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Declaring the Benefits

The North's Annual Profit from International Agricultural Research is in the range of U.S.\$4-5 billion. It's time for an accounting.

The Consultative Group on International Agricultural Research (CGIAR) and its eighteen International Agricultural Research Centres were established to conduct research for the benefit of poor farmers and consumers in Africa, Asia, and Latin America. Some of these Centres have now been operating for more than thirty years. Though financially supported in large measure by aid contributions from industrialized countries of the North, the genetic stock in the Centres' gene banks has been contributed almost entirely by farmers of the South. Yet the Centres, and the CGIAR as a whole, remain controlled by governance structures dominated overwhelmingly by the cash donors of the North, and not the gene donors of the South.

The impact of CGIAR's research has been estimated in various ways, and at times has been hotly debated. But no attempt has ever been made to calculate the hidden value of CGIAR's research to the North.

In this paper, RAFII provides a preliminary assessment of CGIAR's contribution to the agricultural economies of the North. Despite woefully incomplete data to work from, it is nonetheless clear that the North is well served by its contribution to agricultural research in the South. In fact, return on Northern investment may be as high as tenfold.

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Declaring the Benefits

The North's Interests are Well-Served by International Agricultural Research

*On October 24, 1994, when the donors' club for the Consultative Group on International Agricultural Research ("Cigar") gathers in the auditorium of the IMF Building in downtown Washington, few will be aware that it is almost fifty years to the day since Norman Borlaug hopped off a plane in Mexico City to begin the Green Revolution. The occasion calls for reflection, and provides an opportunity to look ahead to the future of international agricultural research for the next half-century. Instead however, the Northern governments and foundations, solemnly convened, will be struggling to see their way through the next twelve months as the CG System - in the throes of a profound philosophical and financial crisis - tries to sort out who it is and whose interests it serves. For the mostly Northern cash donors to the CGIAR, the central issue is finance. For the germplasm donors of the South, the central issue is accountability. Key to the debate for both sides is an understanding of who benefits from the work of the International Agricultural Research Centres (IARCS) of the System. **Declaring the Benefits** offers an analysis for policy-makers, as they contemplate CGIAR's future governance. Those in Washington with a sense of history may also discern a way ahead from their own meeting date. After all, October 24th is United Nations Day.*

In an August, 1994 letter to the U.S. Senate, Warren Christopher and two of his Cabinet colleagues argued that foreign germplasm contributed \$10.2 billion annually to two major crops in the United States¹. It is certain that at least some of that return to U.S. farmers is directly attributable to breeding material developed by one of the centres of the Consultative Group on International Agricultural Research (CGIAR).

Although the declared mandate of the CGIAR is to strengthen food security in the South, the International Centres that comprise the CG System have made a fundamental impact on agricultural development in the North as well. Until recently, the benefits to industrialized countries were discreetly overlooked by the Centres and by their financial backers. Yet a fair calculation of the real flow of benefits is

critical to any effort to change the CGIAR. The System's cash donors - almost exclusively from the North - defend their utter domination of the CG System with the claim of openhanded altruism. In its self-propelled myths and legends, CGIAR has assured itself that its dedication to the hungry of the South is unblemished by self-interest of any kind. If the governance and scientific composition of the System seems biased toward the North, supporters argue, it is the price that must be paid to ensure the System's commitment to non-political scientific excellence. If, on the other hand, it becomes clear that the CGIAR is also an engine of agricultural improvement in the North, then the North's grip on CG governance must be relinquished, and the Invisible IARCy brought to an end.

Is CGIAR a Gift Horse or a Trojan Vacuum Cleaner... or Both?

If university and corporate breeders are not only sacrificing land and labour to support Northern field trials of IARC-derived germplasm solely for the cause of world hunger, but are also taking the opportunity to skim off the most marketable germplasm for their own use - issues such as intellectual property protection and access to germplasm take on still greater importance. Is it, in this light, a virtue or an artifice that the CG System so nobly espouses the free flow of genetic materials? Whose interests are being served? Is the CGIAR a Gift Horse, or a kind of Trojan "vacuum cleaner" inhaling the South's crop genetic diversity for redistribution throughout Europe, North America, Australasia, and Japan?

It is, of course, impossible to quantify the germplasm and intellectual contribution of the South's farmers to the North's agriculture. The most commercially useful genetic material sucked Northward passes through International Agricultural Research Centres (IARCS) either directly via Centre gene banks or indirectly as "improved" nursery stock, exported on request or as part of international field trials.

RAFI has collected data on the distribution of nursery stocks from a series of 17 CD ROM disks published by CGIAR in 1992. The disks cover international agricultural research from 1962 to 1986, and afford the best available source of documentation on the practical work of the System. Unfortunately, even this massive database - including some 90,000 documents IARC by IARC - offers an inconsistent and incomplete account of the flow of seed stocks. RAFI has gleaned relevant data from all of the nursery trial tables on these computer disks, and has combined this review with other data provided by Centres or national public sector researchers, to present a crop by crop review of the South-North flow.

Table 1, on wheat, provides a graphic example of RAFI's basic methodology for all crops

analysed here. Where data are available, we have presented crop by crop estimates of impact on the North, as reported by CGIAR and/or Northern governments. For each crop we have also presented another calculation of impact, which extrapolates a cash value from the percentage of the Northern crop estimated by CGIAR to be derived from CGIAR germplasm. Both figures are surely an inaccurate measure of impact, but perhaps they represent the range within which the truth lies. However imprecise the figures, the conclusion is inescapable. The North is benefitting handsomely from CGIAR research!

