask the World Court (the International Court of Justice at The Hague) for an Advisory Opinion. The Court's views could significantly affect the work of WIPO and the World Trade Organization.

About RAFI: The Rural Advancement Foundation International is an international non-governmental organization headquartered in Ottawa, Ontario (Canada) with an affiliate office in Pittsboro, North Carolina (USA). RAFI is dedicated to the conservation and sustainable improvement of agricultural biodiversity. RAFI is concerned about the loss of genetic diversity--especially in agriculture--and about the impact of intellectual property rights on agriculture and world food security.

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[1] U.S. Plant Variety Protection Certificate No. 9500268, 28 June 1996. Exhibit E. Statement of the Basis of Applicants Ownership.
[2] National Research Council, 1996. *Lost Crops of Africa, Volume 1:* Grains. National Academy Press, Washington, DC., p. 37.
[3] Personal communication with Michael Flitner.
[4] Martina Keller. 1996. Raubzug auf dem Acker. DIE ZEIT No. 24, Dossier, June 7, 1996.
[5] UN Development Programme, "Poverty and Food Security in Africa," A Fact Sheet Prepared for the World Food Summit, Rome, 13-17 November 1996.
[6] National Research Council. 1996. *Lost Crops of Africa.* Volume 1: Grains. National Academy Press, Washington, DC.
[7] National Research Council. 1996, p. 129.
[8] National Research Council. 1996, p. 146.
[9] National Research Council. 1996, p. 77.
[10] National Research Council. 1996, p. 28-29.
[11] National Research Council. 1996, p. 37.
[12] National Research Council, 1996, p. 215.
[13] National Research Council, 1996, p. 42.
[14] National Research Council, 1996, p. 59.
[15] RAFI spoke with PPL Thereapeutics Managing Director, Ron James by telephone.