Crop by Crop

Wheat: The best information available is for wheat material obtained by the North through CIMMYT (the International Maize and Wheat Improvement Centre, Mexico). Our estimates are based upon CIMMYT data for six industrialized countries, and other information from three national research institutes.

For the United States, our estimates draw upon a 1982 OECD report that somewhat cryptically suggests that the value of the South's wheat germplasm to the United States is \$500 million per annum. An unpublished 1983 study by Canadian and American wheat breeders, concerned that an outbreak of Karnal Bunt in Mexican fields might cut access to CIMMYT material, came up with a similar figure exclusively for that institute². RAFI believes these figures afford a minimal calculation of CIMMYT's real contribution. In 1993, CIMMYT reported that at least 34% of the entire U.S. wheat crop for 1984 had been sown to varieties that were either directly from CIMMYT or included substantial CIMMYT germplasm³. This included "Newton", one of the most widely-grown wheat cultivars. CIMMYT goes on to argue that since 1984, their role in the U.S. spring wheat crop has probably expanded, and that today, the durum wheat crop in the U.S. southwest is dominated by varieties based directly on CIMMYT-derived germplasm. RAFI therefore estimates that, in

the mid-eighties, CIMMYT contributed to (roughly) \$3.1 billion annually (34%) of the total farmgate worth of the U.S. wheat crop.

U.S. interest in CIMMYT germplasm is amply reflected in the International Centre's data on the distribution of wheat nursery trial stocks. Throughout the seventies, available information suggest that the U.S. share of all nursery material distributed by CIMMYT may never have fallen below 10% and sometimes came close to 12%⁴. This exceeds the total flow of wheat germplasm to all of Africa in the same years.

Estimates made by Canadian government breeders place CIMMYT's share of the western Canadian wheat crop at 28%. New spring wheat varieties such as Robin, Laura, Hy320, and Genesis, all in cultivation in 1992, were derived from CIMMYT material. CIMMYT nursery stock distribution data for the early seventies suggests that about 2.2% of germplasm shipments made to all countries - South and North - actually went to Canada. This is a substantial proportion considering that CIMMYT's "clients" are in the South. While there are no formal estimates of the value of CIMMYT germplasm to Canada, RAFI has calculated 28% of the farmgate value of the crop to be \$799 million per year.

In a 1991 report for The Crawford Fund for International Agricultural Research in Australia, Derek Tribe offered that the annual additional contribution of CIMMYT material to Australia was probably in the order of \$75 million⁵. RAFI's own calculation at that time placed the figure closer to \$122 million. More modestly, CIMMYT's 1993 report suggests that its share of the incremental per annum yield gain is possibly half of the Tribe assessment. CIMMYT goes on to note however, that the figures are based on the 1983 crop, and that CIMMYT's role in Australian wheat has greatly increased. In May of 1994, Derek Tribe advised RAFI that the overall contribution of CIMMYT wheat to Australia between 1974 and 1994 is now judged to be \$1 billion and that the annual value today is assessed by Australian researchers at \$126 million. According to

CIMMYT, by 1990 at least 85% of Australia's wheat area was directly or indirectly dependent on CGIAR-provisioned germplasm. On the basis of these new figures, RAFI estimates that CIMMYT contributes to almost \$1.4 billion (85%) of the farmgate value of the Australian crop.

Over the past twenty years, Australia has reaped \$1 billion in benefits from CGIAR

Once again, CIMMYT's cooperative international nursery trials were a major means of germplasm dissemination for Australia. Available data suggests that the country obtained about one percent of all CIMMYT material distributed in trials in the seventies and early eighties.

Tribe also cites a 1987 New Zealand estimate that CIMMYT's contribution to that country could be valued at NZ\$338,000 per annum. CIMMYT's own 1993 report places its share of the New Zealand wheat crop at 79% in the mid-eighties - and growing. The direct value, according to CIMMYT, was about \$500,000 per annum. New Zealand's share of nursery trial material climbed from less than half of one percent in the early seventies to close to one percent in the early eighties.

In 1990, a study by INTERAGRES, a CGIAR documentation and information centre in Rome, concluded that CIMMYT's annual contribution to the Italian durum wheat crop was not less than \$300 million⁶. Since 1974 when Italy first introduced CIMMYT-based semi-dwarfs, at least fifty durum wheat varieties have been released in Italy - all derived from CIMMYT germplasm. According to CIMMYT, its contribution to the Italian crop stands at about 60%. In 1983, at least 5% percent of all CIMMYT durum wheat nursery shipments went to Italy. This is a massive contribution. Italy also acquired close to 1% of bread wheat nursery stocks. RAFI estimates that CIMMYT material contributes to a \$1 billion slice (60%) of the total farmgate value of the Italian wheat crop.

RAFI (Rural Advancement Foundation International)

South Africa (cited by CIMMYT in 1993 as an industrialized country) has been a major beneficiary of CIMMYT wheat germplasm for many years. By 1990, CIMMYT estimated that 60% of South Africa's wheat crop was based on CIMMYT material. In 1983, for example, South Africa received 2.1% of all bread wheat nursery stock distributed around the world by CIMMYT, and 2.6% of all durum wheat stocks. At 60% of the national crop, CIMMYT's contribution to the final farmgate value of South Africa's yearly wheat crop would be \$251 million.

The total value of CIMMYT wheat germplasm to four industrialized countries (Australia, Italy, New Zealand, and USA) was by their own (or OECD) estimates, not less than \$926.5 million a year - and covered at least 17 million hectares of farmland - in the mid 1980's.

Surveying two periods (1974-77 and 1981-84) for which reasonable data are available, it appears that the North benefitted from 15-18% of all durum wheat nursery stocks distributed by CIMMYT, and from 25-28% of all bread wheat nursery germplasm⁷. Not bad from an international centre dedicated to the relief of hunger in the South.

Table 1 : Percentage/Value of National Wheat in CIMMYT Germplasm

Country:	Percent of total Area in CIMMYT Germplasm*	Value of CIMMYT Contribution as Reported by Country (U.S.\$m)**	RAFI Estimate: Farmgate value of crop with significant % CIMMYT germplasm***	Country Share of North's Crop Area****
Australia	85%	\$126	\$1,387	5%
New Zealand	79%	\$0.5	-	-
Italy (Durum)	60%	\$300	\$1,037	3%
South Africa*	60%	-	\$251	1%
USA	34%	\$500	\$3,133	18%
Canada (Western region)	28%	-	\$799	8%
Totals:	43% six country average	\$926.5	\$6,607	35% of total North crop

* Byerlee, D., and P. Moya, 1993, *Impacts of International Wheat Breeding Research in the Developing World, 1966-90*, Mexico D.F. CIMMYT, page 72.

** Sources as cited in the text. All figures are in U.S.\$ millions.

*** *World Grain Statistics, 1991 & 1993*, International Wheat Council, London, "Basic Support Levels for Wheat", page 9. All figures are in U.S.\$ millions averaged over the years 1986-90. Figures in this column are based on the price paid to farmers in each country as a proportion of the crop sown to varieties using CIMMYT germplasm.

**** National wheat crop percentages are based upon FAO *AGROSTAT* disks for the period 1986-90 and indicate the share of total industrialized country production in thousands of metric tons averaged over the 1986-90 period. All currency figures are in U.S.\$ millions.

Aside from the six countries (Australia, Canada, Italy, New Zealand, South Africa, and USA) for which dollar estimates or crop shares are available (totalling 21.5 million hectares of wheat lands in CIMMYT material), CIMMYT bread wheat germplasm contributed to varieties released in many other industrialized countries including Portugal, Spain, and Israel⁸.

Table 2: Durum Wheat cultivars (1977-1986) derived from CIMMYT germplasm -

Variety Name	Country
Inbar Hazera	Israel
Castico Celta Faia Faisca Helvio Timpanas	Portugal
Mexa Nuno	Spain

Source: CGIAR/World Bank CIARL-BRS 1962-1986 CIARL-T-04 Document CIMM0102 beginning at 0080.

Given the substantial flow of breeding stock to France, Germany, the United Kingdom, and Scandinavia, it would be logical to assume that further, unrecorded, examples exist in every industrialized country.

Collectively, Australia, New Zealand, Italy, and the USA account for only a quarter (26%) of the North's annual wheat harvest. A conservative estimate would suggest that the countries comprising the other three-quarters have a lower proportion of CIMMYT material. If one assumed one-third of their crops rather than the 43% averaged by the above four countries, then the annual contribution of CIMMYT wheat to the North would be in the order of \$3 billion.

South and North may receive equal benefit from wheat R&D at about \$3 billion each. Governance, however, is not equal.

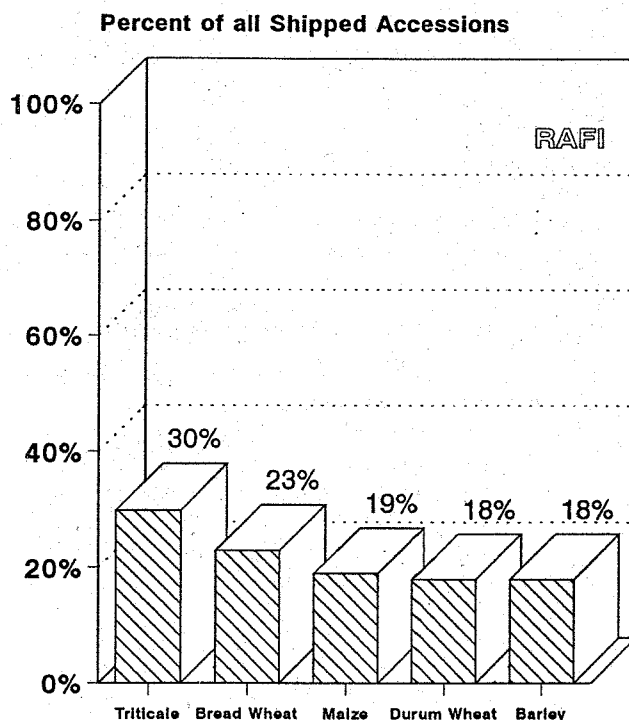
This is a conservative calculation. For the six countries for which data are available, it is evident that CIMMYT material makes a significant contribution to a total farmgate value of more than \$6.6 billion per year. This suggests that on average for the countries studied, less than a fifth of the value of the

farmgate price of the crop sown with CIMMYT material is assigned to CIMMYT.

For its part, CIMMYT concludes that in 1990, the value of its germplasm to producers and consumers in poor countries was about \$3 billion for the estimated 50 million hectares covered by CIMMYT-derived stock⁹. In other words, South and North may share equally in the financial returns on CIMMYT research. The North provides the money, and the South provides the germplasm, but the North maintains control.

With a core operating budget in 1993 of \$24.1 million, CIMMYT offers the North something in excess of a hundred-fold return on its investment every year¹⁰.

**Declaring the Benefits
CIMMYT Distribution - All Mandate Crops
North's Percent Share - Available Years**



Source: CIMMYT CIARL
Cimeum2.cht/707

Not by Bread Alone

Wheat is only one of the 20 major crops targeted for research in the CG System. Operating on the same basis (percentage of annual production in the North), RAFI has also tried to estimate the value of IIRI and CIAT rice material, CIAT beans, and CIMMYT maize. Together these crops account for about a third of all CGIAR research. Once again, we must caution that these figures offer only a crude "ballpark" understanding of the CG's hidden contribution. In the final analysis, probably the most accurate thing to be said is that the South's farmers are contributing "enormously" to the North.

Rice: A 1986 USAID study by Dana Dalrymple showed that 73% of the semi-dwarf rice acreage in the USA was based on IIRI material¹¹. Semi-dwarfs accounted for about 22% of the entire U.S. rice crop. Extrapolating from this, RAFI estimates that the annual farmgate contribution made by IIRI amounted to about \$176 million in 1984. The semi-dwarf share of the American harvest has continued to grow, but RAFI has kept the figure at the 1984 level. Since the U.S. crop equals about 26% of the North's total rice production, the total value of IIRI material to the North is extrapolated to be about \$655 million per year.

In 1993, IIRI's core budget was \$25.8 million, offering the North a 25-fold return on investment per annum. What's more, IIRI has surrendered more than useful genetic traits to Northern breeders. At least once an American company may have appropriated an entire IIRI rice variety as its own. Such is the case for "CB-801" described tactfully as a "derivative of IR8" (released by IIRI in 1966). CB-801 won a U.S. Plant Variety Protection certificate in 1985 for its new "breeder" - The Farms of Texas Co.¹².

IIRI rice has been used in patent claims in the United States

IIRI's contribution to the North continues

unabated - however unintentional. When a W.R. Grace subsidiary (Agracetus) announced its successful patenting of transgenic cotton and soybeans, company spokespersons admitted that they were using IIRI varieties to claim a sweeping patent on hybrid rice. IIRI Director-General, Klaus Lampe, was furious.

Maize: Another U.S. study on maize (by Major Goodman in North Carolina) shows that in 1985, perhaps only one-tenth of one percent of the value of the American maize crop was based on "tropical" exotic germplasm. In the mid-eighties, this tiny percentage still equalled \$20 million of the annual farmgate value of the crop. Since the U.S. produces about 68% of all maize grown in the North, RAFI estimates the total value of the South's maize germplasm to the North to be about \$29 million. Were all this material derived from CIMMYT, this would afford Northern donors a respectable return on their investment of \$24.1 million in 1993. Of course, CIMMYT also conducts research on wheat, barley, and triticale.

Recently, CIMMYT maize breeders advised RAFI that about 30% of the requests they receive for farmers' maize varieties (stored in

On 16 August, 1994, U.S. Secretary of State Warren Christopher valued foreign maize germplasm at \$7 billion per annum in a letter to the U.S. Senate

CIMMYT's gene bank) now come from private companies, and that this percentage is growing rapidly. RAFI believes the Goodman study is outdated. Over the years for which data are available, nearly half (49.1%) of the requests for CIMMYT maize nursery stock came from the North, although these amounted to only a fifth (19.1%) of the volume of all maize accessions distributed. In an August 16, 1994 letter to win Senate support for the Biodiversity Convention, U.S. Secretary of State Warren Christopher asserted that foreign maize germplasm contributes \$7 billion annually to the \$18 billion American crop¹³.

CIMMYT shipped more maize germplasm to South Africa than to the rest of Sub-Saharan Africa

For some industrialized countries, CIMMYT maize germplasm is obviously critical. In the late seventies, for instance, CIMMYT shipped substantial quantities of maize germplasm to South Africa. In fact, apartheid South Africa's share of all maize accessions distributed by CIMMYT rose from an already substantial 9.8% in 1976 to well over a quarter of total distribution to all countries (28.3%) in 1978 - a large multiple of the total maize germplasm sent to the rest of Sub-Saharan Africa in the same period.

Beans: The United States accounted for an average of 54% of the North's dry bean production for the 1986-90 period. According to CIAT authorities, CIAT material contributes \$60 million to the U.S. agricultural economy every year¹⁴. Extrapolating from this figure, the North gains about \$111 million from a CIAT (1990) budget of \$28.1 million - a four-fold return.

Between 1976 and 1986, the demand for CIAT bean germplasm almost doubled worldwide. During the period for which data can be found, the North's share fluctuated between a quarter (26% in 1976¹⁵) and a fifth (19% in 1986¹⁶) but rose to about half of all samples distributed in some years.

In 1980, CIAT bean nursery trial participants included the Rothamsted Station in the UK, and government research stations in Canada and the United States. In 1993, J. White of CIAT noted, "U.S. scientists ... searching for such traits as disease resistance, often request both germplasm accessions and CIAT-bred materials. These are usually provided free."¹⁷ The flow of benefits continues to spread. Elizabeth de Paez and J.E. Ferguson of CIAT report that 'Rimfire', an Australian canning bean released in Queensland in 1993, is based on rust-resistant germplasm selected from CIAT's gene bank¹⁸.

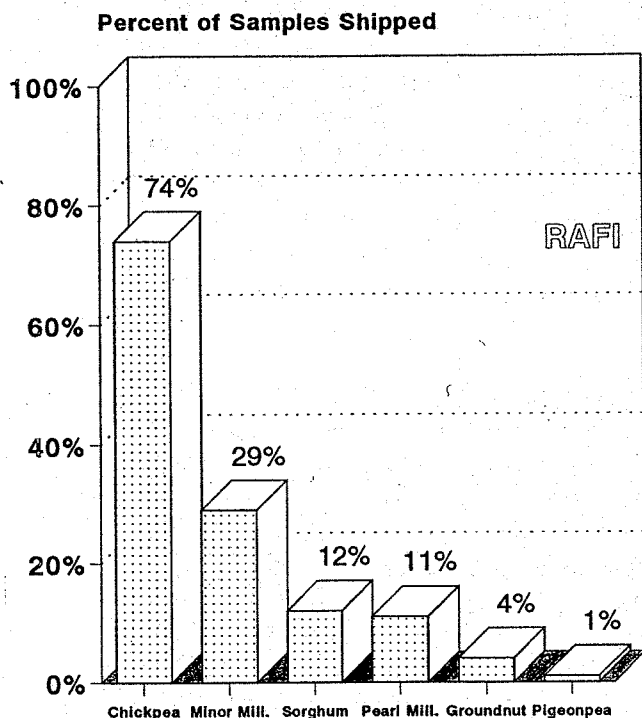
The Colombia-based Centre's involvement in tropical forages is at least as interesting as bean research for Australia's vast ranchlands. The two CIAT staffers go on to predict, "Australia and CIAT share a common interest in tropical agriculture, particularly for developing countries in Southeast Asia and the Pacific. A strengthened partnership between Australia and CIAT is also essential for the continuing development of Australia's tropical north"¹⁹

CIAT support to agricultural development in the North doesn't stop at the provision of germplasm. Out of 159 trainees at CIAT in 1973, 21 (13.2%) were from 8 industrialized countries²⁰. Over the years, the United States alone has had 32 PhD candidates complete their dissertations at CIAT, and another 29 U.S. citizens have taken other training at CIAT²¹. Undoubtedly, some of these trainees were South nationals resident in - and financed by - an industrialized country who ultimately returned to their homeland. Undoubtedly, too, many more of these and other South researchers trained by CIAT and its IARC counterparts eventually found themselves in the North working on the North's agricultural problems.

Other Crops

Benefits to Northern financial donors to CGIAR spread far beyond those few crops for which figures are available. Twelve percent of sorghum samples, 11% of pearl millets, about 4% of groundnuts, and 1% of pigeonpea samples stored at ICRISAT (the International Centre for Research in the Semi-Arid Tropics) in Hyderabad, India, appear to go to the North. However, 29% of other millets distributed by ICRISAT have found their way North, and 74% of chickpea germplasm appears to have been shipped to industrialized countries such as Israel and Australia²². Indeed, ICRISAT and ICARDA (International Centre for Agricultural Research in Dry Areas, Aleppo, Syria) virtually established the Australian chickpea industry, based on 16,000 farmers' varieties given to Australian breeders.

**Declaring the Benefits
ICRISAT Distribution - All Crops
North's Percent Share**



Source: ICRISAT CIARL

icrisum2.ch3/707

Potato: Another case in point is the International Potato Centre (CIP) in Lima, Peru. Like other IARCS, CIP has also made a large contribution to agriculture in North America and Europe. For instance, yield performance trials using CIP material have compared potato cultivar harvests for Kennebec, R. Burbank, TA-37, R. Pontiac, Bintje, DTO-28, Wauseon, Spunta, and Ij, across highly diverse regions ranging from Brazil and Peru to The Philippines, Turkey, Tunisia, Pakistan - and Canada²³.

The commercial potato industry has also tapped CIP germplasm. The Lima-based Centre sent some 5,911 accessions to Germany for example, for study by five private breeders²⁴. In the late eighties, Pepsico's snack foods subsidiary Frito-Lay, and Escagenetics of California, both visited the CIP gene bank in Peru to rummage through the collection. Plant Genetics Systems of Belgium picked up commercially-important

resistance germplasm from CIP and even Monsanto, always on the lookout for herbicide-tolerant materials, took advantage of CIP's open-door policy to acquire breeding stock²⁵.

Barley: CIMMYT data on barley nursery stock distribution to national programmes and individuals, for the periods from 1974-77 and 1981-84, reveal that from 11% to 18% of accessions went North. Eight barley varieties - all drawn from CIMMYT materials - were released in the United States alone. Other beneficiary countries identified in CIMMYT reports are Australia, Canada, and the Netherlands. All released barley varieties based upon CIMMYT germplasm.

Table 3: Barley cultivars with CIMMYT germplasm

Variety Name	Year	Country
Clipper	?	Australia
WI 2197	?	
Bonanza	1970	Canada
Berac	1970	Netherlands
Julia	1968	
Mazurka	1970	
Zephyr	1965	
Beacon	1973	USA
CM 67	1968	
Klages	1972	
Manker	1974	
Nordic	1972	
Steptoe	1973	
Vanguard	1971	
Woodvale	1969	

Source: CGIAR/World Bank CIARL-BRS 1962-1986
CIARL-T-04 Document CIMM4051 beginning at 0027.

Triticale: During the same two periods (1974-77 and 1981-84) between a quarter and a third of all triticale germplasm shipments flowed from CIMMYT nursery trials straight North. Ten Australian varieties can be traced to CIMMYT germplasm as can seven for the United States and three for Canada. Italy, Spain, and Portugal, as well as Poland and Bulgaria, can all boast triticale varieties reliant on CIMMYT's largesse.

Table 4: Triticale cultivars (1977-1986) with CIMMYT and/or INIA, Mexico, germplasm

Variety Name	Year	Country
Coorong	1980	Australia
Currency	1983	
Dua	1980	
Ningadhu	1980	
Samson	1984	
Satu	1979	
Toort	1984	
Towan	1981	
Tyalla	1979	
Venus	1981	
Mexitol 1	1978	
Carman	1980	Canada
OAC Decade	?	
Welsh	1978	
Mizar	1979	Italy
Salvo	?	Poland
Arabian	1981	Portugal
Beagle	1981	
Borba-1	1984	
Mapache	1981	
Monsanto	1983	
Manigero	1979	Spain
Beagle 82	1982	USA
Florida 201	1985	
Juan	1984	
Karl	?	
Kramer	?	
Morrison	1985	
Siskiyou	1977	

Source: CGIAR/World Bank CIARL-BRS 1962-1986 CIARL-T-04 Document CIMM0100 beginning at 0045.

Grouping all of CIMMYT's nursery stock distribution (except maize), it appears that the North's share of all crop materials stayed fairly constant at about 25% throughout the 1974-77 and 1981-84 periods studied.

In general, about a quarter of all CIMMYT nursery stock has gone North for use by breeders there

Surf'n Turf: CGIAR offers the world more than seeds. In fact, livestock research is the largest commodity programme in CGIAR, projected to reach 18% of the System's core resources budget by 1998. By contrast, rice will take up 17% while maize and wheat (with barley) will use 9% each of the core programme²⁶. Two Africa-based Centres, ILCA in Ethiopia and ILRAD in Kenya (restructured into a single institute in 1993/94), focus on livestock (primarily bovine) germplasm, diseases, and feeds. Their information, testing facilities, and breeding stock, are of continuous benefit in particular, to Australia and the United States.

Yet another Centre, ICLARM (the International Center for Living Aquatic Resource Management in the Philippines), is turning Africa's indigenous Tilapia fish into a commercial engine of global import. While ICLARM has concentrated on the adaptation of high-yielding Tilapia for poor fisherfolk in Asia, the fish have managed to swim North into Scandinavia and even Canada where research is underway to farm the fish in Arctic waters in ponds linked to thermal drainage pipes²⁷. This is a highly-profitable venture.

Balancing the Benefits

The issues here are three: transparency, equity, and control. Both IARCS and farmers could, and should, take pride in their contribution to global agriculture. There is no reason why the North should not benefit. The problem arises when the commercial value siphoned Northward is not acknowledged and not compensated. The situation worsens massively when Northern governments allow the patenting of material wholly or partially derived from farmers' varieties, freely given and held in trust in the CGIAR Centres. As private companies move into the South's seed markets, farmers risk paying for the end product of their own genius. The North is becoming a huge *klepto-monopoly*, taking freely-given germplasm from the South and winning patent monopolies in the North. Informal innovators - including indigenous and

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other rural societies - deserve credit and respect for their contribution.

Patents are turning the North into one giant klepto-monopoly

If a return on Northern government investment in the CGIAR offers the North a "silver lining", we must still discover whether there is more than a cloud for the South.

Forty million hectares of Southern lands are sown to CIMMYT wheat material, for example. This represents 70% of all developing country wheat lands²⁸ (excluding China). Using CGIAR crop value estimates, CIMMYT contributes at least \$3 billion to the South's economy and food requirements. The proportion of the crop sown to CIMMYT stock may have a farmgate value as high as \$20 billion. Even CIMMYT maize - grown over only 8% of Southern maize fields - contributes \$1.6 billion (8%) to the farmgate value of the Southern crop.

IRRI and CIAT rice varieties are harvested on close to 70% of developing country fields. CGIAR's data would lead us to conclude that the IARCS contribute germplasm which nets a \$50 billion share of the South's annual rice harvest.

These figures offer an important perspective. If they are the only data to be considered, and if they are correct (and we must remember that all of the data are distressingly "soft") then probably little more than 1% of the wealth created or supported by the CGIAR system accrues directly to the North.

We must also acknowledge that there is no evident connection between the economic importance of an IARC crop to the North and the amount of funding that an IARC receives from the North. The United States, for example, has given more or less equally to IRRI, CIMMYT, and CIAT even though U.S. benefits from CIMMYT are massively greater than from the other two Centres combined. In the last several years, about 43% of the entire CGIAR budget has gone to Africa. There is no

obvious economic self-interest or other geo-political logic to this emphasis. While RAFI could argue that the CGIAR's African initiative has been badly planned and executed, it is clear that the focus on Africa is for altruistic and humanitarian reasons. Northern economic and geo-political interests would probably have been better served by putting money into the more buoyant economies of Asia and Latin America.

It is also evident from conversations with many of the CGIAR's government donors however, (largely from aid agencies and not from agriculture ministries), that they have not seriously considered the value of the CGIAR to their own countries. In fact, most are surprised when presented with specific examples and figures. While they are vaguely aware that the CGIAR has a spin-off value, aid agencies prefer to sublimate the "kickback" home, and to espouse loftier virtues.

Aid agencies espouse loftier virtues, and overlook self-interest

For a comprehensive understanding of the benefits and costs of the CGIAR System, farmers and agricultural economists are going to have to do much more careful study. Consider rice once again. If 70% of Asia's paddy land were not planted to IRRI-based varieties, they would be planted in farmers' or national varieties. Farmers' varieties, while not always so high-yielding, tend to have a much higher market value than the relatively tasteless IRRI strains.

Further, IRRI varieties have stimulated a \$2.4 billion agro-chemical market solely for rice fields. The profit from those sales has gone North. IRRI itself has conceded that it has consistently over-estimated the need for chemicals on rice. IRRI has also admitted that the use of many of these chemicals on rice has caused severe human health problems²⁹ and contributed to significant environmental pollution in Asia - and to Global Warming. In some Asian countries, certainly the Philippines, IRRI's presence has led to the stifling of national research.

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It is hard to conjecture what all this has actually cost the South. It is safe to assume, however, that IRRI's contribution of \$50 billion per annum to the total farmgate value of the South's rice crop does not say it all.

Reality is more complicated. The North need not gain for the South to lose. RAFI is concerned that the real "winners" are the international enterprises seeking control and ownership over biological products and processes. The figures we have discussed, in some ways, are misleading. All the monetary benefits flowing North appear directly in the cash economies of the North. The financial gains for the South, however, are only estimates, since only a small percentage of the crops involved (for rice only 5%) ever shows up in the marketplace. (What shows up in people's bellies is more important). This means that for corporations, the gain is relatively clear and direct. For the South, there is an uncalculated benefit, and an uncalculated opportunity cost. In the case of rice again, it must be remembered that Asian nations would be growing the crop anyway.

Final Tally: Is it possible to come up with a grand accounting of the annual value of CGIAR to the North? No, it is not. RAFI speculates that the annual value of four of the CG's most important commodities is probably in the order of \$3.8 billion.

For a \$300 million annual investment, the North probably gains between \$4 and 5 billion each year

These four commodities account for only 39% of the CG's core research budget and the estimate excludes highly-transferrable research on livestock, potatoes, barley, triticale, soybeans, groundnuts, and fisheries - collectively accounting for an almost equal share of the CG research dollar.

Until more thorough studies can be completed, it is reasonable to argue that the North, for an annual investment of less than \$300 million to

core and auxiliary budgets of the CGIAR Centres) wins back between \$4 and \$5 billion for its own farmers and consumers.

Table 5: Preliminary Estimates of Value to North for Selected Crops (U.S.\$ millions)

Crop	Known Data	Extrapolation
Wheat	\$936.5 (4 states)	\$3,000
Rice	\$126 (USA)	\$655
Beans	\$60 (USA)	\$111
Maize	\$20 (USA)	\$29
4 crops	\$1,142.5	\$3,795

Other Benefits - Political and Opportune

The North and its corporations also benefit in many other ways...

As CIAT watched donor contributions plummet at the beginning of the 1990's, the Centre determined to make a direct appeal to its major financial backers. Staff prepared promotional brochures in appropriate languages, separately targeting the U.S. and Australia, Japan, and Germany. In every case, the brochures argued the importance of Northern access to CIAT-held germplasm. In some cases, such as Australia, CIAT stressed its strategic alliance with Australian aid (and trade) interests in the Pacific.

There was no such effort to ascribe altruism to U.S. interests in CIAT. After briefly referring to the potential negative impact of Southern agriculture on the environment, the brochure emphasized the basics: CIAT could alleviate hunger which would alleviate political instability in the South. That in turn would serve to protect U.S. investment abroad and stave off a tide of economic refugees to the United States.

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By supporting CIAT's work, the USA helps tackle problems of concern to many U.S. citizens. One of these is political instability, which stems from poverty and other social problems, and which threatens U.S. trade and investment abroad. In many countries, poverty and political unrest are powerful incentives for rural-urban migration, and even for massive and unmanageable emigration to other countries, especially the USA. By collaborating with national governments to build up and stabilize food production, the USA can help reduce poverty and migration, and thus alleviate some of its own problems.

- CIAT, 1993³⁰

Having stoked the fires of fear, CIAT made a pitch to America's corporate heartstrings in a section devoted to biotechnology. The Centre pointed out the advantages of having a world-class international scientific facility - loaded with genetic material and testing opportunities - outside of the U.S. regulatory system...

Conversely, new techniques in biotechnology increase the ability of agricultural scientists to manipulate useful genes for crop improvement. Scientists therefore need easy access to diverse genetic resources and to test new products in different environments. Because CIAT offers good facilities and access to a range of germplasm and environments, U.S. scientists will continue to strengthen their links with the Center.

- CIAT, 1993³¹

Short of offering to breed semi-dwarf coca for the drug trade, it is hard to know what more CIAT could offer to attract American support!

Flying across the Pacific in the mid-eighties, a Deputy Director-General of IRRI found himself seated next to a senior executive from Ciba-Geigy of Switzerland. How much, the corporate manager wanted to know, would it take to buy IRRI?³² The question now is whether CGIAR as a whole would give the same answer in the mid 1990's that IRRI gave in the mid 1980's.

This report is adapted from a forthcoming issue of *Development Dialogue*, the journal of the Dag Hammarskjold Foundation

ENDNOTES

1. United States Secretary of State Warren Christopher in a 16 August, 1994 letter to "Mr. Leader" of the United States Senate. The letter is supported by the Secretary of Agriculture and the Secretary responsible for the Environmental Protection Agency and calls for the Senate to ratify U.S. participation in the Convention on Biological Diversity.
2. Personal communication to Pat Mooney of RAFI from Dr. Robert Morrison, Agriculture Canada Research Station, Lethbridge, Canada, December, 1984.
3. Byerlee, D. and P. Moya, 1993, *Impacts of International Wheat Breeding Research in the Developing World, 1966-90, Mexico, CIMMYT Appendix I, pages 72-73.*
4. Data on the dissemination of IARC nursery trial materials and accessions from gene banks is derived from a series of CD-ROM disks published by the Consultative Group on International Agricultural Research. The title of the 17 disk series is *Compact International Agricultural Research Library (CIARL) Basic Retrospective Set (BRS) 1962-1986, 1992, CGIAR, Washington D.C.* The specific data referred to in this paragraph is taken from CIARL-BRS file CIMM4052, CIMM4046, CIMM4042.
5. Derek Tribe, in *Doing Well by Doing Good* cites as his source Brennan, J.P., Spill-over Effects of International Agricultural Research, CIMMYT-based wheats in Australia, *Agricultural Economics* 3:323-332.
6. INTERAGRES, 1990. *The Germplasm Contribution of the CGIAR Centers to the Italian Plant Breeding Programme*, Rome, Italy, International Agricultural Research - European Service.

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7. CIARL-BRS files CIMM4042, CIMM4052 and CIMM4027
8. CIARL-BRS files CIMM4042, CIMM4043
9. Byerlee, D. and P. Moya, 1993, *Impacts of International Wheat Breeding Research in the Developing World, 1966-90, Mexico, CIMMYT (Abstract) and p.31.*
10. All figures given in this report for IARC core budgets in 1993 are taken from tables prepared by the CGIAR Oversight Committee as presented to the Mid-term Review in New Delhi, May 23-27, 1994.
11. Dalrymple, Dana G.. 1986 *Development and Spread of High-Yielding Rice Varieties in Developing Countries*, Washington, D.C., US Agency for International Development, pages 115-116.
12. Dana G. Dalrymple, *Development and Spread of High-Yielding Rice Varieties in Developing Countries*, US AID, 1986, p.115-116.
13. United States Secretary of State Warren Christopher in a 16 August, 1994 letter to "Mr. Leader" of the United States Senate. The letter is supported by the Secretary of Agriculture and the Secretary responsible for the Environmental Protection Agency and calls for the Senate to ratify U.S. participation in the Convention on Biological Diversity.
14. Personal Communication to Pat Mooney of RAFI from CIAT officials in April, 1992 during meetings at CIAT in Cali, Colombia.
15. CIARL-BRS file CIAT4020
16. CIARL-BRS file CIAT4010
17. J. White, "The United States of America and CIAT", Shareholders in Sustainable Development series, CIAT, Colombia, July 1993, p.5.
18. Elizabeth L. de Paez and J.E. Ferguson, "Australia and CIAT", Shareholders in Sustainable Development series, CIAT, Colombia, August 1993, p.5.
19. Elizabeth L. de Paez and J.E. Ferguson, "Australia and CIAT", Shareholders in Sustainable Development series, CIAT, Colombia, August 1993, p.6.
20. CIARL-BRS file CIAT4023
21. J. White, "The United States of America and CIAT", Shareholders in Sustainable Development series, CIAT, Colombia, July 1993, p.3.
22. The data cited for ICRISAT is taken from tables available in CIARL-BRS files ICRI4011, ICRI4016, ICRI4018, ICRI4019, and ICRI4020.
23. CIARL-BRS file CIPP2035
24. CIARL-BRS file CIPP2040
25. For further information see *RAFI Communique: Emerging Technologies for Potato*, Sept/Oct., 1992.
26. TAC Secretariat, *The CGIAR in the 21st Century: Options for Structural Change*, Rome, Italy, May, 1994, Table 2, p.11.
27. Kamoji Wachira, Canadian International Development Agency, 18 August, 1994, personal communication.
28. Byerlee, D. and P. Moya, 1993, *Impacts of International Wheat Breeding Research in the Developing World, 1966-90, Mexico, CIMMYT, p. 31.*
29. Agnes Rola and Prabhu Pingali, *Pesticides, Rice Productivity, and Farmers' Health: An Economic Assessment*, IRRI/World Resources Institute, 1993.
30. J. White, "The United States of America and CIAT", Shareholders in Sustainable Development series, CIAT, Colombia, July 1993, p.1.
31. J. White, "The United States of America and CIAT", Shareholders in Sustainable Development series, CIAT, Colombia, July 1993, p.8
32. Personal communication to Pat Mooney during a visit to IRRI in August, 1986.